DEPARTMENT OF HAWAIIAN HOME LANDS
STATE OF HAWAII

August 13, 2012

ADDENDUM NO. 1

TO

PLANS, BID FORM, SPECIFICATIONS, CONTRACT AND BOND

FOR

MAKUU OFFSITE WATER SYSTEM PHASE 2
PRODUCTION WELL, RESERVOIR AND SUPPORTING FACILITIES

HALONA, PUNA, ISLAND OF HAWAII, HAWAII

IFB NO.: IFB-13-HHL-002

NOTICE TO ALL PROSPECTIVE BIDDERS

This addendum is hereby made a part of the PLANS, BID FORM, SPECIFICATIONS, CONTRACT AND BOND for the MAKUU OFFSITE WATER SYSTEM PHASE 2: PRODUCTION WELL, RESERVOIR AND SUPPORTING FACILITIES, HALONA, PUNA, ISLAND OF HAWAII, HAWAII, and it shall amend the said contract documents as detailed within this Addendum document.

APPROVED:

_____ Date August 13, 2012
Jobie M. K. Masagatani, Chairman Designate
Hawaiian Homes Commission

Please detach, execute, and return immediately, the receipt below, to the Department of Hawaiian Home Lands, P. O. Box 1879, Honolulu, HI 96805, or transmit facsimile to (808) 620-9299.

Receipt of Addendum No. 1 for the MAKUU OFFSITE WATER SYSTEM PHASE 2: PRODUCTION WELL, RESERVOIR AND SUPPORTING FACILITIES, HALONA, PUNA, ISLAND OF HAWAII, HAWAII, is hereby acknowledged.

Signed_____ Title_____

Firm_____ Date_____

ADDENDUM NO. 1
AUGUST 13, 2012

TO

PLANS, BID FORM, SPECIFICATIONS, CONTRACT AND BOND

FOR

MAKUU OFFSITE WATER SYSTEM PHASE 2
PRODUCTION WELL, RESERVOIR AND SUPPORTING FACILITIES

HALONA, PUNA, ISLAND OF HAWAII, HAWAII

IFB NO.: IFB-13-HHL-002

ADVERTISEMENT FOR BIDS

Sealed Bids for IFB-13-HHL-002 for the Makuu Offsite Water System Phase 2: Production Well, Reservoir and Supporting Facilities will be received by the Department of Hawaiian Home Lands (DHHL), Land Development Division at 91-5420 Kapolei Parkway, Kapolei, Hawaii 96707 until 2:00 p.m., Hawaii Standard Time, ~~August 27, 2012~~ **SEPTEMBER 19, 2012** and then at said office publicly opened and read aloud.

REVISED IMPORTANT DATES

Requests for Substitution Must Be Received By: SEPTEMBER 4, 2012 at 2:00 p.m.

Notice of Intention to Bid Must Be Received By: SEPTEMBER 7, 2012 at 2:00 p.m.

Last Day for DHHL to issue an addendum: SEPTEMBER 7, 2012 at 2:00 p.m.

Bid opening changed from August 27, 2012 to **SEPTEMBER 19, 2012 at 2:00 p.m.**

NOTICE OF INTENTION TO BID

1. Remove the "NOTICE OF INTENTION TO BID" and replace with the attached **"NOTICE OF INTENTION TO BID" ADDENDUM NO. 1.** The following changes were made:

   a. The Notice of Intention to Bid due2:00 p.m. September 7, 2012.

   b. The Bids will be opened on 2:00 p.m., September 19, 2012.

PRE-BID MEETING MINUTES

A mandatory Pre-bid meeting was held at the Department of Hawaiian Home Lands - East Hawaii District Office on August 7, 2012. Meeting minutes, agenda and attendance sheets from the pre-bid meeting are in Attachment to this addendum.

LIQUIDATED DAMAGES

When liquidated damages are triggered under the State and Na Kupaa contracts, respectively, the contractor shall pay liquidated damages as follows: $200.00 per day to the State and $800.00 per day to Na Kupaa; for a total of $1000.00 per day.

DHHL Special Condition SC-03 - Completion Schedule and Liquidated Damages is herewith revised to delete "$1000.00 per calendar day" and replace with "$200.00 per calendar day".

Na Kupaa Agreement Between Owner and Contractor, Article 4.03 Liquidated Damages is herewith revised to delete "$200.00 for each day" and replace with "$800.00 for each day".

NA KUPAA GENERAL CONDITIONS TO CONTROL

In the event of a dispute between the parties, the State may, but is not required to, participate in mediation under Article 16 of the Na Kupaa general conditions prior to exercising its legal and/or equitable remedies.

Except as stated above, in the event of a direct conflict between express provisions of the State general provisions and Na Kupaa general conditions, the provision of the Na Kupaa general conditions shall control, unless prohibited by State and/or Federal law.

TECHNICAL SPECIFICATIONS

1. Replace Technical Specification Section 304.01 - Pumps in its entirety and replace with Addendum No. 1 Section 304.01 - Pumps, Attachment to this addendum.

2. Replace Technical Specification Section 304.04 - Chlorinators in its entirety and replace with Addendum No. 1 Section 304.04 - Chlorinators, Attachment to this addendum.

3. Replace Technical Specification Section 304.07 - Pump Discharge Piping and Valve System in its entirety and replace with Addendum No. 1 Section 304.07 - Pump Discharge Piping and Valve System, Attachment to this addendum.

4. Replace Technical Specification Section 304.03 - Electrical Work in its entirety and replace with Addendum No. 1 Section 304.03 - Electrical Work, Attachment to this addendum.

5. Delete Technical Specification Section 303.16A Fluid Applied Roofing Membrane in its entirety.

NOTICE OF INTENTION TO BID

Date:

Ms. Jobie M.K. Masagatani, Chairman
Hawaiian Homes Commission
DEPARTMENT OF HAWAIIAN HOME LANDS
91-5420 Kapolei Parkway
Kapolei, Hawaii 96707

Attention: Patrick Young, Land Development Division
Notice of Intention to Bid due 2:00 p.m., September 7, 2012

Gentlemen:

In accordance with the provisions of Section 103D-310, Hawaii Revised Statutes and Hawaii Administrative Rules 3-122-111, it is the intention of the undersigned to bid on IFB-13-HHL-002, Makuu Offsite Water System, Phase 2: Production Well, Reservoir and Supporting Facilities at Halona, Puna, Island of Hawaii, State of Hawaii, for which bids will be opened on 2:00 p.m., September 19, 2012.

Name of Firm	**Contractor's License No.**
Address	**Hawaii General Excise Tax No.**
City, State and Zip Code	**Telephone No. / Facsimile No.**
	e-mail address

Respectfully submitted,

Signature

Print Name and Title

Date:

Gentlemen:

The Department of Hawaiian Home Lands acknowledges on this date above, your Notice of Intention to Bid on IFB-13-HHL-002.

Jobie M.K. Masagatani, Chairman
Hawaiian Homes Commission

MAKUU OFFSITE WATER SYSTEM PHASE 2:
PRODUCTION WELL, RESERVOIR AND SUPPORTING FACILITIES
IFB-13-HHL-002
August 7, 2012
9:00 A.M.
EAST HAWAII DISTRICT OFFICE
CONFERENCE ROOM
Hilo, Hawaii

1. Introductions:
   - Department of Hawaiian Home Lands
     - Sandra Pfund, LDD Administrator (#620-9271)
     - Patrick Young, Project Manager (#620-9287)
     - Louis Ha'o, Acting District Supervisor (#974-4250)
   - Na Kupa'a O Kuhio
     - Patricia Brandt, Executive Director (#386-0435)
     - Dale Burton
   - Engineers Surveyors Hawaii, Inc.
     - Eric Hee, Vice President (#591-8116)
   - Akinaka & Associates, Ltd.
     - Salvador Quitoriano, Vice President (#836-1900)

2. Single Project Covered by Two Separate Contracts:
   - State of Hawaii
     Subject to all State requirements
   - Na Kupa'a O Kuhio
     Federal ARRA Funding requirements

3. Scope of Work (Eric Hee)

   The project consists of the conversion of an existing exploratory well to a production well with a 1000 gpm deep well pump; 1.0million gallon concrete reservoir; construction of an asphalt-paved access road; construction of a 12-inch diameter water main; installation of a new booster pump system at the Keonepoko Nui Reservoir site; testing and chlorination of existing dry water mains within the Makuu Farm and Agricultural Lots Subdivision and the state highway: construction of supporting facilities, including a control building, installation of a Makuu

Production Well chlorinator, valves, electrical systems, fencing and other improvements as necessary.

4. Important Dates To Remember:

The Notice of Intent to Bid is due by 2:00 p.m. on August 16, 2012. The Notice of Intent included in the bid under the sample forms section is incorrenc and will be replaced in the Addendum that will follow after the pre-bid meeting. August 17, 2012 is a State Holiday therefore the due date has been set for August 16, 2012.

A Standard Qualification Questionnaire for Offerors (Form SPO-21) must be submitted regardless if you submitted one for another DHHL project this year. DHHL require that one be submitted with each project. That form is due in our office 10 working days prior to the bid opening which is Friday, August 10, 2012, by 2:00 p.m.

5. Labor Compliance:

This project includes both federal and state funds therefore payment of prevailing wages and the submission of certified payrolls is required. The Federal Wage Determination included in the IFB has been updated. This Federal wage scale will be locked in 10 days before the bid opening. The current federal wage determination will be included in the addendum issued with the pre-bid meeting minutes. For your reference the current wage determination is HI120001 Modification 8 (8/3/12). Even though the Federal Wage scale is locked in, be mindful that the State wage rate schedule is not locked in, therefore when there is an increase in the State wages the contractor and their subs will have to pay the increase rate.

6. Hawaii Compliance Express:

The State of Hawaii requires the use of Hawaii Compliance Express to obtain proof of Compliance prior to the award of the contract. Therefore to avoid delays in awarding the contract to the lowest bidder, the general contractor and all of their subcontractors will need to be registered on Hawaii Compliance Express. Go to http://vendor.ehawaii.gov for information on how to register.

7. General Requirements and Special Conditions:
   We encourage all bidders to read and comprehend the Project Specifications. Any questions should be directed in writing to:

   Patrick Young
   #620-9287 (telephone)
   #620-9299 (fax)

8. Site Inspection: Following this pre-bid meeting.

9. Question and Answers:

State of Hawaii
Department of Hawaiian Home Lands

Minutes of Pre-Bid Conference for

MAKUU OFFSITE WATER SYSTEM PHASE 2
PRODUCTION WELL, RESERVOIR AND SUPPORTING FACILITIES
HALONA, PUNA ,ISLAND OF HAWAII, HAWAII
(IFB NO.: IFB-13-HHL-002)

Date: August 7, 2012
Time: 9:00AM
Location: Conference Room, DHHL East Hawaii District Office, Hilo

ATTENDEES

The attendance sign in sheets are attached to this addendum.

Pre-Bid Meeting
Patrick Young, the DHHL's Project Manager for this project, called the meeting to order and welcomed everyone to the pre-bid conference. Mr. Young stated that this is a mandatory pre-bid meeting; attendance is mandatory to be eligible to submit a bid. Then the meeting proceeded and each agenda item covered. The agenda is attached to this addendum.

It was noted that in the agenda, there was a typo regarding the bid opening date. The correct bid opening date is August 27, 2012.

Mr. Young announced that an addendum would be issued. The addendum will include, but not be limited to, the minutes of this pre-bid meeting, changes to plans and changes to specifications due to final review comments by Department of Water Supply. It is the bidders' responsibility to check the DHHL procurement website for addenda.

All submittals, including bid forms, need to be sent to the DHHL Kapolei office on Oahu. Bids will be opened at the Kapolei office.

Any questions should be directed in writing to Mr. Patrick Young. Email is ok, address is:
Patrick.K.Young@hawaii.gov
You may send fax to 808-620-9299.

Mr. Young announced that there will be an optional site inspection of the Offsite Well and Reservoir Site and also the Existing DWS Keonepoko Nui Site following this meeting.

CORRECTION

It was incorrectly stated in the pre-bid meeting, that American Reinvestment Recovery Act (ARRA) funds will be used for this project. While federal USDA Rural Development funds will finance a portion of this project, the funds are not designated as ARRA funds, thus ARRA reporting requirements will not be required from the Contractor.

SUMMARY OF PRE-BID CONFERENCE QUESTIONS AND RESPONSES

1. Question: Is this project exempt from the General Excise Tax?

   Response: No, this project is not General Excise Tax exempt.

2. Question: When is Notice To Proceed (NTP) expected?

   Response: The average NTP has been three to four months after bid opening. But this project has federal funding, so it may take longer to issue the NTP. Samantha Shimizu, of USDA Rural Development, explained to the attendees that the local USDA office has to send items to their mainland office for review. The mainland review takes at least thirty (30) days.

3. Question: Will the Federal and State contracts split be on selected individual bid items?

   Response: No. Contractor will need to split his overall invoice 82%/18% (Na Kupaa contract / DHHL contract) on all items.

4. Question: Will separate bonds be required for the State contract and the Na Kupaa contract?

   Response: Yes, each contract (DHHL and Na Kupaa) will require its own bonds.

Meeting Adjourned: 9:45 AM
Minutes Prepared By: Eric Hee
Engineers Surveyors Hawaii, Inc.
August 10, 2012

Date: TUESDAY, AUGUST 7, 2012

PROJECT: MAKUU OFFSITE WATER SYSTEM PHASE 2

PRODUCTION WELL, RESERVOIR AND SUPPORTING FACILITIES

EAST HAWAII DISTRICT OFFICE, HILO, HAWAII

NAME (Please Print)	FIRM	PHONE NO.
1. Michael Erwin	DN Tanks	619 440-818
2. DERRICK MOREIRA	DERICK'S well drilling	557-5309
3. DWight Mills	WRI	7220660
4. Kihei Ahuna	WRI	938-4030
5. ALFRED CHENG	Dyakyo Construction, Inc	479-2177
6. Jeremy Welch	Drayko Construction	206-0162
7. Eric Hei	Engineers Surveyors Hawaii, Inc	591-8116
8. Salvador Quitoriano	Akinaka & Assoc, Ltd	836-1900
9. SAMANTHA Shimizu	USDA Rural Development	933-8307
10. Patrick Young	STATE OF Hi. DHHL	—
11. Sandra Pfund	DHHL	620-9271
12.		
13.		
14.		
15.		
16.		
17.		
18.		
19.		
20.		

REMARKS:

Date: TUESDAY, AUGUST 7, 2012

PROJECT: MAKUU OFFSITE WATER SYSTEM PHASE 2

PRODUCTION WELL, RESERVOIR AND SUPPORTING FACILITIES

EAST HAWAII DISTRICT OFFICE, HILO, HAWAII

NAME (Please Print)	FIRM	PHONE NO.
1. Kyle Sakitani	Kozz	960-2838
2. Erin Welsh	Metcalf West	960-8375
3. FRED G. CAMERO JR	BEYLIK DRILLING	478-7114
4. GERARD YAMADA	GW CONSTRUCTION	966-4582
5. Dana Leatherwood	F&H Construction	871-8575
6. Wen Hao Zeng	Royal Dragon Builders	286-0671
7. Owen Nishioka	Dept. of Water Supply	961-8070, x 259
8. Bryce Harada	Jas W. Glover	935-0871
9. Cecily Unaki	Jas. W. Glover	935-0871
10. Dale Burton	RCAC	934-0559
11. Pat Brandt	Na Kupaa	386-0435
12. SAMANTHA SHIMIZU	USDA Rural Development	933-8307
13. Glenn Kobayashi	Isemoto Contracting	960-7194
14.		
15.		
16.		
17.		
18.		
19.		
20.		

REMARKS:

WATER SYSTEM STANDARDS

DIVISION 300
SECTION 304 – MECHANICAL AND ELECTRICAL

The following shall supplement Section 304.01 of the Water System Standards.

A. SUBMERSIBLE PUMPS:
The following requirements are for the furnishing and installation of the pump, motor, and appurtenances of the Deep Well Pump Station.

A.1 WELL PUMPING UNIT:
This section of the specification covers the furnishing and installing of one new vertical, motor-driven, submersible deep well turbine pumping unit. The pump shall conform to AWWA E 101-88 specifications.

A. Pump Characteristics:

Number Required: One (1)

Pump Rated Capacity and Head: 1000 gpm at 850 ft. head
(Pump efficiency not less than 8**6**%)

Example of pump performance characteristics desired:

1. 0 gpm at 1071 ft. head maximum (shutoff head)

2. 900 gpm at 900 ft. head
(Pump efficiency not less than 8**6**.0%)

3. 1000 gpm at 850 ft. head
(Pump efficiency not less than 8**6**.0%)

4. 1100 gpm at 790 ft. head
(Pump efficiency not less than 8**5.5**%)

Pump used to dimension plans and specify pump performance characteristics:

Goulds Pumps 1770 rpm (12 CMC, 1**8** Stages)

B. Motor Characteristics:

Number Required: One (1)
Electric Motor Rating: 300 HP
Power: 3-Phase, 60 Hertz, 2300 Volts
Minimum Full Load Motor Efficiency: 8**8**%

C. Surface Plate Assembly:
Surface Plate: 2 in. thick x 27.50 in outside diameter x 25.00 in bolt circle

Discharge Elbow: 10 in – 90 degrees, long radius, schedule 40 steel reducing elbow reduced to 8 in dia. down hole as shown in the plans.

Discharge Flange: 10 in – 150 lb ASA flat face

D. Discharge Column:
Minimum Inside Diameter: 8 inches
Minimum Pipe Wall Thickness: .322 inches (Schedule 40)

E. Pumping Unit Efficiency Test Requirements:

Minimum guaranteed overall efficiency of pump unit at rated capacity and head: 73%

F. Well Data:
All elevations refer to mean sea level.
Well Casing Inside Diameter: 16 inches
Length of Solid Steel: 797.5 feet
Length of Perforated Steel Casing: 100 feet
Elevation of Bottom of Solid Steel Casing: +26.49 feet
Elevation of Bottom of Perforated Steel Casing: -73.51 feet
Elevation of Bottom of Pump Submersible Motor: -28.33 feet (estimated)
Elevation of Pump Suction Inlet: -18.2 feet
Elevation of Bottom of Pump Discharge Head/Surface Plate: +824.0 feet
Length of Pump Column as measured from Pump Discharge Elev./Surface Plate to top of Pump Bowl Assy: 833.0 ft (Approximately)
Elevation of Estimated Static Water Level in Well: +16.77 ft, MSL
Estimated Drawdown: 0.5 foot + or – at 1050 gpm

G. Deep Well Pump Description:
The pump shall be as manufactured by Goulds Pumps, or approved equal and meet "Quality Management Standards", ISO 9001:1994 and NSF 61.

