



Republic of the Philippines  
**Department of Agriculture**  
Western Visayas  
Parola, Iloilo City

# TECHNICAL SPECIFICATIONS

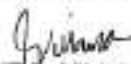
## ESTABLISHMENT OF SIGNE SOLAR- POWERED IRRIGATION SYSTEM

(HVCDP 2025)

Brgy. Signe, Igbaras, Iloilo

PREPARED BY:


  
JHONALYN B. BAUTISTA, ABE  
Engineer I (License No. 0008573)

  
CHRISTINE D. VILLANUEVA, ABE  
Engineer I (License No. 0011915)

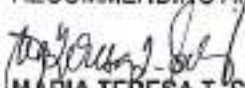
REVIEWED BY:

  
YVONNE GRACE H. SUR, ABE  
Engineer III (License No. 0005970)  
Head, EPDSS

CHECKED/SUBMITTED BY:

  
MOISES D. MANA-AY, ABE  
Engineer V (License No. 0006077)  
Division Chief, RAED

RECOMMENDING APPROVAL:

  
MARIA TERESA T. SOLIS  
OIC-RTD for Operations

APPROVED BY:

  
DENNIS R. ARPIA  
Regional Executive Director

## **I. GENERAL ITEM**

### **SPL1. TEMPORARY FACILITY**

The Contractor shall furnish all materials, labor, equipment, tools and install such temporary works as are necessary for the successful completion of the Contract Work. The Contractor shall negotiate the site for his construction camp, office, and work areas.

These temporary works and construction plan shall include but shall not be limited to the following:

1. Construction camp for housing, feeding and accommodation for all the Contractor's employees. The Contractor shall also, with-in close proximity of his camp, provide an office and sleeping quarter for DA-RAED 6 monitoring employees, complete with facilities and shall have a minimum floor area of 48 sq.m.
2. Facilities such as haul roads, potable water, supply, drainage, lighting, sewage disposal system, sanitation, first aid and fire protection facilities.
3. Workshops, laboratory, warehouses, site offices, stockpile areas, storage areas for materials, equipment, spare parts, fuel and oil.
4. River diversion system including construction of cofferdam.
5. All other temporary facilities not specifically listed but nevertheless required for the proper functioning of the camp set-up and construction activities.

Temporary works shall conform to all government standards and codes and shall meet the sanitary requirements of the Department of Health.

### **SPL2. PROJECT SIGNBOARD, COA BILLBOARD, AND PROJECT MARKER**

Project Marker made of concrete hollow blocks and reinforced with steel bars, plastered finished in a 0.88m x 1.4m dimension and with concrete foundation underneath, marker information seen on the approved plans / drawings.

Commission on Audit (COA) Billboard printed of white tarpaulin, 8 ft x 8 ft dimension; resolution 70 DPI; Font: Helvetica; Font Size: Main information – 3 inches; Sub. Information – 1 inches; and Font color: Black.

Department of Agriculture (DA) Billboard shall be on standard billboard measuring 1.2m x 2.4m (4ft x 8ft) using ½ inch plywood or Tarpaulin posted on 3/16-inch plywood. Billboard shall be installed in front of project site.

### **SPL3. MOBILIZATION/ DEMOBILIZATION**

The Contractor shall mobilize and move into the Project Site (in accordance with his approved Construction Program and Equipment Moving-in and Utilization Schedule) the required construction equipment needed for the successful completion of the Contract Work immediately after receipt of the approved Construction Program. Notwithstanding the approved Equipment Moving-in and Utilization Schedule, the initial equipment required to be mobilized by the Contractor to the Project Site within twenty (20) calendar days after date of receipt of the approved Construction Program are listed below:

#### **MINIMUM EQUIPMENT REQUIREMENT FOR SOLAR-POWERED IRRIGATION PROJECT**

Description	No. of Unit
1. Concrete Mixer 1 bagger	1 unit

2. Bar Cutter & Bender	1 unit
3. Service Vehicle	1 unit
4. Welding Machine	1 unit

If for the reasons or causes other than "major calamities", the Contractor fails to mobilize fully the initial equipment required within said period, and all other equipment listed in his approved Equipment Moving-in and Utilization Schedule, at the discretion of the Secretary/Director, he may be given an extension of time to mobilize them fully but in no case shall it exceed thirty (30) calendar days. Failure to fully mobilize the required construction equipment within said period will be a ground for contract rescission.