Bowls:
The pump bowls shall be ductile iron having a minimum tensile strength of 30,000 pounds per square inch, free from blow holes, sand holes and all other faults; accurately machined and fitted to close dimensions. Bowls shall be porcelain enamel lined. Porcelain enameled finish shall be smooth, nominal 8 mils thick, and shall be free of defects such as thin spots, blister, chipping, spray sagging, air bubbles, fish scaling and pinholes. The manufacturer shall provide the Engineer with pressure ratings of bowls at one and one-half (1-1/2) times shut-off conditions as well as at full load.

Pump Shaft:
The pump shaft shall be of polished ASTM A 582, Grade 416 stainless steel and shall be supported by suitable non-corrosive bearings on both sides of each impeller and positive means must be provided for water lubricating each bearing. The shaft shall be provided with a means to accurately locate the shaft with respect to the bowls during assembly of the bowl unit. The case bearings shall be bronze or other approved material.

Impellers:
Impellers shall be the fully enclosed type of bronze cast from new ingot material of heavy construction, finished all over, accurately fitted and perfectly balanced both statically and dynamically. (Hydraulic "balanced thrust" impellers shall not be permitted.) They shall be locked securely to the impeller shaft with a tapered collet lock bushing or other means.

The bowls and impellers shall be designed with open and smooth passages to secure efficient operation and to prevent air locking or sand locking. The impellers shall be so designed as to permit axial adjustment to compensate for wear. The clearance calculations shall be submitted to the Engineer before the pump is installed.

Surface Plate Assembly:
The surface plate assembly shall consist of a heavy steel base plate with a steel coupling of required strength to carry the weight of the complete pumping unit. The coupling shall be screwed onto the upper end of the column pipe and shall have a long radius steel flanged reducing elbow. The surface plate shall be round with 8 bolt holes. **Two** 1-inch NPT tapped hole**s** shall be provided in the surface plate for connection to the air relief line which will allow the relief of air in the space between the casing and the pump column **and serve as a port for 3/8-inch HDPE line**. Three additional 1-1/4 NPT inch tapped holes shall be provided in the pump base to allow the soundings tubes for water level determination to pass through the base into the area between the column and casing. A suitable opening shall also be provided to pass the power cable from the junction box through the surface plate into the area between the column and casing. Provide suitable lifting lugs of required strength to lift the entire pump unit into or out of the well for installation or maintenance purposes.

Discharge Column Assembly:
The discharge column assembly shall conform to the following requirements:

1. Discharge Column Pipe Size
   The pipe for the discharge column shall have a nominal inside diameter of not less than that specified.

2. Discharge Column Pipe Description
   The discharge column pipe shall be Schedule 40 steel pipe conforming to ASTM specification A 53, Grade B and shall be coated with zinc inside and outside by the hot-dip process. Each section of the column shall be NPT threads. The pipe

shall be furnished in interchangeable sections of 20 feet nominal length. The Schedule 40 pipe specified is the minimum weight to be furnished. The Contractor shall furnish and install a heavier weight of pipe should same be required to satisfy pressure or structural requirements for his proposed pump installation.

3. Certification of Discharge Column Pipe
   A certificate must be submitted to the Engineer before the pump is installed verifying the following:

   a. The thickness of the discharge column pipe furnished is as specified.

   b. The pipe supplied conforms to ASTM Specification A 53, Grade B.

   c. The pipe has been coated with zinc inside and outside by the hot-dip process.

4. Steel Column Couplings
   The pipe shall be fastened with threaded-sleeve type galvanized steel couplings.

   Column Check Valve:
   A column check valve(s) shall be furnished and installed to prevent surging the well due to rapid column drain. The check valve shall be 8 inch nominal size. The location shall be as shown on the plans. The check valve(s) shall be a Lakewood Check Valve, or approved equal with double flapper disk and a round neoprene upper crossbar to absorb seat opening shock. **The check valve(s) shall be constructed with 316 SS pin and Vesconite bearings between flapper knuckles and pin to prevent freezing in the open position.** Hinge openings shall be provided to allow water to bleed back into the well when valve seats are closed. The check valve(s) shall be threaded on both ends to attach the valve to the column pipe and shall be capable of supporting a maximum load of 85,000 pounds.

   Strainer:
   The strainer screen shall be 416 stainless steel. The net area of the screen openings shall be not less than twice the area of the pump suction opening and shall be fastened with stainless steel bolted connections. The pump shaft shall extend through the strainer and shall be supported by adequate bronze, extra long, sleeve type bearings integrally constructed with the strainer body and shall be provided with a sand cap for protecting the bearings against sand and grit.

   Full Face Gasket:
   Provide a full face gasket between the leveling plate and surface plate assembly.

   Motor and Pump Connection:
   Different manufacturers were used to specify the motor and pump assembly. It shall be the responsibility of the pump contractor to supply suitable

adaption/mechanical connection between the motor and the pump assembly. The warranty provisions shall cover the full resultant assembly.

Centering Guides:
Centering guides shall be strapped/installed on the column assembly just above the discharge end of the pump and motor assembly and spaced at 120-degree intervals around the column for the length of that 20-foot column pipe.

Motor Description:
The motor shall be a new and unused of the vertical, submersible type capable of continuous operation at nameplate rating submerged under water at a maximum temperature of 77 degrees F and suitable for "across the line" starting. It shall be provided by the pump contractor to be installed in the existing well with ample clearance for water to flow pass the motor into the pump and shall be rated at 300 HP, 3 phase, 60 Hz, 2300 volts, 1800 RPM with a minimum service factor of 1.1**0**. Minimum Efficiency at full load shall be 8**8**% with a minimum power factor of **88**%. The maximum actual motor diameter shall not exceed **13.5625** inches in diameter at its widest point.

The motor shall be the oil-filled type and filled with a high dielectric strength FDA approved food grade mineral oil that meets NSF 61.

The motor shall be equipped with a double mechanical seal design which will incorporate a chamber between the two seals to collect and return seal leakage to the bottom end of the motor. The motor design shall automatically balance internal pressure in the motor with the well pressure (submergence pressure) outside the motor without the use of diaphragms or springs.

The motor design shall include the capability to carry continuously, the total sum of the weight of the rotating components of the pump and motor, and the hydraulic thrust that the pump might apply in both the up and down direction. The **Kingsbury-Type segmented** motor thrust bearings are to be designed to carry not less than 16,700 lbs. down thrust and 10,600 lbs. of up thrust.

The motor windings shall be a minimum of Class F insulation utilizing a VPI process and be of the form wound design on all voltages 4000 volt and above.

The motor rotor will be squirrel cage with copper bars for maximum efficiency and be dynamically to ISO grade G2.5.

The motor shall be equipped with a factory hot-injection molded plug at the motor terminal end. The plug design shall incorporate a sealing plug-in design, which can be removed without disassembling any part of the motor. The cable plug design shall be capable of withstanding full submergence pressure without failure. The submersible motor shall be a Byron-Jackson, 2300 volts, 4 pole submersible, 300 HP motor or an approved equal.

Manufacturer's certified copies of tests run on a motor of the same type, size and model as being furnished shall be forwarded from the Contractor for inclusion in bound sets for submittal to the Engineer. Test data shall include:

1. A.C. Winding resistance
2. No load current
3. Full load current
4. Locked Rotor current
5. Starting Torque
6. Motor efficiency at 50, 75 and 100% full load
7. Power factor at 50, 75, and 100% full load
8. Power factor at full load with 90 and 110% rated voltage

H. Power Cable:

Provide a sufficient amount of power cable of proper size and voltage rating to reach from the motor terminal connection cable to the junction box above the surface plate and adjacent to the discharge elbow. The cable shall comply in every respect to the National Electrical Code, latest edition. The cable shall have three conductors and sized to confirm for 125% of motor full amps at the conductor temperature rating of **90** degrees C and a voltage drop at the motor not to exceed 3%. The individual conductors shall be class "B" stranding or better, with synthetic rubber or thermoplastic insulation. The cable shall be supported on the pump column by suitable stainless steel straps at intervals not exceeding 10 feet. The cable shall have suitable suitable provisions to take care of any stretching of the pump column.

Type: Cross-linked thermosetting polyethylene insulated cable in conformance with IPCEA (Insulated Power Cable Engineers Association) S-66-524 and NEMA WC-7 (latest issue).

Construction: Three conductors, concentric lay or side by side (to suit clearance requirement of existing well casing), **with** ground wires, **no shielding**. Synthetic insulated, **armored,** and jacketed.

Size: AWG No. 4

Voltage: 2300 volts rated (volt usage)

Usage:

1) Vertical submersible turbine well unit power conductor from surface to driver in well.

2) Environment
- in air (-20 degrees F to +130 degrees F)
- in water (60 degrees F to 190 degrees F)
- variable external pressure from 0 to 50 psig

3) Powering a submersible three-phase, squirrel cage induction motor

4) Vertical suspension, supported every 10 feet with bands or clamps

to the pump discharge column.

Testing: In conformance with IPCEA S-66-524 and NEMA WC-7, latest issue.

Certification of Compliance: The Contractor shall submit three copies of certificate of compliance that the power cable fabrication, materials and testing complies with IPCEA S-66-524 and NEMA WC-7, latest issue.

A.2 KEONEPOKO-NUI NEW BOOSTER PUMPING UNITS:

This section of the specifications covers the furnishing and installing of two (2) new vertical, motor-driven, booster turbine pumping units. The pumps shall conform to AWWA E 101-88 specifications.

A. Booster Pump Characteristics:

Number Required: Two (2)

Pump Rated Capacity and Head: 400 gpm at 290 ft. head
(Pump efficiency not less than 85.0 %)

Example of pump performance characteristics desired:

1. 0 gpm at 384 ft. head maximum (shut-off head)
2. 320 gpm at 316 ft. head
   (bowl efficiency not less than 81.2%)
3. 400 gpm at 290 ft. head
   (bowl efficiency not less than 85.0%)
4. 480 gpm at 251 ft. head
   (bowl efficiency not less than 83.9%)

Pump used to dimension plans and specify pump performance characteristics:

Goulds Pumps, 1770 rpm (9 RCLC, 7 stages)

B. Motor Characteristics:

1. Number Required: Two(2) Premium Efficient
2. Electrical Motor Horsepower Rating: 40 hp
3. Power: 3 phase, 60 cycle, 240/460 volts
4. Minimum Full Load Motor Efficiency: 9**4.5**%
5. Minimum Motor Speed: 1775 rpm
6. Service Factor: 1.15
7. KVA Code Letter: G
8. Totally Enclosed Fan Cooled (TEFC)
9. NEMA Design Code: B

10. Internal Space Heaters: 115 Volts
11. Maximum Sound Pressure at 3 feet: 70 dBA

C. Discharge Head Characteristics:

1. Number Required: Two (2)
2. Size and Class of Discharge Flange:
   4 inches, 300 lbs., ASA
3. Size and Class of Suction Flange:
   8 inches, 150 lbs., ASA
4. Height of Centerline of Discharge/Suction Flanges from Baseplate:
   12 inches.

D. Suction Barrel Characteristics:

1. Minimum Nominal Diameter: 12 inches
2. Minimum Length of Suction Barrel: 9' – 0" long.
3. Minimum Barrel Thickness: 0.375 inches.
4. Minimum Pressure Rating of Barrel: 150 psig.

E. Line Shafting:

1. Minimum Shaft Size: 1-3/16 inches.
2. Shaft Material: High chrome stainless steel ASTM A 582, Grade 416.
3. Coupling Material: High chrome stainless steel ASTM A 582, Grade 416.

F. Pumping Unit Requirements:

Minimum Guaranteed Overall Efficiency of Pumping Units at Rated Capacity and Head: 7**8**%

G. Pump Bowls:

The pump bowls shall be of close-grained cast iron having a minimum tensile strength of 30,000 pounds per square inch, free from blowholes, sand holes, and all other faults; accurately machined and fitted to close dimensions. The bowl shall be porcelain enamel lined, nominal 8 mils thick, finished smooth, and free of defects. Bowls shall conform to ASTM 48, Class 30. Bowl shall be able to withstand the shut-off head. Provide stainless steel bowl cap screws.

H. Impeller Shaft:

The impeller shaft shall be of polished ASTM 582, Grade 416 stainless steel and shall be supported by suitable noncorrosive bearings on both side of each impeller, and positive means shall be provided for water lubricating each bearing. The shaft shall be threaded at the lower end to receive an assembly nut to accurately locate the shaft with respect to the bowls during assembly of the unit.

The bottom base bearing shall be bronze or other approved material. All shaft couplings, head shaft adjusting nuts, shaft pins and all nut exposed to the elements shall be stainless steel of the same composition as the impeller shaft.

I. Impellers:

Impeller shall be the fully enclosed type of ASTM 954 aluminum bronze cast from new ingot material of heavy construction, finished all over, accurately fitted and perfectly balanced both statically and dynamically. (Hydraulic "balanced thrust" impellers shall not be permitted.). They shall be locked securely to the impeller shaft with a tapered collet lock bushing or other means. The bowls and impellers shall be designed with open and smooth passages to secure efficient operation and to prevent air locking or sand locking. The impeller shall be so designed as to permit axial adjustment to compensate for wear. The manufacturer of the pump must provide sufficient clearance in the bowl of the pump he supplies to take care of any stretching of the shaft under shut-off head conditions without the impeller making contact with bottom surface of the bowl.

J. Motor Description:

The motor shall be a normal premium efficient torque, low starting current, vertical, hollow shaft, Totally Enclosed Fan Cooled (TEFC), squirrel cage induction motor or approved equal and shall conform to the standards of the National Electrical Manufacturers Association, American National Standards Institute and the Institute of Electrical and Electronics Engineers. The motor shall be designed for full voltage starting and shall have a horsepower rating of not less than specified, and shall be a U.S. Vertical Hollow Shaft Induction Motor, or approved equal. The motor shall have adequate capacity to drive the pump continuously under the head specified with a temperature rise of not more than 40 degrees C. The maximum starting current shall not exceed that of a motor having a locked rotor current of that specified.

Modifications to the motor shall include 120-volt internal space heaters.

Motors shall have an efficiency of not less than that specified when operating under full load conditions. The bearings of the motor shall be oil or grease lubricated. The motor thrust bearing shall have ample capacity for the thrust loads of the pump thrust and weights of the pump shaft and pump rotating element with pump operating at shut-off head conditions. The thrust bearing shall be of such size that the average life rating is base on five years of continuous operation. It shall also have ample capacity to permit the pump to operate for 10-minute periods with the discharge valve closed.

The selection of the motor shall be the responsibility of the Contractor and Pump Manufacturer and must meet the approval of the Manager before it is ordered.

Manufacturer's certified copies of tests run on a motor of the same type, size and model as the one being furnished shall be forwarded to the pump supplier for inclusion in the bound sets for submittal to the Engineer. Test data shall include:

1. A.C. winding resistance
2. No load current
3. Full load current
4. Locked rotor current
5. Starting torque
6. Motor efficiency at 50, 75 and 100% full load
7. Power factor at 50, 75 and 100% full load
8. Power factor at full load with 90 and 110% rated voltage

K. Discharge head and Suction Barrel:

The discharge head shall be fabricated steel with suction and discharge flanges located above the ground. The mechanical seal in the discharge head shall be Chesterton "Balanced Type" or approved equal. All discharge heads shall be furnished by the pump manufacturer. The pump nameplate shall be securely fastened in a conspicuous place showing the manufacturer's name, serial number, capacity in gpm at rated head in feet, speed in rpm and the number of stages for each pump.

The suction barrel with combination flange and foundation mounting plate shall be fabricated steel with a minim thickness of ¾-inch drilled to match the discharge head and shall be furnished with gaskets and bolts for mounting the discharge head. The suction barrel shall be designed for a minimum pressure rating of 150 psi, with a minimum wall thickness of 0.375 inch and guide vanes at the bottom to reduce vortices. The discharge head and suction barrel assemblies must be approved by the Engineer before they are ordered by the Contractor. Discharge head shall have a bronze bushing just before the mechanical seal to support the pump shaft.

L. Spare Parts:

1 set mechanical seals for the pump. Chesterton 155 or approved equal.

B.1 SUBSTITUTION OF SPECIFIED PUMP UNIT

The pumping unit to be furnished is that used to specify pump unit performance characteristics or their approved equal. This specific model has been used to dimension plans. Substitute pump units can be used only if the following conditions are met:

A. All changes in dimensions resulting from the substitution of the specified pump and motor shall be the responsibility of the Contractor and such changes must be approved by the Engineer ten days prior to bid opening date.

B. The substitute pump and motor must have performance characteristics equal to or better than the specified pump unit. Specific performance characteristics that shall be compared are the required horsepower, efficiency and head capacity curve. The pump and motor shall be OEM unit and be provided with manufacturer's data and actual working applications of a similar pump unit.

B.2 PRELIMINARY PUMP CHARACTERISTIC CURVE

The Contractor shall submit three copies of the preliminary pump characteristic curve to the Engineer for approval prior to ordering and shipping the unit. The curve shall show the proposed head, efficiency and brake horsepower versus capacity characteristics of the pump to be furnished. The Contractor shall furnish the pump shaft size, pump requirements, number of stages, bowl dimensions, and specifications.

B.3 FACTORY PUMP TESTS

The Contractor shall submit three copies of a certified performance curve for the pump and string test which he proposes to furnish, based on a factory witnessed running test for the pump unit and motor made in accordance with the recommended practices of the Hydraulic Institute and the American Waterworks Association to show that the specified conditions can be met by his equipment. The test shall also be certified and witnessed by an independent registered professional engineer. The curve and data sheet must be approved by the Engineer. The performance curve shall show the head capacity at rated speed, efficiency capacity, and required brake horsepower capacity curves for the pump. The pump shall be operated by shut-off condition and at a minimum of five capacity points, including one within ±2 percent of the design speed. The Contractor shall provide a complete pump string test with overall efficiencies in addition to pump and motor efficiency test data. The Contractor shall submit three copies of the data sheet used to plot the curves to the Engineer.