Demobilization shall include dismantling and removal from the site of Contractor's Construction Plant, materials and equipment and all temporary facilities with the exception of some facilities which DA- Western Visayas shall consider to remain and which shall be handled over to DA- Western Visayas at the time of demobilization shall also include clean-up of the site after completion of the Contract Work as approved by DA- Western Visayas and transportation from the site of Contractor's employees.

## **ITEM 1**

### **WELL DEVELOPMENT (Includes Labor, Equipment, and Materials)**

#### **Scope**

This item shall consist of furnishing all plant, labor, equipment, appliances, and materials and performing all operations in connection with drilling, sampling, constructing, developing, and testing the well.

#### **Construction Requirements**

Cutting must be carefully collected for every meter of penetration or at every change of lithology. Penetration rate shall be closely monitored so as to have supplemental data in the evaluation of the hydraulic parameters of the lithology encountered.

Rotary drill is recommended to pave way for electric logging after the drilling exploratory well. Electric logging is used to locate the exact aquifer zone(s). When aquifer zones have been properly located, it is recommended that aquifer testing should be conducted to determine the aquifer characteristics such as maximum yield, before the final well-design be constructed.

Drilling shall be done up to 15 meters (minimum) below the ground surface. Submersible pump must be at the most applicable level inside the casing. Please see attached geo-resistivity results.

Well perforations should have slot opening of at least 15% of the surface area of the pipe.

#### **Stages of Well Development**

##### **1. Jetting.**

After the well is installed, it is jetted starting from the bottom of the perforated pipe to remove the trapped mud and fine aquifer materials.

##### **2. Pumping at low discharge.**

After the jetting fluid significantly clears up, well development is continued by pumping. Initially the pump is operated at a very low and controlled discharge until the water clears and pumping is stopped for at least ten minutes after which pumping is resumed.

3. Pumping at intermediate and higher discharge. The well should be developed at intermediate discharges, and up to a pumping rate that is 50% or more above the designed pump discharge.

#### **Scope of Work**

- a. Site preparation and Rig Set-up
- b. Drilling and Installation of Surface casing

- c. Drilling of Pilot Hole
- d. Electric logging and Preparation of Well Design
- e. Reaming from 0 m. to 15.00m (15.00 m.) 6" dia.
- f. Installation of Casing and Screen with Centralizer
- g. Installation of Gravel Pack Materials
- h. Development by Bailing
- i. Treatment with Sodium Hexametaphosphate
- j. Development by High Velocity Jetting
- k. Development by Surging including Bailing Out of Sediments
- l. Development by Air-lift Method Using Air Compressor
- m. Well Development by Pumping
- n. Step-drawdown pumping test with five (5) steps at one-hour duration each
- o. Discharge rate increasing in equal fraction of the expected maximum yield
- p. Continues Constant Discharge Pumping Test
- q. Grouting

#### NOTE

- Pump testing shall be conducted to determine if the designed discharge is applicable. The size of submersible pump may be changed depending on the result of the discharge test.
- Must be AMTEC Tested (System Test).

## **II. SOLAR PUMP/ ARRAY/MOUNTING STRUCTURE**

### **803 STRUCTURE EXCAVATION**

The work under this Section shall include clearing removal, hauling and disposal of all excavated materials tamping and trimming of foundation bed required for the construction of permanent structure.

Trimming the sides of excavations to the required profiles and levels as well removing all loose material should be executed prior to consecutive process.

Bottoms of excavations shall be approved by the Engineer's Representative before any concrete is laid.

### **404 REINFORCING STEEL BARS**

All reinforcement shall be placed strictly in accordance with the drawings and as instructed in writing by the Engineer. Nothing shall be allowed to interfere with the required disposition of the reinforcement, and the contractor shall ensure that all parts of reinforcement are placed correctly in position and are temporarily fixed where necessary to prevent displacement before or during the process of tamping and ramming the concrete in place. The ties, links or stirrups connecting the bars shall be taut so that the bars are properly braced around which they are intended to fit. Placed correctly in position and are temporarily fixed where necessary to prevent displacement before or during the process of tamping and ramming the concrete in place.

All reinforcing steel bars shall be Grade 40 or PS 275, deformed type and conforming to the requirements of ASTM Designation A-615 or its latest revision. The nominal dimensions and unit weights of bar designation shall be in accordance with the following table:

Bar Number	Designation	Unit (kg/m)	Wt.	Diameter (mm)	Nominal Cross-Section (mm <sup>2</sup> )	Dimensions Area	Perimeter (mm)
10 mm		0.616		10	78.54		
12 mm		0.888		12	113.10		
16 mm		1.578		16	201.06		

Wire for bending reinforcement bars shall be of soft black annealed mild steel wire. The diameter of the Wire shall not be less than 16 S.W.G. (1.6mm) and the binding shall be twisted tight with proper pliers. The free ends of the binding wire shall be bent inwards.

Steel reinforcement shall be protected at all times from injury. When placed in the work, it shall be free from dirt, detrimental scale, paint, oil, loose, rust, grease or other foreign substances. Reinforcement in any member shall be placed and then inspected and approved by the Engineer before the placing of concrete begins. All steel reinforcement shall be accurately placed in the position shown on the drawings and firmly held during the placing and setting of concrete. Concrete placed in violation of this provision may be rejected and its removal is required.

All reinforcement shall be furnished in the full lengths indicated on the drawings. Splicing bars, except where shown on the drawing, will not be permitted without the written approval of the Engineer. Splices shall be staggered as far as possible. Additional splices, other than those shown on the drawings; and allowed by the Engineer, shall be at the contractor's own expense.

#### **1708 LEVELING COURSE**

This item shall consist of approved granular fill material furnished and placed as required to replace unsuitable material encountered below foundation elevation of concrete structures, pipes, and concrete posts.

The term "Coarse Aggregate" is used to designate aggregates of such sizes as to fall within the range of 3/16 inch to 1 1/2 inches (0.5 cm to 3.75 cm.) or any size or range of sizes within such limits. Coarse aggregate for concrete shall be furnished by the Contractor and shall consist of crushed rock or mixture of natural gravel and crushed rock. Coarse aggregate as delivered shall have a uniform and stable moisture content. Any rewashing found necessary to provide clean aggregates shall be done prior to finish screening. Rewashing shall not be performed in finish screens.

Coarse aggregates shall conform to the requirements of ASTM C-33 and shall consist of hard, dense, uncoated durable rock fragments.

Gravel beddings shall consist of natural or processed aggregates such as gravel, sand or stone fragments, which shall conform to the following grading requirements:

##### **Requirements for Grading**

Sieve (mm)	Size	Percent by Weight Passing		
		Grading A	Grading B	Grading C
75.00		100	100	100
5.00		35-70	40-90	50-100
0.075		0.20	0.25	0.30

After the unsuitable material has been removed as required by the DA Project Engineer, gravel blanket shall be placed in thoroughly compacted layers, not exceeding those specified in the Drawing or as directed by the Project Engineer.

#### **414 FORMWORKS**

All forms shall be of wrought plywood and shall be built tight and of sufficient rigidity to prevent distortion due to the pressure of the concrete and other loads incident to the construction operations. Forms shall be constructed and maintained so as to prevent warping and the opening of joints due to shrinkage of the plywood and lumber.

The forms shall be substantial and unyielding and shall be so designed that the finished concrete will conform to the proper dimensions and contours. The Contractor shall take into consideration the effect of vibration on the formwork and shall be responsible for any damage or default resulting thereof.

The number of spacing of the form struts and braces shall be such that the forms will be and uniformly lock joints between form sections shall be free from play or movement. The shape, strength rigidity, water tightness and surface smoothness of re-used forms shall be always maintained. Any warped or bulged lumber must be resized before being re-used. Forms which are unsatisfactory in any respect shall not be re-used.

In the determining of the time for removal of forms, consideration shall be given to the location and character of the structure, the weather and other conditions influencing the setting of the concrete and the materials used in the mix. In general, the forms of any positions of the structure shall not be removed until the concrete is strong enough to prevent injury to the concrete when the forms are removed.

Method of form removal likely to cause overstressing of the concrete shall not be used. In general, the forms shall be removed from the bottom upwards. Forms and their supports shall not be removed without the written approval of the Engineer. Supports shall be removed in such a manner as to permit the concrete to take the stresses due uniformly and gradually to its own weight.