B.4 INSTALLATION INSTRUCTIONS AND MAINTENANCE MANUAL

The pump manufacturer shall also provide at least four copies of the instructions for the installation of the pumping unit and proper maintenance of the same in bound folders.

B.5 EQUIPMENT ASSEMBLY

Installation of the pumping unit shall be made for the Contractor by a DWS-approved subcontractor possessing current C-57 Well Drilling Contractor License and/or a C-57a Pump Installation Contractor License or a C-68 Pump Specialty License at the time of bidding and throughout the project and shall be under the direction of the supplier of the pumping unit. The unit shall be installed in the presence of the Engineer or his designated representative. The Contractor installing the pump unit shall have at least five years experience in installing deep well pumps.

Immediately after the Contractor is given the notice to proceed and prior to ordering the submersible deep well pump, the Contractor shall provide a "gage" of the same length and diameter as the combined pump and motor assembly to test the plumbness and alignment of the well. In the presence of the Engineer or his designated representative, the Contractor shall lower the "gage" into the well to the elevation at which the motor

and pump are to be placed. If the "gage" can be lowered to this point without binding and to the satisfaction of the Engineer, the Contractor may proceed in ordering the pump.

All equipment shall be located, leveled and aligned to accurately maintain all lines and grades shown on the applicable drawings. Where assembly tolerances are established by written instructions provided by the equipment manufacturer, such tolerances shall govern. If the equipment manufacturer does not provide assembly tolerances, such tolerance shall be normal for the class of fit and the type of work involved. Alignment of rotating shaft centers at couplings shall not exceed proper allowance for the expansions of the driving and driven units when operating; and faces of coupling halves, with coupling square on their shafts, shall be parallel. In any case, tolerances and alignments must be approved and witnessed by the Engineer or his designated representative.

Grouting of equipment bases and supports shall be performed after final positioning at proper elevation, with all plumbing, leveling and aligning completed and with anchors tightened. Grouting of equipment bases and supports shall be in accordance with Article GROUTING of Section 2.2. Once grouted, the item shall not be operated or subjected to other vibration or stresses until the group has reached an age of seven days minimum.

Shimming of equipment bases and supports shall be performed after final positioning at proper elevation, with all plumbing, leveling and aligning completed and with anchors tightened.

The Contractor shall do lubrication of all moving parts with the lubricants recommended by the manufacturer. Rotating equipment, which has been shipped dismantled for assembly in the field or is not shipped with lubricants, shall have the bearings flushed clean and lubricated when assembly is complete.

The following requirements and instructions of equipment manufacturers shall be followed precisely regarding lubrications.

All surfaces of equipment shall be cleaned prior to assembling and erecting. All internal surfaces shall be maintained clean and free of dirt, water, loose scale and all other foreign materials during assembling and erecting, and shall subsequently be thoroughly cleaned prior to initial operation or use.

B.6 PAINTING

Paintings of new deep well pump unit, all exposed pipes, fittings, and valves associated with the new pump stations shall be as specified herein and in Section 2.26 – "Painting". Paint shall be delivered to the site in factory-sealed containers and applied in accordance with the manufacturer's instructions. All surfaces to be painted shall be thoroughly cleaned of dirt, dust, oil or grease with clean, dry rags and solvents. Rust, mill scale, stain and any other injurious materials shall be removed by scraping, chipping, wire brushing or sand blasting. Drop cloths and other suitable covering shall be used to eliminate paint drips or overspray beyond the painted surfaces. **All materials shall be painted prior to assembly. After final assembly, painting touch ups will be**

performed as required to the satisfaction of the Inspector. All fastener threads, flange faces and valve stems shall be protected from paint.

B.7 LAYOUT DRAWINGS

Three sets of the pump and piping layout drawings shall be submitted for approval to the Engineer prior to construction. All dimensions of the pump, valves, piping, fittings, well dimensions (static water level), solid casing info, bottom hole, sounding tube location and appurtenances shall be shown.

B.8 FIELD TESTING OF PUMP UNIT

After installation of all equipment and before any field tests are conducted, the pump shall be operated continuously for a period as determined by the Engineer or as required by the pump installation permit. The Contractor shall make his own arrangements and pay for power and other costs.

Throughout the operating test, the pumping unit shall run smoothly without vibration or heating of the bearings. If, during or as a result of this test, any structural or mechanical defect or weakness develops, or if the equipment fails to deliver its required discharge at the respective head under required conditions, the Engineer reserves the right to reject any part or all of the equipment and demand reconstruction or replacement to meet the requirements of these specifications at no cost to the DWS.

After the operating test has been completed to the satisfaction of the Engineer, an efficiency test shall be made for the pumping unit covering a period of not less than two hours. This efficiency test shall be made by the Contractor in the presence of the Engineer and in accordance with the recommended practices of the Hydraulic Institute and American Waterworks Association. The capacity of the pumping unit will be tested under the head capacity conditions specified.

All gages and equipment required for tests, which are not available in the permanent equipment, will be furnished, installed and tested by the Contractor. All gages shall be calibrated and calibration curves shall be submitted.

The overall efficiency of the pumping unit shall be the ratio of the water horsepower delivered by the pumping units as measured at the pump discharge head to the total electrical power consumed by the unit. Overall efficiency shall include all pump, motor, and power cable losses.

The quantity of water delivered shall be based on the readings of the flow meter. No special calibration will be made. Tests shall be made with the electric current normally furnished by Hawaii Electric Light Company, Ltd. No adjustment of the electrical power will be allowed.

Should the test for efficiency for the pumping unit result in an overall efficiency of less than that specified in the guaranteed capacity and head point, the Contractor shall make

the necessary changes and replacements. The Contractor shall pay all such changes and replacements and any additional tests required. During the period between the first test and the final acceptance of the pumping unit by the Owner, the unit shall be left in place and in good working condition for use by the Owner in order to provide service, if required, at no additional cost to the Owner.
The pump contractor shall also provide at least three copies of the field-testing that the pump is accepted at.

B.9 AS-BUILT DRAWINGS

The Contractor at no additional cost shall return one set of red marked as-built drawings to the Engineer.

B.10 PACKING AND SHIPMENT

Pump equipment shall be packed in substantial containers to protect them adequately from damages during normal handling in transit.

B.11 STORAGE

The Contractor shall, as a minimum, comply with the following requirements for protection of all equipment during storage.

Equipment shall be stored off the ground, properly supported on skids, blocking, cribbing or other suitable support. Equipment having saddle or dollies shall be supported mainly from these supports. Equipment supports shall be leveled and aligned on wedges or shims as necessary to prevent any twisting or bending stresses on the supported equipment.

At the time of delivery, the factory-installed closures on nozzles and equipment openings shall be inspected for weather-tightness. Any closures, which are punctured, or missing shall be replaced with temporary closures and made weather-tight. All closures shall be maintained weather-tight and left in place until the Engineer or his representative authorizes removal.

Motor and controls shall be stored only in an enclosed cover, except that if outdoor storage of a short duration is necessary, these items may, for that period, be stored off the ground and fully covered with a suitable waterproof covering free from punctures or tears and secured against displacement. The protective measure for all such outdoor storage will be provisional upon approval by the Engineer.

B.12 COORDINATION OF WORK

The Contractor's work and installation of equipment and materials shall be closely coordinated with the Engineer and other contractors working on the project to avoid all possible interferences, delays, omissions, and overlapping of responsibilities.

B.13 WARRANTY

The Contractor shall guarantee the equipment covered by these specifications against any defective material and workmanship for two years after the date of acceptance of the

installed pump unit. The Contractor shall replace and correct all defective parts within this period and pay for all costs thereof including shipping, removal and reinstallation of the necessary parts. It shall be understood that any shipping damages shall be corrected and paid for by the Contractor, and final acceptance and payment will be subject to satisfactory delivery of the equipment.

B.14 PAYMENT

The pumping unit, which includes motor, measured as provided above, will be paid for at the applicable contract unit price at the well site:

"One only vertical turbine submersible deep well pump and motor unit, inclusive of discharge column, Lakewood check valves, surface plate assembly, power cable, 1-1/4-inch Sounding Tubes, pump discharge piping, valves, fittings, silent check valve, air and vacuum valve assembly, pump control valve assembly, electromagnetic flow meter, flow transmitter, flow switch, air relief valve assembly, sand sampler assembly, and pressure gage assemblies, inclusive of painting and testing, fully operational per plans and specifications."

Which price shall be full compensation for furnishing, handling, installing, and testing pumping unit; and for all equipment, tools, labor, materials, including drawings and instruction books, and incidentals necessary to complete the work.

Payment for the item shall be made as follows:

Forty percent of the total cost for the item will be paid when the complete pumping unit is acceptably delivered at the job site.

An additional 40 percent of the total cost for the item will be paid after the pumping unit has been installed.

The remaining 20 percent of the total cost for the item will be paid after the pumping unit has been tested and accepted.

The Contractor shall make payment for the inspection and testing of the pumping unit within 30 days after receipt of invoices. The Engineer shall have the right to withhold from monies due the Contractor, a sufficient amount to cover such invoices. The right to withhold money from the Contractor will be at the discretion of the Engineer and shall be without recourse by the Contractor.

WATER SYSTEM STANDARDS

DIVISION 300- CONSTRUCTION
SECTION 304.04 – PUMP STATION MECHANICAL EQUIPMENT

D. CHLORINATORS

The following shall modify and supplement DIVISION 300- PUMP STATION MECHANICAL EQUIPMENT in the Water System Standards, 2002

Paragraph D. Mechanical Work shall be added to and supplemented as follows:

CHLORINATION SYSTEM AND APPURTENANCES

SCOPE:

Section Includes: All labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the work of this section, complete, as specified herein. The work includes, but is not limited to the following:

a) Examine all other sections for work related to those specifications and required to be included as work under this section.

b) Furnishing and installing a gas-fed chlorination system as indicated. The installation shall include equipment, pipes, fittings, electrical connections, and all appurtenances to affect a complete operational and functioning chlorination system.

CHLORINATION SYSTEM DESCRIPTION:

A. CHLORINE AUTOMATIC SWITCHOVER MODULE:
The automatic switchover gas feeder shall be Capital Control ADVANCE Series 200 Gas Feeders, or an approved equal, and shall be of the vacuum operated, solution feed type and shall automatically switch the gas supply from an empty source to a full source. The system shall have automatic reset and shall not permit return to the initial source until the second is empty. The gas feeder shall have a maximum capacity of 25 pounds per day of chlorine gas feed and shall be equipped with a remote mounted gas flow meter of 0 to 25 pounds of gas feed per day.

The gas feeders shall mount directly on the gas cylinder valve by means of a positive yoke type, gasket connection and shall be provided with a gas valve direction indicator.

B. CHLORINE GAS FEEDER DESIGN:
The gas feeder design shall provide for conveying the gas under vacuum from the vacuum regulator to the ejector-check valve assembly to insure complete system safety. The gas feeder design shall permit the entire system to be vacuum checked in the field without using special tools or manometers. The gas feeder shall be constructed of

materials specially selected for wet or dry gas services. All springs used in the gas feeder shall be of a tantalum alloy for chlorine gas service. The rate valve and seat shall be constructed of fine silver for chlorine. A double thickness diaphragm shall be provided for vacuum regulation.

The rate of gas feed shall be set manually and shall remain constant until manually changed. A differential pressure regulator shall not be required for gas flow control.

C. CHLORINE GAS FEEDER ASSEMBLY:

The gas feeder shall be comprised of the following: vacuum regulators, gas flow meter with manual rate valve, pressure relief valve, ejector-diffuser assemblies, gas supply indicator, and automatic switchover module:

1. Vacuum Regulators:
   Each vacuum regulator shall mount directly on the gas valve by means of a positive yoke type, gasket connection. Vacuum shall be controlled by a spring-opposed diaphragm regulator which shall close tight upon loss of vacuum. Each regulator shall be equipped with a gravity-actuated loss-of-gas indicator, and gas flow-meter.

2. Yoke Assembly:
   The corrosion-resistant yoke assembly shall be fitted with a metallic inlet valve and filter capsule which is field replaceable using only a screwdriver. The coating on the corrosion-resistant yoke assembly shall be fusion-bonded epoxy.

3. Gas Flow Meter and Rate Valve:
   The gas flow-meter with solid silver rate valves and solid silver seats for chlorine shall be mounted on a chemical resistant panel for mounting. The gas flow-meters shall indicate the flow of gas to a minimum of 1/20 maximum feed.

4. Relief Valve:
   Pressure will be prevented from building up in the system by means of a spring-loaded, diaphragm-actuated pressure relief valve located at the vacuum regulator. The gas shall vent at the vacuum regulator.

5. Ejector-Diffuser Diaphragm Type:
   The ejector-diffuser assemblies shall receive all gas and ejector water and discharge the resulting solution to the point of application. The ejector shall be equipped with a check valve which will prevent water from backing up into the vacuum regulators. A loss of water supply shall automatically shut-off the gas flow. The diffuser shall be a universal type providing a open-end outlet and a one-inch NPT threaded connection for ease of field installation.

6. Supply Indicator:
   Each gas feeder shall be equipped with gravity actuated device, directly connected to the main control diaphragm, to indicate when gas supply is exhausted.

7. Valve Direction Indicator:
A gas valve direction indicator shall be provided with each gas feeder.

8. Automatic Switchover Module:
The automatic switchover module shall be vacuum operated, switching from an empty gas source to a full gas source. There shall be no manual reset required when switchover has been made and the empty container replaced with a full container. The module shall be wall mounted and operated on a spring loaded toggle. The switchover module shall be factory set and shall not require field adjustment.

D. CHLORINE DIFFUSER ASSEMBLY:
The diffuser shall fit a one-inch (1") NPT tap and accommodate a chlorine flow rate of 0 to 25 pounds per day. The diffuser shall protrude into the ten-inch(10") main discharge line as recommended by the manufacturer. The assembly shall also include a corporation cock, with a one-inch(1") hose connection as indicated on the drawings. Assembly shall be manufactured by Chlorinator's Inc. Capital Controls Company, Inc., Penwalt, or approved equal. Installation shall be per manufacturer's recommendation.

E. CHLORINE CYLINDERS:
Furnish two(2) full chlorine cylinders with a net weight of 150 pounds for each cylinder. The contractor shall be licensed to furnish chlorine cylinders or if not, make the necessary arrangements with a licensed provider for their delivery.

SUBMITTALS
Submit manufacturer's information and descriptive literature.

CHLORINATION SYSTEM ACCESSORIES:

A. CHLORINE CYLINDER SCALES:
Furnish two (2) chlorine cylinder scales to weigh the contents of two remotely compressed-gas cylinders independently. Each platform shall be remotely located as shown on the drawings.

Platforms shall be of PVC and stainless steel construction, with sealed stainless steel strain gauge load cells. Platform shall be secured to the floor with 316 stainless steel fasteners. Platform height shall not exceed 1-1/2 inches.

The indicator shall be housed in a NEMA 4X enclosure with an LCD display and knob to set tare weights for each scale independently. Indicator shall independently monitor two platforms. Indicator shall display net remaining, daily usage, total amount used, rate of feed, days until empty, tare weight, and gross weight for each platform. Indicator shall come with two level relay contacts and a 4-20mA output signal. Provide compatible cable of adequate length between platform and indicator. Locate indicator as directed by the Engineer.

Scale accuracy shall be better than 1% of full scale. Scale shall be **SCALETRON Model 2310** with 3-1/2 Digital Controller as manufactured by Scaletron Industries Ltd., Plumsteadville, Lafayatte, PA 18949, or approved equal.

B. RESIDUAL CHLORINE MONITOR:

1. General:

a. This section includes the Chlorine Analyzer for monitoring free residual chlorine.

b. The method of measuring free or total chlorine will be with colorimetric chemistry.
   1) The chemistry will be USEPA accepted N, N-diethyl-p-phenylenediamine (DPD) method.

c. Other methods of chlorine measurement, such as amperometric, potentiometric and iodometric with electrodes are not acceptable.

d. Performance Requirements:
   1) Measurement range: 0 to 5 mg/L free or total residual chlorine.
   2) Accuracy: ± 5 percent of reading or ± 0.035 mg/L, whichever is greater.
   3) Precision: ± 5 percent of reading or ± 0.005 mg/L, whichever is greater.
   4) Minimum detection limit: 0.035 mg/L.
   5) Resolution: 0.01 mg/L
   6) Repeatability: 0.05 mg/L.
   7) Cycle time: 2.5 minutes.

e. Certifications:
   1) CE approved
   2) ETL listed to UL 1262
   3) ETL certified to CSA 22.2 No. 142

f. Operational Criteria:
   1) Sample flow rate: 200 to 500 mL/minute
   2) Sample pressure: 1 to 5 psig
      a) The supplied conditioning kit allows for up to 120 psig.
   3) Sample temperature: 5 to 40 degrees C
   4) Operating temperature: 0 to 40 degrees C
   5) Operating humidity: 90 percent at 40 degrees C maximum

g. Warranty:
   1) The product includes a one-year warranty from the date of shipment.

h. Scheduled Maintenance
   1) Reagent replenishment: monthly, approximately 15 minutes per month
   2) Pump tubing replacement: operating temperature dependent
      a) Below 80 degrees F: six-month intervals
      b) Above 80 degrees F: three-month intervals
   3) Analyzer tubing replacement: annually

2. Products:

a. Model CL17 Chlorine Analyzer, Free Residual, PN 5440001, by Hach Company, Loveland, CO.

b. The CL17 Chlorine Analyzer consists of a sample valve, flow cell and buffer and indicator solutions.

c. The CL17 is housed in a NEMA 12 enclosure, IP62-rated with the gasketed door latched.

d. Equipment:
   1) The CL17 operates using 115 or 230 volt selectable AC power.
   2) Between analysis points, the CL17 performs a self-test auto-blanking to eliminate potential drift.
   3) The CL17 operates unattended 30 days between chemical reagent changes and sample cell cleaning.
   4) The CL 17 has two feed control operation modes to operate chemical feed pumps.
      a) On/off control where the concentration alarm outputs turn the pump on or off when chlorine levels fall below or exceeds acceptable levels.
      b) Proportional control where the 4-20 milli-amp output current is scaled to pace the feed pump proportional to the output.
   5) Output:
      a) Standard optically isolated analog output, selectable as 0 to 20 milli-amp or 4 to 20 milli-amp, field programmable over any portion of the analyzer range.
      b) Standard two internal alarms, each are SPDT relays with contacts rated for 5 amp resistive load at 230 volt AC power. Alarms include:
         (1) Concentration set point
         (2) Analyzer system warning
         (3) Analyzer system shut down

e. Components

   1) Standard equipment:
      a) Analyzer
      b) One-month supply reagents
      c) Spare pump tubing
      d) Wall mount kit
      e) Sample conditioning kit
      f) Manual
   2) Dimensions:
      a) 13.5 inches wide (343 mm)
      b) 17.9 inches high (455 mm)
      c) 7 inches deep (178 mm)

3) Weight: 25 pounds (11.3 kg)
4) The CL17 includes a standard sample conditioning element consisting of a pressure regulator, strainer and shut-off valve.
5) Connectors:
    a) Sample inlet quick-connect 0.25-inch O.D. polyethylene tubing
    b) Sample drain 0.50-inch I.D. flexible tubing
    c) Overflow drain 0.50-inch I.D. flexible tubing
    d) Air purge quick-connect 0.25-inch O.D. polyethylene tubing (optional).

f. Accessories:

1) Power cord (PN 5448800)
2) Maintenance kit with pre-assembled tubing (PN 5444301)
3) 1 year reagent supply (PN 2556900 qty 11)
4) Pocket Colorimeter II for free and total chlorine, low and high range combination unit (PN 5870000)

3. Execution:

a. Preparation:

1) Wall mount
2) Clearances
    a) Horizontal: 15.2 inches (386 mm) minimum, 27 inches (686 mm) ideal
    b) Vertical: 19 inches (483 mm)
    c) Depth: 20 inches (508 mm)
3) Power connection is made by three-wire barrier terminal block through 0.5-inch conduit hole in case using 12 to 18 AWG.

b. Installation:

1) Contractor will install the analyzer in strict accordance with the manufacturer's instructions and recommendation.
2) Manufacturer's representative will include a half-day of start-up service by a factory-trained technician, if requested.
    a) Contractor will schedule a date and time for start-up.
    b) Contractor will require the following people to be present during the start-up procedure.
        (1) General Contractor
        (2) Electrical Contractor
        (3) Hach Company factory trained representative
        (4) Owner's personnel
        (5) Engineer

C. GAS DETECTOR ALARM UNIT:

1. The chlorine gas detector unit shall consist of a wall mounted receiver and remotes sensor. The gas detector shall have a range of 0-10 parts per million (ppm).

2. The receiver shall provide a LED bar graph display. The LED bar graph display shall be color-coded to indicate sensor status, gas concentration and alarm set point. Additionally, LEDs shall provide for indication of set point alarm, sensor malfunction, power ON and sensor ready. The receiver shall be housed in a NEMA 4X enclosure.

3. The sensor shall be an electrochemical type requiring no chemical addition with a response time of 30 seconds maximum for 80% of full range at 20 degrees C. The sensor shall be wall mounted and housed a NEMA 4X enclosure.

4. The alarm and malfunction contacts shall be SPDT rated at 10 amps at 240 VAC or 28 VDC maximum resistive or inductive loads. The alarm and malfunction contact shall be field configurable for manual reset (latching) or automatic reset (non-latching).

5. Communications between the sensor and receiver shall be 3-wire, shielded, 22 gauge cable. The maximum distance between the receiver and sensor shall be 1000 feet/305 meters.

6. The gas detector shall operate from a 120 VAC, 50/60 Hz, 1 phase power supply. The receiver and sensor electronics shall have provisions for protection against radio frequency/electromagnetic interference.

7. Weatherproof visual and audible alarms shall be provided.

8. A sensor test kit shall be provided; BM-4709.

9. The gas detector unit shall be a Severn Trent Services, ADVANCE 610B or an approved equal.

10. This gas detector shall be provided with a power back-up unit for continuous monitoring as provided by the supplier of the gas detector unit.

D. PAYMENT:

Payment for Chlorination System will be made at the Lump Sum Price Bid. Payment shall represent full compensation for furnishing and placing all materials and for all labor, tools, equipment and incidentals required to complete the work as shown on the drawing and as specified, in place complete ready for use.

STANDARDS AND CODES:

Installation shall conform to all applicable provisions of the latest editions of the following, as well as to specific standards listed elsewhere in these Specifications:

a) Uniform Plumbing, 1991 Code with County of Hawaii Amendments.

b) State of Hawaii, Title 11 Administrative Rules, Department of Health.

c) American Society for Testing and Materials (ASTM):

A74-75	Cast Iron Soil Pipe and Fittings
A120-78	Black and Hot-Dipped Zinc Coated (Galvanized) Welded and Seamless Steel Pipe for Ordinary Uses
B88-78	Seamless Copper Water Tube

d) American National Standards Institute (ANSI):

B16.18-78	Cast Bronze Solder Joint Pressure Fittings
B16.22-73	Wrought Copper and Bronze Solder Joint Pressure Fittings

REQUIRED SUBMITTALS

A. Shop drawings and brochures and catalog cuts of fixtures and equipment. Show all layout and locating dimensions, clearances for fittings, and fixture centerline dimensions. Show construction details of pipe hangers and anchors.

B. Certificate of compliance by the test laboratory analyzing the water samples following the pipeline disinfection and flushing.

PIPING MATERIALS

Potable Water:

1. Water Lines Above Grade: Copper Type L, hard temper, with wrought copper or cast bronze fittings made up with 95-5 solder.
2. Water Lines Below Grade: Copper Type K, soft temper, with silver-solder brazed joints.
3. Service Valves: 2" and smaller, Nibco "U" valve No. T-22. Larger than 2", Nibco 113 bronze gate valve.

VALVES

A. General: Model and number listed in these specifications are the basis for type and quality. Pressure ratings indicated are "working steam pressure" (WSP).

B. Gate Valves: 2-1/2" and smaller: bronze body, 125 psig, non-rising stem Nibco 113.

VALVE BOX

Dimensions and locations are shown on the drawings. Box frame shall be concrete or approved hard fiberglass material. Plate cover shall be cast iron and similar to Type III Standard Detail 43 for Board of Water Supply, City and County of Honolulu. Plate cover shall be flush to the box frame.

UNIONS

A. Copper: bronze body, 200 psig. For pipes 2" and smaller use ground joint, for pipes 2-1/2" and larger use flanged face.

B. Dielectric Unions shall separate all ferrous and nonferrous metals in all piping systems. Unions shall match those above, except that of metal-to-metal contact shall be avoided. Where flanges are used, the bolts shall be electrically insulated from the body of the flange.

ROUGH-IN PIPING SPECIALTIES

Floor Drains (FD): Smith Fig. 2010-A Duco, epoxy coated, cast iron body, adjustable strainer, secured square hole grate, nickel-bronze strainer with trap primer connection.

ESCUTCHEONS

Brass body, chrome-plated finish. Of sizes sufficient to cover pipe openings through the floor, wall, or ceiling. Escutcheons shall be secured in place by either spring clips or setscrews.

PIPE SLEEVES

Schedule 40 galvanized steel pipe sleeves in concrete, 18 gage galvanized sheet metal sleeves in other construction. Sleeves shall be sized to provide a minimum of 1/4" clearance around bare or insulated piping or as otherwise required by Code.

PIPE HANGERS AND SUPPORTS

A. General: Elcen, Fee and Mason, Globe, Grinnell, Superstrut, and Unistrut are approved. Fee and Mason figure numbers indicate type and quality. Provide concrete insert at all pre-stressed planks for pipe and equipment installation and coordinate with pre-stressed plank contractor.

B. For Uninsulated Copper Tubing: Fee and Mason No. 307, 364, or 365.

C. For Insulated Copper Tubing: Fee and Mason No. 800.

D. Riser Clamps: Black steel, Fee and Mason No. 241. Copper coated, Fee and Mason No. 368.

E. Hanger Spacing:

Pipe	Maximum Spacing
Copper tubing, 1-1/2" and smaller	6 feet
Copper tubing, 2" and larger	10 feet
Cast iron soil pipe	At each joint and at intervals not to exceed 8 feet.

F. Hanger Rods: Continuous-threaded rod conforming to ASTM A-107. Eye rods shall be Fee and Mason Figure No. 228 and 228 WL. Sizes shall be as follows:

Pipe Size	Rod Size
1/2" to 2"	3/8"
2-1/2" to 3"	1/2"
4" to 6"	5/8"

EMERGENCY EYE-WASH/DRENCH SHOWER

A. Floor-mounted, emergency eye-wash basin/drench shower HAWS stainless steel Model 8330 WC with stainless steel shower head with barrier-free-combination eye/face wash stainless steel receptor/basin or approved equal. Stainless steel pull rod activates shower and a push flag activates eye/face wash basin. One pieces solid 1-1/4-inch Type 304 Stainless Steel construction to be protected by an inline strainer. Supply and Waste: 1-1/4-inch IPS. Complete assembly must be certified by the CSA to meet ANSI Z358.1-2004 Standard for Emergency Eyewash and Shower equipment to be considered as an approved equal and requires the approval of the Engineer before being ordered.
Required: One (1) Unit Complete

B. Water pressure reducing valve shall be installed in the supply line as shown on the plans before this emergency eye-wash basin/drench shower to prevent any surges to occur. Valve shall be a Watts Regulator Co. Series 223 or an approved equal.

Required: One (1)
Size: 1-1/2 inch
Rating: 125 lb, down-stream adjustable from 50 psi and lower.

HOSE BIBB

Chicago No. 952 with vacuum breaker, 3/4" hose thread outlet, removable key handle, chrome finish with square head cock.

BOOSTER/EMERGENCY SHOWER/EYEWASH/WATER LUBE LINE PUMP:

GRUNDFOS Pump Company BoosterPaQ Model no. HYDRO MPC-CUE-20CR5-7, One-Phase 240 VAC, Variable-Speed drive unit featuring Two(2) centrifugal multi-stage vertical turbine pump installed in parallel, a Hydro-Pneumatic Tank as described below, a self-contained Motor Control Center pre-wired to all control components and elements or an approved equal. This pump shall be 3500 RPM, 2-horsepower, Single phase, 240 VAC with TEFC motors. Capacity of this pump shall be 30 GPM at 150 feet TDH and shall contain 7 stages. Pump shall be outfitted for operation with potable water having a temperature range of 50°F to 80°F. Provide with a packaged control system to include but not limited to: a motor starter and all required controls and relays and additionally; two (2) pressure switches: one to start the pump to sustain the water pressure in the hydro-pneumatic tank and the other to serve as a low pressure cutoff and alarm.

Required: One (1) Complete Unit Assembly

HYDRO-PNEUMATIC TANK:

A. Hydro-Pneumatic Pressurized Storage Tank, a free standing model, shall be a Amtrol Model No. ST-210V or an approved equal. It shall be ANSI Certified, NSF approved, rated for a maximum pressure of 125 psig and a volume of 86.0 gallons. It shall be durable seamless full-size blow molded interior replaceable air-cell of heavy gauge polyether urethane (PEU).

   Required: One (1)

B. Pressure Relief/Sustaining Valve shall be used to protect the hydro-pneumatic storage tank from water pressures higher than tank rated pressures. It shall be hydraulically operated, pilot-controlled, modulating valve designed to maintain upstream pressure within close limits. In operation, this valve is actuated from water pressure within the tank, opening fast at a pre-set pressure below the maximum pressure rating of the tank preventing damage to it. Operation is completely automatic and pressure setting may be easily changed. The valve shall be a Clayton Model 50-01 or an approved equal.

   Required: One (1)
   Size: 1-1/2 inch, screwed ends
   Minimum Pressure rating of valve: 150 psi
   Class: 125 lb

PACKING AND SHIPMENT

The Contractor shall be responsible for inspecting equipment and acceptance thereof prior to delivery to the site. Immediately upon the arrival of the pumping unit at the job site, the Contractor shall make a careful inspection of the pumping unit and all incidental items that go with the unit and shall submit a certified check list describing all items checked. All defects and or parts not conforming to these specifications shall be replaced without delay.

INSTALLATION INSTRUCTIONS AND MAINTENANCE MANUAL

A. The manufacturer shall also provide at lease five copies of the instructions for the installation and proper maintenance of the plumbing equipment in bound folders. Included in the folders shall be drawings of the individual components and its accompanying material list.

B. Installation shall be performed in accordance with the manufacturer's instructions.

GUARANTEE

A. The equipment covered by these specifications shall be guaranteed against defective parts due to faulty material or workmanship for one year after date of acceptance of project. The Contractor shall guarantee to replace all defective parts within the period of time specified. The Contractor shall pay for all costs for the replacement of defective parts at no cost to the Department of Water Supply. The guarantee shall be in writing and shall be given to the Department of Water Supply prior to the completion of the project.

DUCT WORK:

All duct work shall be constructed and installed per SMACNA Guidelines.

END OF SECTION

WATER SYSTEM STANDARDS

DIVISION 300
SECTION 304 -- MECHANICAL AND ELECTRICAL

The following shall supplement Section 304 "Mechanical and Electrical" in the Water System Standards, 2002.

SECTION 304.07 PUMP DISCHARGE PIPING AND VALVE SYSTEM

GENERAL DESCRIPTION

MAKUU OFF-SITE PRODUCTION WELL:

A. Pump Discharge Piping and Valve System: A pump discharge piping and valve system, consisting of a pump silent check valve, a pump gate valve, a pump control valve, a pump combination air and vacuum release check valve, a pump combination air release valve, a Electro-Magnetic flow meter and transmitter, a pump flow switch, a well lever sensor and transmitter, a Tank Level Pressure Transmitter, a "Duckbill" Elastomeric Check Valve, a Rossum Sand Tester, and all necessary appurtenances and piping shall be furnished as shown on the plans.

1. Pump Control Valve:

   a) Number required: One (1) pump control valve with external pressure source.
   b) Size of valve: 8 inches
   c) Minimum pressure rating of valve: 150 psi
   d) Class of flanges valve shall be mounted between: ANSI B16.42, Class 150 psi

2. Pump Discharge Silent Check Valve:

   a) Number required: One (1)
   b) Size of valve: 10 inches
   c) Minimum pressure rating of valve: 150 psi
   d) Class of valve flange: 125 lb., ANSI B16.1

3. Pump Combination Air and Vacuum Release Check Valve:

   a) Number required: One (1)
   b) Size of valve: 3 inches
   c) Minimum pressure rating of valve: 150 psi
   d) Class of valve flange: 125 lb., ANSI B16.1

4. Surge Check Valve:

   a) Number required: One (1)
   b) Size of valve: 3 inches

5. "Duckbill" Elastomeric Check Valve

   a) Number required: One (1)
   b) Size of valve: 8-inch
   c) Location: End of Pump Waste Bi-charge Pipe

B. PLAN OF OPERATION OF PUMP CONTROL VALVE UNIT

The pump control valve unit shall be designed to (1) release air in the pump discharge column on starting up, (2) break the vacuum in the pump discharge column as the water drops back when shutting down, and (3) eliminate objectionable pipeline water pressure surges by controlling the opening and closing speeds of the pump control valve whenever the unit is started and stopped.

The pump control valve shall be open with pumping unit stopped. After the pump is started, the solenoid valve (a part of the pump control valve) shall be energized which will slowly close the control valve. The air and initial inrush of water from the pump column shall be expelled through the pump control valve. As the pump control valve moves from its open position, the silent check valve will open to permit the flow of water into the main line.

When the pump is to be shut off, the pump control valve solenoid valve is de-energized causing the pump control valve to slowly start opening. As the control valve nears the open position, the silent check valve will close and a limit switch on the pump control valve shall shut down the pumping unit. Should the water, on falling back into the well, create a vacuum in the pump discharge column, the combination air and vacuum release valve opens and breaks the vacuum.

This valve shall be a modified globe-type, hydraulically operated by a double-acting diaphragm. An externally mounted, four-way, rotating disc-type, solenoid-operated pilot valve shall control the valve operation. High-pressure water from the existing high-pressure waterline shall be used for pilot valve operation. When the solenoid is energized, the pilot valve shall close the main valve. When it is de-energized, the pilot valve shall open the main valve. Two flow control valves shall permit separate regulation of both valve opening and closing rate. The control valve body and cover shall be ductile iron; stem shall be stainless steel; seat shall be bronze and removable; disc shall be synthetic rubber and the diaphragm shall be nylon fabric, bonded with synthetic rubber. Two (2) limit switches shall be installed on the valve stem to detect separately when the valve is fully open and when it is fully closed and shall be adjustable over the entire valve travel. The valve unit shall be Clayton Valve No. 661-02 Pump Control

Valve, or approved equal. The valve shall be epoxy coated internally and be equipped with silicon bronze or stainless steel nuts and bolts.

C. PUMP SILENT CHECK VALVE

The pump discharge silent check valve shall be flanged, center-guided check valve, APCO Globe Style Series 600, Valmatic Series 1800 or approved equal. The valve body shall be semi-steel or cast iron with bronze trim, stainless steel spring and bronze-bushed center-guides. The valve shall be installed on the discharge line of the pump.

D. PUMP COMBINATION AIR AND VACUUM RELEASE CHECK VALVE SYSTEM:

The Deep Well pump air and vacuum release check valve shall vent large quantities of air through the discharge orifice when the pump starts, close tight when liquid enters and permit large quantities of air to re-enter through the orifice when the pump stops to prevent vacuum forming in the pump suction column.

The main valve parts shall be a body, cover, baffle, float and seat. The baffle shall shield the float from direct impact of air and water to prevent premature float closure. The seat shall slip fit in the baffle or cover and lock in place without any distortion. The entire float and baffle assembly must be shrouded with a water diffuser to prevent water from slamming the float shut. Outlets to be threaded.

The float shall be stainless steel, center guided for positive shut-off into the seat.

Valve exterior to be painted with universal metal primer paint as accepted by the EPA for use with potable water.

Materials of construction shall be certified conforming to following ASTM specifications:

Body and cover	Ductile iron	ASTM A536 Gr. 65-45-12
Baffle, size 3”	Cast iron	ASTM D2133
Float	Stainless steel	ASTM A240
Seat	Buna – N	
Water diffuser	Stainless steel	ASTM B16

Valve System to be manufactured to AWWA C-512.