The Contractor shall include in his prices for any formwork which may have to be left in position due to the impossibility of removal of same.

#### **405 CONCRETE WORKS**

This section describes and specifies work required for plain and reinforced concrete, including formwork intended to be used for the Project under the Contract in accordance with the Drawings, Bills of Quantities and as directed by the Engineer.

At the beginning of each month, the Contractor shall submit to the Engineer his concreting programme for that month, stating the pouring dates, so that adequate checking and supervision can be provided before and during the pouring operation. No pouring shall be allowed unless the Engineer has been given a week-advanced notice of the intention to pour.

All the applicable provisions of the latest revision of the ACI Building Code (ACI- 318 -85) and American Society for Testing Materials (ASTM) shall govern in all cases not specifically provided for herein.

All cement requirements of concrete works for the contract shall be contractor-furnished. The form to the requirements of the standard specifications for Portland Cement (ASTM: C150 Type 1). All cement shall be stored in suitable weatherproof and approved storage sheds which will protect the cement from dampness. Cement shall be used in the order of its delivery to site, new deliveries shall not be used unless the cement from earlier deliveries has been completely used.

The term "Fine Aggregates" is used to designate aggregates in which the maximum size of particles is 3/16 of an inch (6 millimeters). As a means of providing moisture control, the Contractor may be required to stockpile the fine aggregates over porous drain to get rid of excess water and to stabilize the moisture content.

Fine aggregates shall conform to the requirements of ASTM C-33 and shall consist of hard, tough, durable uncoated rock particles. The Contractor shall exercise every possible precaution in transporting, washing, and screening operations to prevent contamination of sand particles.

Fine Aggregate from different sources of supply shall not be mixed or stored in one pile nor used alternately in the same class of construction or mix.

The term "Coarse Aggregate" is used to designate aggregates of such sizes as to fall within the range of 3/16 inch to 1 1/2 inches (0.5 cm to 3.75 cm.) or any size or range of sizes within such limits. Coarse aggregate for concrete shall be furnished by the Contractor and shall consist of crushed rock or mixture of natural gravel and crushed rock. Coarse aggregate as delivered shall have uniform and stable moisture content. Any rewashing found necessary to provide clean aggregates shall be done prior to finish screening. Rewashing shall not be performed in finish screens.

Coarse aggregates shall conform to the requirements of ASTM C-33 and shall consist of hard, dense, uncoated durable rock fragments.

The mixtures for all classes of concrete shall be designed by the Contractor and approved by the Engineer to obtain the compressive strength at the age of twenty-eight (28) days.

The Contractor shall provide the required samples of concrete to Engineer without cost. Sampling will, in all cases, be performed by or under the direct supervision of the Project Engineer and Contractor shall provide without cost to DA all-available tools and labor as may be required. Concrete sampling shall be carried on during concrete operations at the rate of one standard sample for each 75 cubic meters of concrete or fraction thereof placed during each continuous placing operation but in no case shall there be less than one sample for each day concreting. Each standard sample shall consist of three (3) standard cylinders 6-inch diameter and 12-inch high. The Contractor shall keep a record of the samples and the portion of the structures and volume represented which shall be available to DA on demand.

Sampling shall conform to ASTM Designations C-172, preparation, storage and curing to ASTM Designation C-31 and testing to ASTM Designation C-39. The samples are to be tested by an approved testing laboratory at the expense of the Contractor.

#### **1705 STRUCTURE BACKFILL (25% compaction)**

Backfill and fill shall be a structurally sound material such as gravel or native soil free of rocks with size more than 5cm, lumps, vegetables and other organic materials obtained from suitable excavated material and/or from approved borrow pits.

#### **SPL4 SOLAR POWER MODULE MOUNTING STRUCTURE**

1. Concrete pedestal 0.30m diameter with post 2" diameter G.I. pipe schedule 40 welded to the reinforcement.
2. Support beam- 2"x4"x5mm G.I. Tubular Pipe (cleaned from rust and primed with epoxy primer).
3. Railings - 2"x3"x3mm C-Channel Bar (cleaned from rust and primed with epoxy primer).
4. Bracing- 2"x2"x5mm Angle Bar (cleaned from rust and primed with epoxy primer).

#### **SPL5 SOLAR POWER MODULES (5,500 WP)**

##### **Brand New**

1. 5,500 WP Total Solar Power Modules  
10 pcs. Solar Modules @ 500 Wp, or its equivalent
2. Manufactured in ISO 9001- Certified Factories
3. Must be CE marked
4. Must have TUV Certification (IEC 61215)
5. Cell type: Mono-crystalline

The number of panels may change based on the actual power of the pump used.

Solar Power Modules shall be clamped properly to the Mounting structure.

The installation of solar power module shall be in accordance with the approved Plans or agreed by the Project Engineer of the Department of Agriculture Western-Visayas.

The number of panels may change based on the actual power of the pump used.

The Solar Power Modules shall have a minimum of Five (5) years warranty from the date of acceptance by the DA-WV.

#### **SPL6 INVERTER AND CONTROLLER (4 kW)**

**1 Unit- 4 kW** or must be compatible with the offered pump (may varies/change if the pump power used changed) inverter with system monitoring.

##### **Brand New**

1. Pump is running
2. Input power and alarm indication for; service needed in case of no contact to pump, overvoltage, over temperature and overload and dry running.
3. Maximum Power Point Tracking (MPPT).
4. AC/DC compatibility
5. Overcurrent Protection
6. No load protection
7. Operating History Memory
8. Enclosure Class IP66
9. Sine wave Filter
10. RS485 / Ethernet Capability

The Inverter shall have a minimum of Five (5) years warranty from the date of acceptance by the DA-WV.

#### **SPL7 SUBMERSIBLE PUMP (4.0hP)**

##### **Brand New**

Pump power may change/varies based on the pumping test result, drilling and actual total dynamic head of site. *Must be AMTEC Tested (System Test)..*

##### Pump

1. 1 unit – **4.0 kW** Submersible Pump
2. Capacity : 40.22 cu.m/hr (177.1 gpm)
3. Total Dynamic Head: 19.33 m (63.40 ft)
4. Pump Efficiency : 71%

##### Motor Specification: Built into Pump

1. Built-in frequency converter
2. Can be supplied by either DC or AC voltage source
3. Inverter and control unit must be integrated in the motor
4. Built-in maximum power point tracking (MPPT)
5. Enclosure class: IP68

##### Motor protection:

The built-in electronic unit must protect the motor in case of: (as standard, without additional equipment)

1. Dry running sensor
2. Over and under voltage
3. Overload
4. Over- temperature

The design system for the **4.0 hP pump** is corresponded to the minimum Watt Peak (WP) of Solar Power Module. Any design higher than these specifications requires additional WP and inverter capacity in

correspond to the minimum design. The additional requirements to meet the minimum specification of the agency shall be at the expense of the contractor.

Electrical cables/wirings must be free from any defects. Wires and cables shall be of approved type meeting all the requirements of the Philippine Electrical Code bearing the PSA mark. All wires shall be copper, soft drawn and annealed, smooth and cylindrical form and shall be centrally located inside the insulation. All wiring devices shall be standard products of reputable electrical manufacturers.

The Electric Motor Submersible Pump shall have a minimum of Five (5) years warranty from the date of acceptance by the DA-WV.

#### **IV. ELEVATED TANK**

##### **SPL**

##### **METAL STRUCTURE/FRAME**

(Solar Power Module Mounting Structures and Storage Tank Metal Frame)

##### **Description**

This work shall consist of steel structures and the steel structure portions of composite structures, constructed in reasonably close conformity with the lines, grades and dimensions shown on the Plans or established by the Engineer.

The work will include the furnishing, fabricating, hauling, erecting, welding and painting of structural metals called for in the Special Provision or shown on the Plans. Structural metals will include structural steel, rivet, welding, special and alloy steels, steel forgings and castings and iron castings. This work will also include any incidental metal construction not otherwise provided for, all in accordance with these Specifications, Plans and Special Provisions.

##### **Material Requirements**

Materials shall meet the requirements of Item 712, Structural Metal; Item 409, Welded Structural Steel, and Item 409, Welded Structural Steel; and Item 709, Paints. All materials shall be brand new and free from fractures/defects.