Air Release Valve No. 50 shall also be attached to this valve to port any remaining air in the pump line.

a) Number required: One (1)
b) Size of valve: Three (3) inches
c) Minimum pressure rating of valve: 150 psi
d) Class of valve flange: 125 lb, ANSI B16.1

Valve to be APCO Series 146 Air/Vacuum valve with Water Diffuser manufactured by DeZurik Corp. or an approved equal.

E. SURGE CHECK VALVE:

The Surge Check Valve shall have integral flanges for the installation to the inlet of the above specified Pump Combination Air and Vacuum Release Valve System on the line. It shall consist of a body, seat, flow disc and compression spring. The surge check unit shall operate on the interphase between the kinetic energy and relative velocity flows of air and water. After air passes through and water rushed into the surge check, the disc start to close, reducing the rate of flow of water into the air valve by means of throttling orifices in the disc to prevent water hammer in the air valves. The surge check orifices must be adjustable for regulation in the field to suite operating conditions.

The Surge Check Valve shall fit to the inlet of the above air/vacuum system.

The Surge Check Valve shall have been flow tested and the test data submitted to the Engineer to verify surge pressure reduction in the valve.

Valve exterior to be painted by Universal Primer for high resistance to corrosion.

All materials of construction shall be certified in writing to conform to ASTM specifications as follows:

Body	Cast iron	ASTM 1265, Gr. B
Seat & disc	Bronze	ASTM B584
Spring	Stainless steel	T302

Valve shall be APCO Series 1600 Surge Check Valve, as manufactured by Valve & Primer Corporation, Schaumburg, Illinois, USA or an approved equal. Note: Entire Pump Combination Air and Vacuum Release Valve System include this Surge Check Valve must as a system be an approved equal.

F. COMBINATION AIR RELEASE VALVE

Combination air valve, (single-body, double orifice) allows large volumes of air to escape out the large orifice when filling a pipeline and closes when liquid enters the valve. During large orifice closure, the small air release orifice will open to allow small pockets of air to escape automatically and independently of the large orifice.

The large orifice shall also allow large volumes of air to enter during pipeline drainage to break the vacuum. The body inlet must be baffled to protect the lower float from direct forces of rushing air and water to prevent premature valve shut-off. The top large orifice plug or float must be protected in similar manner for the same purpose.

The Buna-N seat must be fastened to the valve cover, without distortion, for droplight shut-off. The floats shall be heavy stainless steel, hermetically sealed; designed to withstand 1000 psi. The top plug or float shall be center-guided through hex bushings for positive shut-off.

All materials of construction shall be certified in writing to conform to ASTM specifications as follows:

Body and Cover	Cast Iron	ASTM A48, Class 30
Float	Stainless Steel	ASTM A240
Needle and Seat	Buna-N	
Plug	Bronze	ASTM B124
Leverage Frame	Delrin/Cast Iron Class 30	ASTM D2133/ASTM A48,

a) Number required: One (1)
b) Size of valve: 1 inches
c) Minimum pressure rating of valve: 150 psi
d) Class of valve flange: 125 lb., ANSI B16.1

Valve to be APCO Series 140C combination air valve as manufactured by Valve & Primer Corp. or approved equal.

G. <u>"DUCKBILL" ELASTOMERIC CHECK VALVES:</u>

1. Check valves are to be all rubber and the flow operated check type with an integral flanged end connection. The port area shall contour down to a duckbill. This shall allow passage of flow in one direction while preventing reverse flow. The flange and flexible duckbill sleeve shall be one-piece rubber construction with nylon reinforcement. The top and bottom of the valve shall flare out to form the duckbill shape. The bill portion shall be thinner and more flexible than the valve body.

2. The flange drilling shall conform to ANSI B16.5 and ANSI B16.47 Class 150 standards. The valve shall be furnished with galvanized or stainless steel back-up rings for installation.

3. Manufacturer must have available flow test data from an accredited hydraulics laboratory to confirm pressure drop data. Company name, plant location, valve size and serial number shall be bonded to the check valve. Valve shall be manufactured in the USA.

4. Function: When the line pressure inside the valve exceeds the backpressure outside the valve, the line pressure forces the bill of the valve to open, allowing flow to pass. When backpressure exceeds the line pressure, the bill of the valve is forced closed preventing backflow.

5. Manufacturer: All valves shall be of the Series 35 as manufactured by Tideflex Technologies Inc. of Pittsburgh, PA 15205 or approved equal.

H. GATE VALVE

The gate valve supplied shall be of the size indicated on the drawings. It shall be equipped with a hand wheel, outside stem and yoke, and shall conform to the Department of Water Supply's Water System Standards.

I. FLANGED COUPLING ADAPTERS

The flanged coupling adapters shall be Series 2100 MEGAFLANGE adapter as produced by EBAA Iron, Inc. or an approved equal.

1. Restrained flange adapter shall be used in lieu of threaded welded flanged spool places. Flange adapters shall be made of ductile iron conforming to ASTM A536 and have flange bolt circle that are compatible with ANSI/AWWA C110/A21.10.
2. Restraint for the flange adapter shall consist of a plurality individual actuated gripping wedges to maximize restraint capability. Torque limiting actuating screws shall be used to insure proper initial set of gripping wedges.
3. The flange adapters shall be capable of deflection during an assembly or permit lengths of pipe to be field cut to allow a minimum 0.6-in gap between the end of the pipe and the mating flange without affecting the integrity of the seal.
4. For PVC pipe, the flange adapter will have a pressure rating equal to the pipe.
5. For Ductile iron pipe, the flange adapter shall have a safety factor of 2:1 minimum.

J. PUMP FLOW SWITCH

1. Flow Switch

This section of the specifications covers the furnishing and installing of the flow switch and appurtenant equipment for deep well pump unit.

a. Total Number Required: One (1)
b. Pipe Size: 10 inches (discharge line)
c. Flow Rate: 1000 GPM
d. Location: As shown on plans

2. Flow Switch

The flow switch shall be an OMEGA Model FSW 42A-SS, with an internal screw adjustment which provides continuous switch adjustment while in operation. Multiple drag disks and strips shall be provided with each unit to provide incremental switch point adjustment to match flow condition. Spare drag disks or strips shall be delivered to Owner as spare parts. The flow switch shall be a

single pole double-throw snap switch, 15 Amp, 120 volts, 60 Hz power. "Duct Seal" is to be used to seal the flow switch chamber from the incoming conduit and packed tightly around the leads.

a. Number Required: One (1)
b. Vane Area: As req'd for 4.1 feet per second flow
c. Location: As shown on plans

K. PUMP SAMPLING CONNECTION AND ROSSUM SAND TESTER

The single (1) sampling connection and rossum sand tester assembly shall be installed in-line to the horizontal centerline of the 10-inch discharge line. The assembly shall be located as close as possible to the discharge flange without causing hindrances to the removal process of the adjacent flanged coupling adapter. Sand sampler shall be fixed in place by a support bracket shown in the plans.

1. Sampling Connection.

Assembly shall be of size and material as indicated on the drawing and capable of operating under 150 psi working pressure. Installation shall be per manufacturer's recommendation.

2. Rossum Sand Tester.

The above shall be the system manufactured and supplied by Beylik Drilling & Pump Service Hawaii of Honolulu, or approved equal. Installation shall be per manufacturer's recommendation.

Manufacturer of the system shall also provide at least five copies of the instructions for operation of the rossum sand tester and proper maintenance of the same in bound folders. Included in the folders shall be drawings of the tester describing its individual components and its accompanying material list.

L. ELECTROMAGNETIC FLOWMETER:

The Siemens SITRANS FM MAGFLO 5100W electromagnetic flow meter or an approved equal shall consist of a flow sensor based on Faraday's Law of Electromagnetic Induction and Microprocessor-based signal converter, remote type MAG 6000 (SCADA ready) mounted within the Control Building or an approved equal.

Sensor:

Operating principle: Utilizing Faraday's Law of Electromagnetic Induction, the flow of liquid through the sensor induces and electrical voltage that is proportional to the velocity of flow.

Construction:

a. The sensor flow tube and liner material shall be constructed of an EPDM liner, subject to the approval of the Engineer, surrounded by two integral coils. Measurements and grounding electrodes shall be 316 stainless steel.
b. Connecting flanges shall be carbon steel. Wetted materials shall be NSF approved for drinking water service.

Installation:

a. A minimum of five (5) pipe diameters upstream and three(3) pipe diameters downstream are recommended. (Factory shall be consulted for any variations).
b. Operating Temp: -20 to +200 degrees F.
c. Size: 10-inch for Makuu Well Site.
8-inch for Keonepoko-Nui Site.
d. Submergence: The sensor shall be pedestal sealed against accidental submersion to 3 feet for 30 minutes standard, permanently submerged to 30 feet when the terminal box is backfilled with a non-setting, transparent potting material.

1. Signal converter: Remote Type MAG 6000 (SCADA ready) or an approved equal compatible with the rest of the assembly.
   a. Enclosure: NEMA 4X enclosure
   b. Display: Background illumination with alphanumeric 3-line, 20-character display to indicate flow rate, totalized values, settings, and faults (a blind version of the MAG 6000 signal converter is available.
   c. Power supply: 115/230 VAC or 11-24 VAC.
   d. Operating temperatures: -4 to +140 degrees F.
   e. Outputs: 0-20 mA or 4-20 mA into 800 Ohms max. One relay rated at 42 VAC/2A, 24 DC/1A. Digital (frequency or pulse) for external display of flow rate or totalizer.
   f. Communications: Optional HART available.

2. Sensor and signal converter performance:
   a. Flow range: 1.5 fps to 33 fps for accuracies stated below.
   b. Accuracy: 0.25% of actual flow rate.
   c. Separation: Maximum distance of 900 feet between signal converter and sensor without the use of any additional equipment.
   d. Bi-directional flow capabilities shall be standard.

3. Totalizer:
   Two eight-digit counters for forward, net or reverse flow.

4. Calibration:
   a. Each flow sensor shall be wet calibrated and all of the calibration information and factory setting matching the sensor shall be stored in an integrally mounted SENSOR-PROM memory unit. The SENSOR-PROM

shall store calibration data and signal converter settings for the lifetime of the product. At initial commissioning, the flow meter commences measurement without any initial programming. Any customer specified settings are downloaded to the SENSOR-PROM. Should the signal converter need to be replaced, the new signal converter will upload all previous settings and resume measurement without any need for reprogramming or rewiring.

b. A certificate of calibration shall accompany each flow sensor.

5. Signal Converter Function Details:

The following functions shall be provided:

a. All programming shall be accomplished through an integral keypad and all programming shall be protected by a user-defined pass word.

b. The signal converter shall be integrally mounted or remotely mounted using a remotely-mount kit provided by the manufacturer.

c. The signal converter shall provide a 4-20 mA DC signal proportional to the flow rate into 800 ohms max. Output selectable as unidirectional or bi-directional.

d. The relay shall be programmable as error indicator, limit alarm or pulsed output.

e. The signal converter system shall be equipped with an error and status log with 4 groups of information.

1) Information without a functional error involved.
2) Warnings which may cause malfunctions in the application.
3) Permanent errors, which may cause malfunction in the application.
4) Fatal error, which is essential for the operation of the flow meter.

f. A system error shall be indicated by a flashing icon on the display or activation of the relay when set as an error alarm.

The first nine standing errors shall be stored in the error pending log. A corrected error pending log. A corrected error is removed from the error pending log. A status log shall be provided to store the last 9 error messages received for 180 days regardless of correction.

6. Reverification:

a. Verification using a stand-alone Siemens MAGFLO Verificator to measure a number of selected parameter in the flow sensor and signal converter, which affects the integrity of the flow measurement, shall be available through a factory verification service.

Verification of the Flow Meter shall consist of the following test routines:

1) Insulation test of the entire flow meter system and cables. Test of sensor magnetic properties.
2) Digital output test.
    a) Analog output test.
    b) A certificate of verification shall be issued if flow meter passes all of the tests with-in 1% of the original factory test parameters.

7. Installation:
   a. Follow manufacturer's recommendation for the minimum upstream and downstream installation requirements.
   b. Wiring between flow sensors and remote mounted signal converters shall use cable type and procedures as per manufacturers' recommendation.

8. Warranty:
   a. The manufacturer of the electromagnetic flow meter shall for one year of operation, warrant that the equipment shall be free from defects in design, workmanship, or materials.
   b. In the event a component fails to perform as specified, or is proven defective in service during the guarantee period, the manufacturer shall promptly repair or replace the defective part at no cost to the owner.

9. Spare Parts:
   a. One set of manufacturer's recommended spare parts.
   b. Extra operations manuals as required.

10. The electromagnetic flow meter shall be a Siemens Model SITRANS FM MAGFLO 5100W flow sensor with a Siemens Remote Model MAG 6000 (SCADA ready) signal converter or an approved assembly. Insertion type flow meters will not be accepted.

11. Project Requirements: Makuu Off-Site Deep Well:
   a. Siemens 10-in MAG 5100W Carbon Steel Flanges, EPDM liner (subject to approval of the Engineer), Hastelloy-C measuring and grounding electrodes, Part No. 7ME6520-4VJ12-2AA2 or an approved equal compatible with the Transmitter. Quantity: One(1).
   b. Siemens Remote MAG 6000 Transmitter, 115/230 VAC, Part no. 7ME6920-1AA10-1AA0.
   Quantity: One(1).

M. DIGITAL PRESSURE GAUGES:

This digital pressure gauge offers a menu-driven display for easy customization. User selectable features include 12 units of measurement, password protected calibration and disable functions, adjustable bar graph and update rate. The readout shall be a five digit display for maximum resolution with a 4-20mA output with the range printed on the keypad and shall meet ASME B40.7 specifications and manufactured in the USA.

Number required: 4 (four)

The digital pressure gauge shall be an Ashcroft Model No. 30-2274-SD-02L-200 psig as manufactured by Ashcroft Inc., 250 East Main Street, Stratford, CT 06614, USA or approved equal.

KEONEPOKO-NUI BOOSTER PUMP UNITS:

A. Pump Suction/Discharge Piping and Valve System: A pump suction/discharge piping and valve system, consisting of Booster Pump Control Valves, Combination air release valves, Pressure relief valves, Pump flow switches, Electro-Magnetic Flow Meters and all necessary appurtenances and piping shall be furnished on the plans.

1. Booster Pump Control Valves:

   a. Number required: Two(2)
   b. Size of valve: 4 inches
   c. Minimum pressure rating of valve: 250 psi
   d. Class of flanges valve shall be mounted between 300 psi, class

2. Combination Air Release Valve

   a. Number required: Two(2)
   b. Size of valve: 1 inch
   c. Minimum pressure rating of valve: 250 psi

3. Pressure Relief Valves:

   a. Number required; Two(2)
   b. Size of Valves: 1-1/2 inch
   c. Minimum pressure rating of valve: 250 psi
   d. Valve shall have screwed ends

B. PLAN OF OPERATION OF BOOSTER PUMP CONTROL VALVE UNITS:

Valves shall be diaphragm actuated, single seated, and hydraulically operated globe-type valve. It shall have two operating chambers sealed from each other by a flexible synthetic rubber fully supported diaphragm. The valve disc shall be resilient with a rectangular cross-section and shall be retained on three sides. Control of valve operation shall be by means of an externally mounted, four-way, and solenoid pilot valve. Self-cleaning strainer shall be used to protect the control system. Valve shall utilize line pressure for operation. Limit switches must be installed to be adjustable over the entire valve travel to indicate full closing and full opening of the valve. Valve shall be equipped with a built-in lift type check feature to prevent reverse flow. It shall operate independently of the solenoid control. Valve shall be similar in all respects the Clayton 60-11 Booster Pump Control Valve or an approved equal.

C. PRESSURE RELIEF/PRESSURE SUSTAINING (BACK PRESSURE UNIT):

Pressure relief valve shall be a diaphragm type, pilot controlled, cast iron body, Clayton No. 50 G-01 or an approved equal. Valve shall have bronze trim and be equipped with "Delrin" stem sleeves. Valves shall be designed for maximum operating pressure of at

least 1.5 times the pump design pressure or 1.2 times shut-off head of the pump whichever is greater. Valve shall be epoxy coated internally. Pilot control shall be factory set to open at 15% over the pump head design. Provide adjustment rage of 20 to 350 psig.

D. DIGITAL PRESSURE GAUGES:

This digital pressure gauge offers a menu-driven display for easy customization. User selectable features include 12 units of measurement, password protected calibration and disable functions, adjustable bar graph and update rate. The readout shall be a five digit display for maximum resolution with a 4-20mA output with the range printed on the keypad and shall meet ASME B40.7 specifications and manufactured in the USA.

Number required: 4 (four)

The digital pressure gauge shall be an Ashcroft Model No. 30-2274-SD-02L-200 psig as manufactured by Ashcroft Inc., 250 East Main Street, Stratford, CT 06614, USA or approved equal.

E. PUMP FLOW SWITCH:

1. Flow Switch:

This section of the specification covers the furnishing and installing of the switch and appurtenant equipment for the new booster pump units:

a. Total Number required: Two(2)
b. Pipe Size: 8 inches (Suction Line)
c. Flow Rate: 400 GPM
d. Location: As shown on the plans

2. Flow Switch:

The flow switch shall be an OMEGA Model FSW 42A-SS, with an internal screw adjustment which provides continuous switch adjustment while in operation. Multiple drag disks and strips shall be provided with each unit to provide incremental switch point adjustment to match flow conditions. Spare drag disks or strips shall be delivered to the DWS as spare parts. The flow switch shall be a single pole double-throw snap switch, 15 amp, 120 volts, and 60 Hz power. “Duct Seal” is to be used to seal the flow switch chamber from the incoming conduit and packed tightly around the leads.

a. Number required: Two(2)
b. Vane area: As required for flow velocity of 2.55 ft/sec

3. ELECTRO-MAGNETIC FLOWMETER (MAGMETER):

The Siemens Electro-Magnetic SITRANS FM MAGFLO 5100 W Flow Meter shall be similar to the flow meter specified earlier in the specifications for the well complete with all connected appurtenances including the Siemens Remote MAG 6000 (SCADA ready) Transmitter 115/230 VAC. Part No. 7ME6920-1AA10-1AA0 mounted within existing control building or an approved equal.