##### **1. Post and Frames and Other Accessories for solar power mounting structures**

###### **a. Posts**

Posts shall be made of 50.8 mm - Schedule 40 Galvanize Iron Pipe, embedded into the pedestal as shown on Plans.

###### **b. Frames**

Support frames shall be 2" x 3" x 5mm C-Channel, 2" x 4" x 5mm Tubular G.I Pipe and 2" x 2" x 5mm Angle Bar placed as shown on plans.

##### **2. Storage Tank Metal Frame**

###### **a. Posts**

Post shall be made of 3 inches GI pipe Schedule 40 embedded into the pedestal as shown on plans.

###### **b. Support frames**

Bottom Support shall be made of 2 inches GI pipe Schedule 40 welded on post placed as shown on plans.

Lateral Support shall be made of 2in x 2in x 1/4 in, 1in x 1in x 1/4 in and 1in x 1in x 3/16 in angle bars placed as shown on plans.

c. Ladder - 1in x 1in x 3/16 in angle bars placed as shown on plans.

3. Painting

All exposed steel materials must be painted with epoxy primer.

## **CONSTRUCTION REQUIREMENT**

### **Fabrication**

These Specifications apply to riveted, bolted and welded construction.

Workmanship and finish shall be in accordance with the best general practice. Portions of the work exposed to view shall be finished neatly.

Structural material, either plain or fabricated, shall be stored above the ground upon platforms, skids or other supports. It shall be kept free from dirt, grease or other foreign matter, and shall be protected as far as practicable from corrosion.

### **Welding**

Shall conform to the applicable requirements of Item 409, Welded Structural Steel (DPWH Bluebook, volume 2).

### **Erection**

#### **1. General**

The Contractor shall provide the falsework and all tools, machinery and appliances, necessary for the expeditious handling of the work and shall erect the metal work, remove the temporary construction, and do all work necessary to complete the structure as required by the Contract and in accordance with the Plans and these Specifications.

### **Handling and Storing Materials**

Materials to be stored shall be placed on skids above the ground. It shall be kept clean and properly drained. If the Contract is for erection only, the Contractor shall check the material turned over to him against the shipping lists and report promptly in writing any shortage or damage discovered. He shall be responsible for the loss of any material while in his care, or for any damage caused to it after being received by him.

### **Method and Equipment**

Before starting the work of erection, the Contractor shall inform the Engineer fully as to the method of erection he proposes to follow, and the amount and character of equipment he proposes to use, which shall be subject to the approval of the Engineer. The approval of the Engineer shall not be considered as relieving the Contractor of the responsibility for the safety of his method or equipment or from carrying out the work in full accordance with the Plans and Specifications. No work shall be done until such approval by the Engineer has been obtained.

### **Assembling Steel**

The parts shall be accurately assembled as shown on the working drawings and any match marks shall be followed. The material shall be carefully handled so that no parts will be bent, broken or otherwise damaged. Hammering which will injure or distort the members shall not be done. Bearing surfaces and surfaces to be in permanent contact shall be cleaned before the members are assembled.

## Painting

All surfaces of new structural steel shall be cleaned before applying Epoxy Primer.

**803 STRUCTURE EXCAVATION** *(Refer to Item II, 803- Solar Pump/Array/Mounting Structure)*

**1705 STRUCTURAL BACKFILL** *(Refer to Item II, 1705- Solar Pump/Array/Mounting Structure)*

## 414 FORMWORKS AND SCAFFOLDINGS

### FORMWORKS

All forms shall be of wrought plywood and shall be built tight and of sufficient rigidity to prevent distortion due to the pressure of the concrete and other loads incident to the construction operations. Forms shall be constructed and maintained so as to prevent warping and the opening of joints due to shrinkage of the plywood and lumber.

The forms shall be substantial and unyielding and shall be so designed that the finished concrete will conform to the proper dimensions and contours. The Contractor shall take into consideration the effect of vibration on the formwork and shall be responsible for any damage or default resulting thereof.

The number of spacing of the form struts and braces shall be such that the forms will be and uniformly lock joints between form sections shall be free from play or movement. The shape, strength rigidity, water tightness and surface smoothness of re-used forms shall be always maintained. Any warped or bulged lumber must be resized before being re-used. Forms which are unsatisfactory in any respect shall not be re-used.