Keonepoko-Nui Booster Pump Site:

a. Siemens 8-in SITRANS FM MAGFLO 5100W
Carbon Steel Flanges, EPDM liner,
Hastelloy-C measuring and grounding electrodes,
Part No. 7ME6520-4PJ12-2AA2 or an approved equal
compatible with the below transmitters.

b. Siemens Remote MAG 6000 (SCADA ready) Transmitter, 115/230 VAC, Part No.
7ME6920-1AA10-1AA0.

1) Number required: Two(2)
2) Flow range: 0-600 gpm
3) Size: 8-inch
4) Minimum pressure rating of the meter: 150 psiG
5) Class of meter flange: 125 lbs, ANSI B16.1

F. TEST OF PUMPING UNIT

After installation of all pump discharge piping components and other equipment, a complete operating test of the pumping unit and other equipment shall be made as specified elsewhere in this specification listed under Section 304.01 subsection C.9 for Makuu Deep Well Production Pump, new Booster Units at Keonepoko-Nui Pump Site.

G. PUMP DISCHARGE PIPING AND VALVE SYSTEM PAYMENT

1. General.

No separate payments will be made for the work covered by this section of the specifications. All costs in connection with furnishing and installing of the various items shall be included in the Lump Sum Price Bid of which the item is a part.

H. COMPENSATION

Payment for the furnishing and installing of equipment will be made at the Lump Sum Price Bid of which the item is a part and shall be full compensation for all work in connection therewith, complete and finished in accordance with the drawings and specifications.

END OF SECTION

WATER SYSTEM STANDARDS

DIVISION 300
SECTION 304 - MECHANICAL AND ELECTRICAL

The following shall supplement Section 304 "Mechanical and Electrical", in the Water System Standards, 2002.

SECTION 304.03 ELECTRICAL WORK

A. GENERAL:

1. The Detailed Specifications of the Special Provisions for each project shall be added and made a part of this section for electrical work.

B. SCOPE OF WORK: Furnish all labor, supervision, and tools, and provide all materials and equipment necessary for a complete installation as shown on the drawings and specified herein, and as required for its correct and proper operation. It is the intent and purpose of these specifications and the related drawings that, upon completion of the project, the electrical installation shall be complete in all respects. The work includes but is not limited to:

1. Providing a complete electrical system as indicated on the drawings and in accordance with the true intent and meaning of the drawings and these specifications.

2. Confirming and coordinating electrical service requirements with serving utilities, complying with their requirements. Paying for any service related connection work, fees, and costs to serving utility company. (Provide for a total allowance of $850,000.)

3. Procuring all permits, paying for same, and arranging for the necessary inspections required by the County of Hawaii ordinances.

4. Furnishing submittals per specification requirements for review and acceptance by the Department. Furnishing reproducible shop drawings.

5. Coordinating materials and equipment delivery to insure satisfactory completion of the Contract in the scheduled time.

6. Testing complete installation and correcting all defects and malfunctions of material and workmanship at no additional costs.

E. MATERIALS AND WORKMANSHIP

2. Rules, Standards, and Specifications

All electrical work shall comply with the applicable portions of the following current editions which are also to be considered a part of these specifications:

NEC – National Electrical Code

NEIS – National Electrical Installation Standards

NECA – National Electrical Contractors Association

County of Hawaii Ordinances

Serving Utility Company's Service Installation Manual Requirements and Rules and Regulations.

G. EQUIPMENT AND SHOP DRAWINGS

1. Materials and Equipment Data

a. Submit a complete list of all materials and equipment proposed to be furnished and installed under this Section. For each item, submit manufacturer's shop drawings, specifications and/or catalog cuts as required to demonstrate compliance with the specified requirements. Shop drawings shall include complete dimensioned general arrangement, wiring, schematic, and connection diagrams.

b. Any item installed without a review and/or written signature of acceptance from the Department shall be subject to rejection and disqualification. Replacement shall be provided by the Contractor as acceptable to the Department at no additional costs to the Department.

c. Submit manufacturer's recommended installation procedures for applicable items, which, when accepted by the Department, will become the basis for inspecting and accepting or rejecting actual installation procedures used by the Contractor.

d. Submittals shall be submitted all together at one time in order to demonstrate that all items of electrical work have been properly coordinated and will function properly with each other. Partial or incomplete submittals will be returned to the Contractor without a review by the Department.

e. Submittals shall be submitted in form that folds-out to right in folders or binders. Top fold-over submittals will not be acceptable and will be returned without review.

f. Submittals shall be certified by the Contractor that all submittals have been reviewed by the Contractor prior to submittal to the Department and that the submittals are in compliance with the Contract requirements and can be installed in the designated spaces indicated on the drawings. Submittals without certification by the Contractor shall be returned to the Contractor without a review by the Department.

g. Reproducibles: Upon acceptance of the Contractor's submittals by the Department, the Contractor shall submit a set of reproducible shop drawings to the Department. Drawings shall be the original or mylar sepias. Drawings shall be erasable and correctable.

H. SUBMITTALS

1. As-built Drawings. Submit a clearly and legible red-marked complete set of Electrical Drawings and submittal shop drawing showing all deviations in conduit routing,

equipment locations, circuiting, detail revisions, and any other changes done during construction affecting the electrical work. Drawings shall be submitted within five working days after acceptance of the electrical work by the Department as a condition for release of final payment to the Contractor.

2. Manuals. Four sets of bound instruction, installation, maintenance, and parts list manuals shall be furnished for all electrical apparatus and control items. The Contractor shall submit a list of proposed manuals for review and acceptance by the Department.

I. DEFINITIONS

1. Provide – Furnish and install.

2. Replace – Remove existing and provide new.

3. Restore – Match existing types, rating, functions at existing or new location as applicable. Re-use existing wiring if can be relocated without splicing. Provide additional new wiring and splice to existing and extend to new location where applicable.

4. Relocate – Disconnect, remove, store, re-install, re-connect, and place into correct operation all without causing any damage to affected items.

5. Reattach – Replace mounting attachment methods. Replace all mounting hardware, screws, bolts, washers, nuts. Match existing types, sizes, and quantities. Replace all wiring splices, terminations, connections. Match existing types, sizes, and quantities.

6. Wiring – Provide all conduits, conductors, fittings, devices, protective equipment, and any other material as necessary for a completed, working electrical circuit or system.

7. Outlet – In addition to definition in the NEC, outlet shall mean the required outlet boxes, conductors, terminations, wiring devices, and cover plates, to provide for the intended use, application, or utilization equipment.

8. Interior – Within imaginary lines formed by outer surface of building walls and roof.

9. Exterior – Beyond imaginary lines formed by outer surface of building walls and roof, including all projections thereof such as roof eaves and overhangs.

10. Field Locate: Final location adjusted to suit field conditions to accommodate Contractor's construction methods, while complying with minimum requirements of NEC and as acceptable to the Department. Allow for minimum 10 feet horizontal adjustment without additional costs and/or provide for the additional adjustments where noted.

11. Field Route: Final conduit routing selected by Contractor with acceptance by the Department to suit site conditions avoiding interferences with other equipment, piping, structural steel, structural walls, etc., and to match construction methods desired by Contractor.

12. AHJ: Authority Having Jurisdiction

J. GENERAL REQUIREMENTS

1. Specifications and Drawings. Drawings show approximate locations for all electrical items. The drawings are diagrammatic and shall not be scaled for dimensions. The drawings are intended to be complete as to specific intent and requirements but not to actual details of construction, installation, and locations.

2. Coordinating of Work. Contractor's work and installation of electrical items of work shall be closely coordinated to avoid all interferences, omissions, and overlapping of responsibilities. Contractor shall study and review all drawings and specifications and coordinate all electrical requirements. Failure by Contractor to propose and provide wiring for electrical requirements due to lack of coordination shall not be grounds for additional costs. Advise the Department of and resolve any discrepancy before performing any work.

3. Quality Assurance. For actual fabrication, installation and testing of work of this Section, use only licensed, thoroughly trained, and experienced workmen completely familiar with the items required and with the manufacturer's recommended methods of installation. In accepting or rejecting installed work, no allowance will be made for lack of skill or experience on the part of workmen.

   Good workmanship and appearance shall be considered of equal importance with electrical and mechanical operation. Carefully lay-out all work in advance and install in a neat and workmanlike manner and in accordance with recognized good practices and standards. All electrical work shall conform to the methods or standards described in NECA 1-2006, Standard For Good Workmanship In Electrical Construction.

   Installation shall be complete in every detail as specified and ready for use. Any item supplied developing defects of design, construction, or quality within one year of final acceptance by the Department shall be replaced at no cost to the Department by such materials, apparatus, or parts to make such defective portion of complete system conform to the true intent and meaning of the drawings and these specifications.

4. Defective Materials and Equipment. Defective materials and equipment or materials and equipment damaged in the course of installation or testing shall be replaced or repaired in a manner meeting with the approval of the Department and at no additional costs to the Department.

5. Nameplates. Each major component of equipment shall have as a minimum the manufacturer's name, address, catalog number, model, style, or type on a plate securely and conspicuously attached to the item or equipment. Nameplates for electrical apparatus shall conform to the referenced NEMA publication.

6. Prevention of Corrosion. Exposed metallic parts of outdoor apparatus shall be Type 316 stainless steel where available as a catalog standard product or Type 304 if not available. All such parts as boxes, bodies, fittings, guards, and miscellaneous parts made of ferrous metals but not of stainless steel, shall be hot-dipped galvanized after fabrication. The Contractor shall not join dissimilar metals that will result in deterioration due to galvanic corrosion. All screws, machine screws, nuts, bolts, washers, and similar hardware and mounting brackets/hardware shall be stainless steel, Type 316. Conduits at exposed

exterior locations including those continuing from underground shall be Type 316 stainless steel.

7. Verification of Dimensions and Available Spaces. The Contractor shall be responsible for the coordination of the proper relation of his work to the site and to the work of all trades. The Contractor shall visit the premises and thoroughly familiarize himself with all details of the work and working conditions, shall verify all dimensions in the field, and advise the Department of and resolve all discrepancies before performing any work. The electrical plans are diagrammatic and shall not be scaled for dimensions. Use dimensions and measurements from detailed drawings, as obtained from actual field measurements, and from shop drawings of the equipment to be installed.

8. Cutting and Repairing. Provide all cutting, patching, channeling, drilling, etc., in building structure or areas only as necessary for electrical work. Locate holes to be drilled, etc., coordinate work with all other trades on the job, and make arrangements for necessary openings and chases, and for stub-ups. Make necessary repairs where patching or refinishing is necessary for electrical work. Actual work involved in these repairs shall be done by skilled craftsmen in the trades involved, but paid for under this Section of the specifications.

K. REMOVED ELECTRICAL ITEMS OR WIRING: Any item of electrical work which is to be removed by the Contractor shall remain the property of the Department, unless otherwise indicated. The Contractor shall consult the Department for delivery, storage, and/or disposal instructions. When so instructed by the Department, the Contractor shall dispose of removed items at no additional costs to the Department. Unless instructed otherwise, all removed items shall be delivered to the Department of Water Supply's baseyard on Leilani Street, Hilo, Hawaii.

L. SERVICE INTERRUPTIONS

1. All work requiring electrical outages, system shutdowns, or interruptions of existing utility lines shall be scheduled with the Department a minimum of three working days in advance. The number of outages and shutdowns and the duration of each outage shutdown shall be subject to the approval of the Department. All work shall be expedited to shorten the shutdown time as much as possible.

2. The Contractor shall plan and schedule his work to allow continued operation of the existing water system as required. Normal flows shall not be disrupted except as approved by the Department. Existing water system shall remain in the "AUTO" operating mode during the non-working hours. During normal working hours, the existing water system may be operated in the "HAND" operating mode as allowed by the Department.

M. PRODUCTS

1. General

a. Unless indicated or specified otherwise, materials and equipment shall conform to the National Electrical Code and to the standards, codes, regulations and specifications referenced herein. All materials and equipment shall be new and shall not have been stored unprotected in the outdoors.

b. Materials and equipment shall be essentially the standard catalog product of a manufacturer regularly engaged in the manufacture of the produce, shall meet the requirements of the specifications, duplicate materials and equipment that have been in satisfactory use for the past two years on the Island of Hawaii, and be acceptable to the Department.

c. Brand names, manufacturer's names and catalog numbers, where indicated establish standards of design and quality desired. Substitutions will not be accepted unless specifically accepted in writing by the Department. No substitutions will be allowed after acceptance of Contractor's proposal by the Department, unless otherwise allowed in writing by the Department.

2. Conduits. Rigid metal (steel) conduit, stainless steel rigid metal conduit, electrical metal tubing, rigid non-metallic conduit, liquid tight flexible steel conduit, and flexible steel conduit shall conform to U.L. Standards.

3. Fittings. Threaded fittings only for use with rigid metal conduit, compression and set screw type for use with electrical metal tubing, and solvent welding for non-metallic conduit. Fittings for liquid tight flexible metal conduit shall be cadmium or zinc-coated. End fittings for conduit shall be insulated throats or bushings. All hardware shall be Type 316 stainless steel.

4. Conductors. Conductors shall be copper, stranded, 600 VAC, Type MTW for all control wiring systems, Type THWN-2 for connections to control devices at exterior locations, and Type THWN-2 for all power wiring circuits. Type THHN for lighting fixture wiring where 90 degree C. conductors are required.

5. Connectors and Terminals. Connectors and terminals conforming to UL Standard 486 shall be designed for use with the specific associated conductor material and shall provide a uniform compression over the entire contact surface of both the connector or terminal and the conductor.

6. Wireways. Fabricate from NEC code gauge Type 316 stainless steel, square or rectangular cross-section. Manufacture according to applicable NEC requirements. Enclosure classification as indicated or as required for the location and application.

7. Pull and Junction Boxes. Boxes shall be code gauge Type 316 stainless steel with screwed-on covers. Sizes as indicated on the drawings. Where no size is indicated, size per the NEC. Enclosure classification as indicated or as required for the location and application.

8. Lighting Fixtures. Lighting fixtures shall be furnished as indicated and specified on the drawings and shall be complete with lamps, ballasts, and all necessary accessories and shall be in accordance with NEC Article 410.

Lighting fixtures located at exterior walls of building shall be "Dark Sky Compliant".

Where indicated/noted, furnish LED lamps in 4 feet, T8 equivalent size. Power consumption 15 watt maximum at minimum 95 percent power factor. Color temperature 4000 K. to 6000 K. with minimum CRI at 80. UL listed. Lamp life minimum 40,000 hours. No UV or IR radiation.

Furnish tube guards for exposed lamps or any lamp not totally enclosed within housing or diffuser.

9. Wiring Devices (Furnish Specification Grades). Duplex Receptacle: Rated 2 pole, 3 wire, grounding, 20 amperes, 125 volts, unless otherwise indicated. Bodies shall be brown molded phenolic compound mounted on a corrosion resistant metal mounting strap. Switches shall be as indicated for the functions required.

   Lighting Switches: Rated quiet type, AC only, 20 amperes, 125 volts. Bodies shall be brown molded phenolic compound mounted on a corrosion resistant metal mounting strap. Switches shall be as indicated for the functions required.

10. Device Plates. Device plates of the one piece type shall be provided for all outlets and fittings to suit the devices installed. Plates on unfinished wall and on fittings shall be of zinc-coated steel or cast metal having round or beveled edges. Plates on finished walls shall be stainless steel. Plates for outdoor receptacles shall be weatherproof, gasketed, cast metal, with a spring-hinged cap over each receptacle opening.

11. Outlet and Small Pull and Junction Boxes. Outlet boxes may be pressed galvanized steel boxes for interior concealed or recessed locations, sized per the NEC, suitable for the application intended. Device outlet boxes shall be minimum 2-1/4 inches deep. Furnish with raised ring as required to suit the application intended.

    Outlet boxes at exposed or surface mounted locations shall be cast metal or cast aluminum, sized per the NEC, suitable for the application intended.

    Pull or junction boxes shall be Type 316 stainless steel where indicated, with screwed on covers, sized as indicated on the drawings and suitable for the application and location intended. Where no size is indicated, size per the NEC.

12. Grounding and Bonding. Grounding and bonding equipment shall conform to UL Standard 467. Ground rods shall be copper-clad steel not less than 5/8 inch in diameter, 10 feet long.

13. Circuit Breakers for Service Disconnect. Thermal magnetic, insulated case, ambient compensated, adjustable instantaneous trip, ratings as indicated. UL labeled for service disconnect. Enclosure type and classification as indicated or as required for the location and application. Enclosure material Type 316 stainless steel. General Electric, Westinghouse/Cutler-Hammer.

14. Electrical Metering Equipment. As indicated on the drawings. Comply with utility company requirements. Enclosure material Type 316 stainless steel.

15. Motor Control Equipment. Motortronics Medium Voltage Solid State Type MVC Plus Series with all required options, accessories, and related items as indicated on the drawings.

16. Safety Disconnect Switches. Switches shall be heavy duty type with rating as indicated on the drawings. Enclosure types shall be as indicated or as required for the application.

Enclosure material Type 316 stainless steel. General Electric, Westinghouse/Cutler-Hammer.

17. Control Equipment and Devices

a. General: Control equipment and devices shall be of rating and type as indicated on the drawings. Enclosures and mountings shall be suitable for and fit into the intended spaces and locations. Specifications apply to all items of control work, whether furnished individually or part of other equipment such as motor control equipment, control panels, and other panels or equipment.

b. Enclosures: Type 316 stainless steel, classification, size, and mounting as indicated on the drawings. Furnish Hoffman brand unless otherwise indicated. Enclosures shall be sized adequately to provide a minimum of 5 inches of wiring space between terminal block and side or bottom of enclosure.

c. Terminal Blocks: General Use: Control type, one piece, 600 volt, 30 amperes, phenolic marking strip, screw with wire saddle-type clamps on both sides, total number of points as indicated, end-to-end mounting as required. General Electric CR151B series.

d. Control Relays: Cutler-Hammer Type M. Relays shall be equipped with a neon indicating light mounted on the relay to indicate the state of the magnet coil. Number of contacts and types as indicated on the drawings. Furnish with mounting channels. Furnish mounting channels in place for future relays where indicated.

e. Selector Switches: Cutler-Hammer Type T., oiltight, with knob operator and maintained contacts unless otherwise indicated. Operation, contact arrangements, and legend plates as indicated on the drawings.

f. Pushbuttons: Cutler-Hammer Type T, oiltight, with flush button operator, black color unless otherwise indicated. Operation, contact arrangement, and legend plates as indicated on the drawings.

g. Emergency Stop Pushbutton: Cutler-Hammer Type T, maintained contact with separate reset pushbutton, large mushroom red pushbutton with wording "EMERGENCY STOP".

h. Indicating Lights: Cutler-Hammer Type T, oiltight, press-to-test, transformer type, glass lens, color and legend plates as indicated on the drawings.

i. Time Delay Relays: Cutler-Hammer Type PN, for pneumatic type, 0-3 minutes adjustable. Agastat Series 7000 for timing ranges longer than 3 minutes. Operation, contacts, and timing range as indicated on the drawings.

j. Sequence Timer: Siemens LOGO. Contacts, operation, and timing range as indicated.

k. Control Relay, Plug-in Type: Potter and Brumfield Type KRP Series with mounting socket, hold-down spring, 8-pin or 11-pin as applicable.

l. Legend Plates: Standard size, aluminum black field, engraved.

m. Wire Markers: Slip-thru type, white bands with black numbers, compression type or heat shrink, identification numbers as indicated on the drawings.

n. Nameplates: Laminated plastic, engraved lettering, 5/16 inch high lettering minimum, white on black, durable and legible. Attach with self tapping screws. Lettering as indicated on the drawings.