In the determining of the time for removal of forms, consideration shall be given to the location and character of the structure, the weather and other conditions influencing the setting of the concrete and the materials used in the mix. In general, the forms of any positions of the structure shall not be removed until the concrete is strong enough to prevent injury to the concrete when the forms are removed.

Method of form removal likely to cause overstressing of the concrete shall not be used. In general, the forms shall be removed from the bottom upwards. Forms and their supports shall not be removed without the written approval of the Engineer. Supports shall be removed in such a manner as to permit the concrete to take the stresses due uniformly and gradually to its own weight.

The Contractor shall include in his prices for any formwork which may have to be left in position due to the impossibility of removal of same.

### SCAFFOLDINGS

No scaffolds shall be erected, moved, dismantles, or altered except under the supervision of competent persons or the supervising engineer.

Scaffolds and their components must be capable of supporting without failure 4 times the maximum intended load.

Steel scaffolding shall be used in accordance with manufacturers recommendations, proper seating and locking of all connections, using the corrective devices.

During setting up and dismantling of scaffolds, warning signs, safety Gordon and other safety measures shall be provided to ensure safety.

<b>405</b>	<b>CONCRETE WORKS (3,000 PSI)</b>	<i>(Refer to Item II, 405- Solar Pump/Array/Mounting Structure)</i>
<b>404</b>	<b>REINFORCING STEEL BARS</b>	<i>(Refer to Item II, 404- Solar Pump/Array/Mounting Structure)</i>
<b>1032</b>	<b>PAINTING WORKS</b>	<i>(Refer to Item II, 1032- Solar Pump/Array/Mounting Structure)</i>

## **ITEM 1602 & 1603**

### **INSTALLATION OF PIPELINE (PIPES, FITTINGS AND OTHER ACCESSORIES)**

#### **Description**

This item shall consist of furnishing and installation of all pipes, fittings, closure pieces, bolts, nuts, gaskets, jointings materials, flanges and appurtenances as shown and specified on the drawings, and as required by the designated assigned Engineer for a complete and workable piping system.

#### **Material Requirements**

Materials shall be in accordance with the approved Plans. Materials used must be brand new and in good condition.

#### **Construction Requirements**

After a section of a pipe has been lowered into the prepared trench and immediately before joining the pipe, the ends of the pipe to be joined shall be cleaned, and the rubber gasket lubricated, with a vegetable compound soap all in accordance with the pipe manufacturer's instructions. Assembly of the pipe length shall be in accordance with the recommendation of the manufacturer of the type of the joint used. All special tools and appliances required for joining the pipe shall be provided by the Contractor. When cutting or machining of the pipe is necessary, only tools and methods recommended by the pipe manufacturer and approved by the Engineer shall be employed.

### **INSTALLATION OF VALVES AND TANK**

#### **Description**

This item shall consist of the installation of valves and water tank in accordance with the plans/drawings or as directed by the Engineer.

#### **Material Requirement**

All materials shall conform to AWWA and ISO specification for valve installation.

Storage Tank shall be a 2000 liters Dark Color Vertical Polyethylene Tank, as shown on the plans. It must be brand new.

#### **Construction Requirements**

Valves shall be installed as specified herein and as shown on the drawings. All valves shall be new and of current manufacture.

**PIPE CASING (6"Ø G.I. PIPE, SCH. 40), PIPE (4"Ø G.I. PIPE, SCH. 40), DISCHARGE PIPE (3"Ø HDPE PIPE, SDR 11), DELIVERY PIPE (3"Ø HDPE PIPE, SDR 17), FITTINGS AND OTHER ACCESSORIES**

1. Discharge Pipe: 3" dia. HDPE Pipe SDR 11 (PE 100) Irrigation pipe– 10 Linear meters

2. Distribution Pipes:
  - a. 3" dia. HDPE Pipe, SDR 17 (PE100) Irrigation pipe - 132 Linear Meters
3. Fittings (Transition Fitting Reducer, Reducing Tee, Couplings, Elbows): HDPE SDR 11 & 17

#### PIPE LAYING AND INSTALLATION

Before laying and installing, the pipe shall be excavated cleared levelled at design slope. Pipe shall be laid and covered. All pipes shall be connected by coupling band and supported by concrete collar. A concrete manhole must be constructed in every 3 lengths of pipe depending on the actual site condition/location.