18. Secondary Surge Arrestor. Eaton Secondary Surge Arrestor suitable for indicated voltage application.

19. Line Protection Units (LPU). Furnish as indicated on the drawings. Furnish Poly Phaser Impulse Suppressor IS-SPXL as standardized by the Department. Mount in readily accessible location for ease of maintenance and replacement. Where an enclosure is required, furnish with type NEMA 12, size as indicated or as required for the application.

20. Communications Surge Arrestor. Furnish as indicated on the drawings. Furnish one spare unit. Mount in readily accessible location for ease of maintenance and replacement. Where an enclosure is required, furnish with type NEMA 12, size as indicated or as required for the application.

21. 120 VAC Power Surge Arrestor. Furnish as indicated on the drawings. Furnish base mounted metal oxide varistors, 150 VAC RMS, 200 VDC, 220 Joules at .01 microseconds, 20,000 peak pulse current for .4 microseconds.

22. Panelboard. Dead front, copper bussed, neutral and ground busses, with ratings and branch circuit breakers as indicated. Galvanized sheet steel enclosure with hinged door, latch, lock, and 2 keys. General Electric, Westinghouse/Cutler-Hammer.

23. Tank Level Transmitter (XMTR ____). Pressure transmitter, static water pressure application, indicating type, Foxboro IGP10 series with silicon strain gauge microsensor. Electronic solid-state circuitry. 0 to 20 feet scaled indicator, 4-20 milliampere output. Maximum working pressure 30 PSI. Power source from remote loop-type current power supply, 22 milliampere minimum. Furnish with weatherproof enclosure complete with mounting bracket for 2-inch pipe mounting and with bleeder block assembly.

24. Tank Level Recorder (RCDR ____). Circular chart recorder and controller, Chessel 392 Recorder series, single input, electric drive, 120 VAC with OFF-ON switch, 4-20 milliampere input, 10-inch circular chart, 0-20 feet scaled, 7-day per revolution, minimum 6 output control contacts, all independently adjustable. Marking by disposable colored markers. Furnish with power supply for tank level transmitter with voltage output matching measured loop resistance. Furnish isolated scaled 4-20 milliampere retransmission signal. Configuration shall be by integral keypad with logical menu driven steps displayed in English. Furnish with 200 7-day charts and 48 extra colored markers.

25. Well Level Transmitter (XMTR ____). Furnish transducer type with recorders as specified under Mechanical work.

26. Well Level Recorder (RCDR____). Circular chart recorder and controller, Chessel 392 Recorder series, single input, electric drive, 120 VAC with OFF-ON switch, 4-20 milliampere input, 10-inch circular chart, 0-20 feet scaled, 7-day per revolution,

minimum 6 output control contacts, all independently adjustable. Marking by disposable colored markers. Furnish with power supply for tank level transmitter with voltage output matching measured loop resistance. Furnish isolated scaled 4-20 milliampere retransmission signal. Configuration shall be by integral keypad with logical menu driven steps displayed in English. Furnish with 200 7-day charts and 48 extra colored markers.

27. Flow Transmitters. Furnished/installed with Mechanical Work. (Mag-Flo 5100W series as specified by the Department sized to match piping served. Furnished complete with all required accessories including signal converter, cabling, remote mounted transmitter.) Furnish all electrical wiring and testing.

28. SCADA Cabinet. The Contractor's SCADA work shall include providing a SCADA cabinet and terminating all inputs to terminal blocks within a SCADA cabinet. Termination shall be maintained tight to top, front of the enclosure's left side. Terminal blocks shall be neatly aligned in a single column and arranged in the following sequence from top to bottom: Power (Line), Power (Neutral), Power (Ground), Power Distribution, Digital Inputs, Digital Outputs, Analog Inputs, and Analog Outputs. Terminal blocks shall be color coordinated in the following patterns:

TERMINAL BLOCK SCHEDULE

DESCRIPTION	COLOR	PART #
POWER (LINE)	BLACK	PHOENIX CONTACT UT4, 3045143
POWER (NEUTRAL)	WHITE	PHOENIX CONTACT UT4, 3045130
POWER (GROUND)	GREEN	PHOENIX CONTACT UT4, 3045156
POWER DISTRIBUTION	ALTERNATING RED/BLACK YELLOW	PHOENIX CONTACT UT4, 3045127, 3045143
DIGITAL INPUT		PHOENIX CONTACT UTTB4, 3035467
DIGITAL OUTPUT	GRAY	PHOENIX CONTACT UT2.5-3L, 3214259
ANALOG INPUT	BLUE	PHOENIX CONTACT UTTB4, 3044791
ANALOG OUTPUT	BLACK	PHOENIX CONTACT UTTB4, 3074282

Terminal blocks shall maintain one block spacing between groups, with exception for Power (Line), Power (Neutral) and Power (Ground) which shall be grouped together. Further, Digital Input, Digital Output, Analog Input and Analog Output shall be segmented into groupings of eight (8) blocks with one block spacing between groupings.

Contractor's wiring shall be terminated to left side of terminal blocks, with negative on the base tier and positive on the top tier for double level terminal blocks; and with common on the base tier, N.O. on the second tier, and N.C. on the top tier for multi-level terminal blocks. Wiring shall be marked with wire tags at both ends and color coordinated as follows:

WIRING SCHEDULE

DESCRIPTION	COLOR
POWER (LINE)	BLACK
POWER (NEUTRAL)	WHITE
POWER (GROUND)	GREEN
POWER DISTRIBUTION	RED
DIGITAL INPUT	YELLOW
DIGITAL OUTPUT	GRAY
ANALOG INPUT	BLUE
ANALOG OUTPUT	BLACK

The SCADA enclosure shall also include grounding strip, 120V AC power for use by the DWS. Enclosure shall be free standing, NEMA 4X, 316 stainless steel, single door dual access, 72" x 24" x 24" in dimensions. Front door shall be left handed and back door shall be right handed. Enclosure shall include L-style rack mounting angles for standard 19" equipment which provides for 35U rack units of space. Enclosure shall be Hoffman A722424SSFSDAN4.

Any and all references to "SCADA READY"" are for references only to indicate work by DWS.

29. Supervisory Control and Data Acquisition (SCADA) System

General

a. General Conditions: This section covers the supervisory control and data acquisition (SCADA) system including equipment and wiring as indicated on the plans and specified herein.

   1) As specified in Section 304.03 Electrical Work. The provisions of these related sections apply to this section and work described in this section shall comply with them.

b. Scope of Work: Provide all articles, materials, equipment, operations, and services herein or on Drawings, include all labor, materials, taxes, fees, insurance, and incidentals required to insure completion.

   1) System Overview – These specifications are for a distributed supervisory control and data acquisition (SCADA) system for a water system, including Intelligent Remote Telemetry Units (RTUs). Initially, this system shall require the furnishing of all RTU hardware and installation of a SCADA ready enclosure at the Makuu Offsite Water System Site.

(a) The contractor shall furnish all RTU and hardware as required at the Makuu Offsite Water System Site with all appurtenances, whether specifically referenced herein or not, but which may be required for operation. Communications between the Makuu Offsite Water System Site and the Department of Water Supply baseyard in Hilo shall be by radio telemetry.

(b) The contractor shall furnish and install a SCADA ready enclosure as indicated on the plans and specified herein.

(c) The Department of Water Supply shall provide all installation and programming required for the RTU hardware and software.

2) During bidding and construction, Contractor shall coordinate his work with other trades to avoid omissions and overlapping responsibilities. Electrical contractor shall notify other trades and suppliers of project voltages, including control voltages.

3) Work by Others: Instrument transmitters shall be provided by respective sections of this contract. Installation of equipment complete with power wiring and electric controls and interlock wiring shall be part of Electrical Work.

c. Submittals: Submittals shall be made for approval and resubmitted until approval is received for the following:

1) Catalog Cuts – Submit for approval six (6) copies of catalog cuts of following equipment:

(a) SCADA system components and equipment.
(b) Conductors and Wiring.
(c) Wiring and functional or block diagrams.
(d) Manufacturer's recommendations for installation.
(e) Manufacturer's recommended list of spare parts for a one-year period of operation.

2) Electrical Installation Drawings – At least 10 days prior to any testing the Contractor shall submit three (3) sets of approved completed electrical installation drawings. The installation drawings shall include the manufacturer's wiring diagrams for the SCADA ready enclosure and any built-to-order equipment.

3) As-Built Drawings: Upon completion of the final inspection and testing, the Contractor shall provide six (6) copies of as-built installation drawings and manufacturer's wiring diagrams for the SCADA ready enclosure and any built-to-order equipment.

d. Local Support: The manufacturer of the SCADA system supplied shall be represented by a company with offices in the State of Hawaii. This local office shall be capable of responding to request for maintenance and repair to the system by having a technician skilled in the repair, maintenance and operation of the system at the job site within 24 hours of being notified. This local representative shall carry all

spare parts which are recommended by the manufacturer.

Products

a. General: Unless otherwise indicated, provide all first quality, new materials, free from defects, in first class condition, and suitable for the space provided. New old stock materials shall not be furnished as new material and shall not be accepted. Provide materials approved by UL wherever standards have been established by that agency. Where two or more units of the same class of material or equipment are required, provide products of a single manufacturer. Component parts of materials or equipment need not be products of the same manufacturer.

b. Standard Products: Unless otherwise indicated, provide materials and equipment which are the standard products of manufacturers regularly engaged in the production of such materials and equipment. Provide the manufacturer's latest standard design which conforms to these specifications.

c. Equipment Finish: Electrical equipment may be installed with manufacturer's standard finish color, except where specific color, finish, or choice is indicated. If the manufacturer has no standard color, equipment shall be painted ANSI G1, Light Gray.

d. SCADA Ready Enclosure: The Contractor's SCADA work shall include terminating all telemetry inputs and outputs to terminal blocks within a SCADA enclosure. Termination shall be maintained tight to top, front of the enclosure's left side. Terminal blocks shall be neatly aligned in a single column and arranged in the following sequence from top to bottom: Power (Line), Power (Neutral), Power (Ground), Power Distribution, Digital Inputs, Digital Outputs, Analog Inputs, and Analog Outputs. Terminal blocks shall be color coordinated in the following patterns:

TERMINAL BLOCK SCHEDULE

DESCRIPTION	COLOR	PART#
POWER (LINE)	BLACK	PHOENIX CONTACT UT4, 3045143
POWER (NEUTRAL)	WHITE	PHOENIX CONTACT UT4, 3045130
POWER (GROUND)	GREEN	PHOENIX CONTACT UT4, 3045156
POWER DISTRIBUTION	ALTERNATING RED/BLACK	PHOENIX CONTACT UT 4, 3045127, 3045143
DIGITAL INPUT	YELLOW	PHOENIX CONTACT UTTB4, 3035467
DIGITAL OUTPUT	GRAY	PHOENIX CONTACT UT2.5-3L, 3214259
ANALOG INPUT	BLUE	PHOENIX CONTACT UTTB4, 3044791
ANALOG OUTPUT	BLACK	PHOENIX CONTACT UTTB4, 3074282

Terminal blocks shall maintain one block spacing between groups, with exception for Power (Line), Power (Neutral) and Power (Ground) which shall be grouped together. Further, Digital Input, Digital Output, Analog Input and Analog Output shall be segmented into groupings of eight (8) blocks with one block spacing between groupings.

Contractor's wiring shall be terminated to left side of terminal blocks, with negative on the base tier and positive on the top tier for double level terminal blocks; and with common on the base tier, N.O. on the second tier, and N.C. on the top tier for multi-level terminal blocks. Wiring shall be marked with wire tags at both ends and color coordinated as follows:

WIRING SCHEDULE

DESCRIPTION	COLOR
POWER (LINE)	BLACK
POWER (NEUTRAL)	WHITE
POWER (GROUND)	GREEN
POWER DISTRIBUTION	RED
DIGITAL INPUT	YELLOW
DIGITAL OUTPUT	GRAY
ANALOG INPUT	BLUE
ANALOG OUTPUT	BLACK

The SCADA enclosure shall also include grounding strip, 120V AC power for connection to 24 V DC power supply, and UPS with 4 back-up batteries installed and ready for "drop-in" installation of pre-fabricated RTU panel by DWS. Enclosure shall be free standing, NEMA 4X, 316 stainless steel, single door dual access, 72"x24"x24" in dimensions. Front door shall be left handed and back door shall be right handed. Enclosure shall include L-style rack mounting angles for standard 19" equipment which provides for 35U rack units of space. Enclosure shall be Hoffman A722424SSFSDAN4. UPS and four (4) back-up batteries shall occupy the bottom 10U of rack space. UPS shall be APC Smart-UPS RT 1500, SURTA1500RMXL2U. Back-up batteries shall be APC, SURTA48RMXLBP2U.

e. SCADA Hardware: The Contractor shall furnish the following list of RTU hardware and an equal quantity of spare equipment to the Department of Water Supply.

1) (3) Siemens S7-1200, CPU, PN# 6ES7 214-1AE30-0XB0
2) (1) Siemens SB1221, Digital Input Signal Board, PN# 6ES7 221-3BD30-0XB0
3) (2) Siemens SM1221, Digital Input, PN# 6ES7 221-1BH30-0XB0

4) (1) Siemens SB1222, Digital Output Signal Board, PN# 6ES7 222-1BD30-0XB0
5) (1) Siemens SM1222, Digital Output, PN# 6ES7 222-1BH30-0XB0
6) (12) Siemens SM1231, Analog Input 8AI, PN# 6ES7 231-4HF30-0XB0
7) (1) Siemens SM1232, Analog Output, PN# 6ES7 232-4HB30-0XB0
8) (1) Siemens PM1207, Power Switch, PN# 6EP1 332-1SH71
9) (1) Siemens CSM1277, Unmanaged Communications Switch, PN# 6GK7 277-1AA00-0AA0
10) (3) Siemens KTP1000, 10" Panel, PN# 6AV6 647-0AF11-3AX0
11) (6) DIN Rails, 35mm x 7.5mm x 2000mm, Phoenix Contact PN# 0801733
12) (50) Terminal Block, Black, Phoenix Contact UT4, PN# 3045143
13) (150) Terminal Block, White, Phoenix Contact UT4, PN# 3045130
14) (100) Terminal Block, Gray, Phoenix Contact UT4, PN# 3044102
15) (50) Terminal Block, Red, Phoenix Contact UT4, PN# 3045127
16) (100) Terminal Block, Yellow, Phoenix Contact UT4, PN# 3045114
17) (50) Terminal Block, Green, Phoenix Contact UT4, PN# 3045156
18) (50) Terminal Block, Blue, Phoenix Contact UT4, PN# 3044115
19) (34) Fuse Holder, Phoenix Contact, PN# UK63-HESI
20) (34) 2PDT, 24VDC Coil, 10A, Rockwell PN# 700-HC22Z24-3-4
21) (34) Screw Terminal Base Socket, Rockwell PN# 700-HN104
22) (34) Relay Retainer Clips, Rockwell PN# 700-HN114

f. Desktop Workstation: Provide one (1) desktop workstation with the following minimum configuration:

Catalog Number/Description	Product Code	Qty	SKU	Id
Dell Precision T3500: Dell Precision T3500, CMT, Standard Power Supply, C2 Motherboard	T3500W	1	[224-8671]	1
Operating System: Genuine Windows® 7 Ultimate, w / XP Mode, No Media, 32-bit, English	7UN31XE	1	[330-6228] [421-2262] [421-5335] [421-5636]	11
Processor: Quad Core Intel™ Xeon W3550 3.0GHz, 8M L3, 4.8GT/s, Turbo	W3550	1	[317-2539]	2
Memory: 4GB, 1333MHz, DDR3 SDRAM, ECC (4 DIMMS)	4G3E334	1	[317-0117]	3
Graphics: 512MB NVIDIA® Quadro® NVS420, Quad Monitor, 4DP	NVS420	1	[320-8136]	6
Keyboard: Dell Multimedia Pro Keyboard, with Palmrest	USBMPRO	1	[330-1990]	4

Hard Drive Configuration: C1 All SATA drives, No RAID For 2 Hard Drive	SATA1A	1	[341-8562]	9
Boot Hard Drive: 1TB SATA 3.0Gb/s, 7200 RPM Hard Drive with 32 MB DataBurst Cache™	1TBST	1	[341-8997]	8
2nd Hard Drive: 1 TB SATA 3.0Gb/s, 7200 RPM Hard Drive with 32 MB DataBurst Cache™	1TBSTA	1	[341-9001]	23
Hard Drive Controller: Integrated Intel chipset SATA 3.0Gb/s controller	NSASCTL	1	[341-9289]	24
CD-ROM, DVD and Read-Write Devices: 16X DVD+/-RW w/Cyberlink PowerDVD™/Roxio Creator™, No Media	DVRW16N	1	[313-7457] [421-4370] [421-4539]	16
Floppy Drive and Media Card Reader Options: Internal 19:1 USB Media Card Reader	MCR19	1	[341-8560]	10
Productivity Software: Microsoft® Office Professional 2010 with Adobe Acrobat X Standard, English	10HPADE	1	[410-0560] [421-3950] [421-3957]	22
Security Software: Trend Micro Worry-Free Business Security Services, 30-days	TMWF30	1	[410-0329]	37
Monitor: Dell UltraSharp™ U2410 24in HAS Wide Monitor, VGA/DVI/DP/HDMI	U2410	2	[320-8276]	5
Mouse: Dell® USB 6-Button Laser Mouse	USBLDT	1	[330-1170]	12
Speakers: Speakers on Monitor	(TO BE DETERMINED)			
System Recovery: Resource DVD – contains	RDVD	1	[330-4025]	47

Diagnostics and Drivers				
Quick Reference Guide:				
Quick Reference Guide, English	REFE	1	[330-4020]	39
Chassis Configuration:				
Mini-Tower Chassis Configuration	MT	1	[311-7463]	15
Resource DVD:				
No Resource DVD	NORCD	1	[330-4024]	27
Energy Efficiency Option:				
No Energy Star	NOESTAR	1	[330-3201]	25
Hardware Support Services:				
3 Year Basic Limited Warranty and 3 Year NBD Onsite Service	U3OS	1	[992-8982] [993-3080] [993-9018] [993-9027]	29
Documentation:				
Documentation, English, with 125V Power Cord	DOCENG	1	[330-3156] [330-3157]	21
Shipping Packaging Options:				
Shipping Material for System	SHIP	1	[330-3209]	40

g. Laptop Computer: Provide one (1) laptop computer with the following minimum configuration:

Catalog Number/Description	**Product Code**	**Qty**	**SKU**	**Id**
Dell Precision M6500:				
Dell Precision M6500, Mobile Workstation	M6500	1	[224-7095]	1
Operating System:				
w/XP Mode, Genuine Windows® 7 Professional, No Media, 32-bit, English	W7PN31E	1	[330-6322] [421-8099]	11
Processor:				
Intel® Core™ i7-840QM Quad Core 1.86GHz 8 MB	840QM	1	[317-4995] [330-9154]	2
Memory:				
8.0GB, DDR3-1333MHz SDRAM, 2 DIMMS	8G2D3	1	[317-2588]	3
Graphics:				
1.0GB NVIDIA® Quadro® FX	FX2800M	1	[320-1126]	6

2800M Graphics

Internal Keyboard:				
Internal English Backlit Keyboard	ENGBL	1	[330-1652] [330-5876]	4
Fingerprint Reader Options:				
No Fingerprint Reader	NOFR	1	[313-8680]	9
Primary Storage:				
256GB Mobility Solid State Drive	256SSDM	1	[341-8492]	8
Secondary Hard Drive:				
256GB Mobility Solid State Drive	256SSD2	1	[341-8493]	23
Media Bay Devices:				
8X DVD+/-RW Slot Load w/Roxio and Cyberlink PowerDVD™, no media	8XDVRSN	1	[313-8694] [421-4370] [421-4539]	16
LCD Options:				
17" Wide Screen WXGA+ LCD Panel w/microphone	WXGMIC	1	[313-8684] [313-8685] [320-1130]	10
Productivity Software:				
Microsoft® Office Professional 2010, English	HPRO10E	1	[421-3950] [421-3957]	22
Contactless Smartcard:				
Contactless Smart Card Reader	SMART	1	[313-8936]	17
AC Adapter:				
210W/240W switchable Slim 3P A/C Adapter	210ACS	1	[330-1838] [330-4127]	15
Primary Battery:				
9 Cell Battery	9C	1	[312-0222]	27
Hardware Support Services:				
3 Year Basic Limited Warranty and 3 Year NBD Onsite Service	U3OS	1	[905-9378] [905-9407] [906-7342] [907-7080]	29
System Documentation:				
No System Documentation	NODOCS	1	[313-3673]	25
Additional Power Options:				
Additional 9 Cell Battery	9C2	1	[312-0211]	147

Wireless LAN (802.11):				
Dell Wireless™ 1397 802.11b/g Mini Card	DW1397	1	[430-3085]	19
RAID Configuration:				
All Hard Drives, Non-RAID, 1 or 2 drive total configuration	NORAID	1	[341-7876]	26
Modem:				
Add Modem	(TO BE DETERMINED)			
Serial Port:				
1 Required	(TO BE DETERMINED)			

h. Radio and Communications:

1) Communications: The Contractor shall take complete responsibility for the system communications. The initial investigation has determined that the radio frequency in the VHF range to transmit from the remote site to the central computer would be the most efficient method of communication. The Contractor shall take the responsibility of checking out and verifying this mode of communication.

(a) Communication Path Survey: Based on the coordinates and elevations of the various remote sites, the Contractor shall perform and furnish a computerized paper path survey to determine the gain margin for each proposed transmission path. The survey should stimulate use of actual frequency and proposed equipment.

(1) The survey shall include but not be limited to: a printout graph for each communications path which shall show the path profile, site elevations, site name, frequency, ERP, antenna type, distance between sites, and predicted losses versus desired losses. The Contractor shall design the radio and communications system for at least 99.9% reliability.

(2) Radio Path Study: A representative of DWS shall be present for any radio path study field work.

(b) Licensing: The Contractor shall prepare all paperwork required for FCC coordination and FCC licensing in accordance with the FCC Rules and Regulations governing the licensing of the proposed channels. One VHF frequency shall be required to accommodate the RTU reception and transmission to the central computer. The Contractor shall submit all FCC coordination requirements to the FCC for frequency approval. The Contractor shall be responsible for the payment of FCC license fees.

(c) FCC Type Acceptance: All equipment related to the radio communication shall be FCC type accepted, indication authorization by the FCC to allow the equipment to be used by the licensee.

2) Radio Equipment: The Contractor shall furnish and install latest edition CalAmp

DataRadio Viper SC Ethernet radios as required by the Makuu Offsite Water System project.

3) Antenna and Accessories: All antenna hardware shall comply with FCC rules and governing the design characteristics and mounting requirements for licensed frequencies used in the SCADA system. In general, the remote stations shall employ directional gain antennas. The central computer site will use an omni-directional gain antenna. Feedlines between antenna and SCADA ready enclosure shall be solid, shielded coax (minimum 7/8" in diameter), low density, foam heliax. Each coax run shall be continuous and shall terminate with factory-installed connectors which are specifically designed for use with the above-described cable. The coax shall be run through conduit between the SCADA ready enclosure and the antenna. The conduit shall be a minimum of 3" nominal diameter, with no more than two (2) 90 degree bends with a minimum bend radius on 36 inches. The SCADA ready enclosure shall be equipped with a combination lightning arrestor and bulkhead fitting to allow coax termination through the enclosure. The feedline signal loss shall not exceed 1.55 dB (VHF) for each one hundred feed of run. The total connector loss at each site shall not exceed 1.0 dB.

(a) Ground hardware kits specifically designed for use with the cable selected shall be furnished and installed by the Contractor.

(1) Antenna Specifications:

Frequency Range: Match licensed channels
Nominal Impedance: 50 Ohms
Forward Gain: 6 - 10 dB
Polarization: Vertical
Power Rating (min): 200 Watts
Materials: Anodized Aluminum/Stainless Steel
Construction: Welded
Mounting Clamps: 2" O.D. Galvanized Pipe
Wind Rating: 125 mph, 90 mph w/1/2" ice
Termination: Captive Type N
Lightning Protection: Direct ground connection

i. Radio Hardware: The Contractor shall furnish and install the following list of telecommunication hardware and provide an equal quantity of spare equipment to the Department of Water Supply.

1) (1) VHF Licensed Ethernet Router, Dual Port, CalAmp DataRadio Viper SC
2) (1) VHF Licensed Ethernet Router, Single Port, CalAmp DataRadio Viper SC
3) (1) VHF Omni Antenna, 167-174 MHz, 6.0 dB, Telewave ANT150F6-7
4) (2) VHF Yagi Antenna, 167-174 MHz, 9.5 dB, 6 element, Sinclair SY206-SF5SNM
5) (3) Lightning Arrestor, PolyPhaser VHF50HN

N. INSTALLATION

1. General

a. Electrical installation shall conform to the NEC and to the requirements specified herein. All equipment and materials shall be new unless indicated specified otherwise. The Contractor shall provide all equipment and materials specified, required, or implied herein, and incidentals in compliance with the NEC and Standards referenced herein and any local rules and regulations.

b. The Contractor shall advise the Department by written notification of any required modifications to the design with regard to installation or specified equipment to suit the actual equipment to be furnished, or to suit field conditions, or to comply with applicable local codes and regulations.

c. Where applicable, materials and equipment shall be installed and connected in accordance with the manufacturer's instructions and drawings. Contractor shall have available at the job site for the Department's inspection and use a complete file of manufacturer's instructions and drawings for the materials and equipment being installed.

O. DUCTLINE CONSTRUCTION

1. Excavation and Trenching: All excavating, trenching, and backfilling shall be done in conformity with the applicable sections of the specifications. Additionally, trenchings for all underground conduits shall be excavated to required depths indicated on the drawings. Depth of trenches shall be measured from finished grade and shall not exceed indicated depth by one foot unless approved by the University. Bottom of trenches shall be tamped hard. Rocks, where encountered, shall be excavated to depth of 6 inches below bottom of conduit jacket and before conduit is laid, space between bottom of duct jacket and rock surfaces shall be filled with gravel to the satisfaction of the Manager. Any existing underground piping or conduit that is encountered shall be properly shored and protected from damage. Any damage resulting from the Contractor's operations shall be repaired by him at his own expense.

2. Backfilling: After conduits have been inspected and approved by the University and prior to backfilling, forms shall be removed and excavation shall be cleaned of trash and debris. Material for backfilling shall consist of excavated, or borrow of sand or gravel, and shall be free of trash, lumber or other debris. Backfill shall be placed in horizontal layers, not exceeding 8 inches in thickness and properly moistened. Each layer shall be compacted to density equal to that adjacent undisturbed material that will prevent excessive settlement or shrinkage.

3. Ductlines: Ducts and/or conduits shall be laid in trenches on plastic saddles or on concrete spacers. Spacing between ducts shall be 3 inches minimum. After cables have been installed, seal all ducts with mastic compound to prevent entry of water. All spare ducts shall be plugged.

P. CONDUITS

1. Conceal all conduits in wall or ceiling spaces unless specifically otherwise indicated on the drawings.

2. Conduits shall be installed as follows:

a. Exterior and exposed where subject to physical damage: Stainless steel rigid metal conduit.

b. Exterior exposed where not subject to physical damage: Rigid non-metallic conduit, SCH 80.

c. Interior, concealed from view but exposed in ceiling spaces: EMT.

d. Interior, concealed in wall vertical spaces: EMT.

e. Interior, concealed in wall spaces, horizontal runs: EMT or FMC.

f. Interior, exposed: EMT, painted.

g. Below exterior grade: Rigid non-metallic conduit, SCH 40, concrete encased. (Except as indicated.)

h. In ground floor concrete slab or passing through for branch circuits and feeders: Stainless steel rigid metal conduit.

i. Below ground floor concrete slab for branch circuits: Stainless steel rigid metal conduit, or SCH 80 rigid non-metallic conduit in approved cushion material.

j. Below ground floor concrete slab for feeders: Stainless steel rigid metal conduit or SCH 80 rigid non-metallic conduit in approved cushion material.

3. Conduit size shall be minimum 3/4 inch except that 1/2 inch may be used with 3-No.12 plus 1-No.12 ground.

4. Provide conduit support directly from building structure in spaces above removable ceilings. Contractor shall not attach conduits to suspended ceiling grid framing or to the supporting wires.

5. Where required and allowed and approved, exposed conduit shall be installed parallel with or at right angles to the building walls and ceiling and shall be supported by straps, wall brackets, hangers or ceiling trapeze.

6. Fastening of conduit supports and clamps shall be by wood screws or screw type nails to wood; by toggle bolts on hollow masonry units; by concrete inserts or expansion bolts on concrete or brick; by machine screws, welded threaded studs, or spring-tension clamps on steel work. All mounting hardware shall be Type 316 stainless steel.

7. Provide UV rated nylon pull cords in all empty conduits, regardless of use or length.

8. Outlet, Pull and Junction Boxes. Boxes shall be provided in the wiring or conduit systems wherever required for pulling of wires, making connections, and mounting of devices or lighting fixtures.

9. Conductors (Other Than Control Work)

a. Color code in accordance with the NEC.

b. Form neatly in enclosures for minimum of cross-overs and for adequate ventilation and air spaces around conductors.

c. Splices shall be in accessible locations. Splices in wires No. 10 AWG and smaller shall be made with an insulated pressure type connector. Splices for wires No. 8 and larger shall be made with solderless connectors and shall be covered with an insulation material equivalent to the conductor insulation. Splices shall not be pulled into or through conduits or wireways or other raceways.

d. Provide types of insulation as follows:

1) Type THWN-2 for service, feeder, and branch circuits.

2) Type THHN where required for 90 degree C. rated conductors in dry applications.

3) Type MTW for control circuits.

e. Unless otherwise indicated on the drawings, install no conductors smaller than No. 12 AWG.

f. Conductors in conduit shall be stranded only.

g. Provide stranded conductors only for control circuits.

h. Install conductors continuous from terminal point to terminal point, from outlet to outlet or junction box. Keep splices to a minimum, but where necessary, make them in a readily accessible outlet box or junction box.

10. Equipment Supports. All electrical equipment shall be properly supported and securely mounted by approved methods for static loads and for earthquake loads of seismic Design Category F.

11. Grounding and Bonding. All exposed noncurrent carrying metallic parts of electrical equipment, conduits, control equipment and devices, grounding conductors in non-metallic conduits, and neutral conductor of wiring systems shall be grounded. Unless otherwise indicated, a grounding conductor with Type THWN insulation and sized according to the NEC shall be provided in all motor circuits and branch circuit conduit systems.

12. Equipment Connections. All wiring for the connection of control equipment as indicated on the drawings shall be provided under this Section of the specifications. Flexible connections of short length shall be provided for all equipment subject to vibration, noise transmission, or movement. Liquid-tight flexible conduit shall be used. A separate grounding conductor shall be provided across all flexible connections.

13. Lighting Fixtures and Lamps. No wiring other than the branch circuit as defined in the NEC supplying a continuous line of fixtures shall be installed in the fixture wiring

channels. All fixtures shall be securely supported with approved seismic hangers for Seismic Zone 4. They shall be set in perfect alignment and elevation. All splices shall be carefully placed in outlet boxes or wiring gutters with no crowding. Fixtures shall be supported from structural ceiling or structural supports.

Connections to recessed fixtures shall be with 1/2 inch minimum flexible metal conduit 6 feet in length from fixture to outlet box. Provide grounding conductor in flexible conduit.

Surface mounted fixtures shall mount directly to the outlet box. Boxes shall be securely supported for Seismic Zone 4. Flexible conduit between fixture and outlet box is not allowed.

All fixtures, lamps, and tube guards must be thoroughly cleaned as a requirement for acceptance by the Department.

14. Painting and Finishing. All exposed surfaces of electrical equipment, conduits, supports, and other items shall be field painted. Refer to the applicable Painting Section for paint requirements. The basic intent is to have all electrical items of work painted the same color as the wall or other mounting support to which it is attached. All threaded portions of conduits shall be cleaned with solvent and painted with corrosion resistant paint.

    Patch, repair, and restore to approval of the Department all structural and architectural elements cut or drilled for installation of electrical work. Paint with primer and finish coat of paint.

15. Control Work

    a. Unless otherwise indicated, control wiring shall be No. 14, Type MTW, copper, stranded, 19 strands, 600 volts.

    b. All control wiring shall be installed without splices and shall be terminated "point-to-point". No splices will be allowed.

    c. All control wiring shall be neatly loomed, laced, and bundled by the indicated groupings and properly identified.

    d. Control wire bundle routings in equipment spaces shall be subject to approval by the Department.

    e. All control items and devices shall be correctly and properly labeled as indicated. Labeling shall follow nameplate specifications.

    f. The Contractor shall follow the color coding indicated on the drawings for all control work wiring. No exceptions will be allowed.
    g. The terminal block numbers and wire number indicated on the drawings shall be used on all shop drawings and for the actual installation. Any approved deviation shall be properly noted on the as-built drawings.

16. Tank Level Transmitter: Install per manufacturer's requirements and installation drawings. Comply with all start-up, testing, and calibration requirements of manufacturer and the Department.

17. Flow Transmitter: Install per manufacturer's requirements and installation drawings. Comply with all start-up, testing, and calibration requirements of manufacturer and the Department.

18. Supervisory Control and Data Acquisition (SCADA) System

    a. SCADA Cabinets: Install all components, hardware, and accessories as indicated and/or specified.

    b. Configuration, set-up, and programming of the new SCADA system and the existing SCADA system at the Department's Hilo Baseyard to incorporate the new SCADA site into the existing system will be by DWS. Coordinate and schedule this work.

    c. Provide start-up and testing prior to work by DWS. Coordinate and schedule with DWS.

Q. EQUIPMENT CALIBRATIONS: The Contractor shall calibrate all equipment furnished by him in the field to the satisfaction and acceptance of the Department. Any required testing and calibrating equipment shall be provided by the Contractor. Settings shall be furnished by the Department to the Contractor. All calibrations shall be done to the satisfaction of the Department.

R. INSPECTION AND TESTS

1. Poor workmanship or unacceptable workmanship as determined by the Department shall be repaired and/or corrected to acceptable standards at no additional costs to the Department.

2. After the installation is completed and at such time as the Department may direct, the Contractor shall conduct an operating test for approval and acceptance. The complete electrical system shall be demonstrated to operate in accordance with the requirements of these specifications. All tests shall be performed in the presence of the Department.

3. Wiring systems shall be tested for insulation resistance after all wiring is completed and ready for connections to equipment. Tests shall be made with an approved instrument capable of measuring resistance at 500 volts potential. The insulation resistance between conductors and also between each conductor and ground shall be measured. These tests shall insure that all wiring and equipment are free from short circuits and from grounds other than the required grounds. These tests shall not cause any damage to any existing or new equipment. All readings shall be recorded on the as-built drawings and shall be subject to acceptance by the Department.

4. Ground system shall be tested with an approved ground testing system. Readings shall be recorded on the as-built drawings and shall be subject to acceptance by the Department.

5. Test each device outlet for the correct and proper connections, voltages, neutrals, and grounds.

6. Any deficiencies found shall be corrected and work affected by such deficiencies shall be completely retested at Contractor's expense and in the presence of the Department.

END OF SECTION