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TECHNICAL SPECIFICATIONS

ESTABLISHMENT OF MARAPAL SOLAR POWERED IRRIGATION SYSTEM (SPIS)

Brgy. Marapal, Lemery, Iloilo

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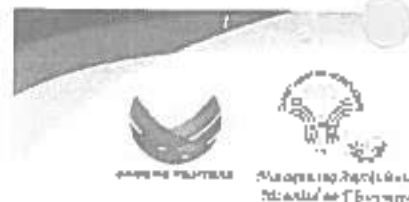


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GENERAL REQUIREMENTS

A-1 - 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. Temporary facilities shall be rental bases.

Temporary works shall conform to all government standards and codes and shall meet the sanitary requirements of the Department of Health. The Contractor shall be responsible for the maintenance and protection of all facilities to be provided during the duration of the Contract, including providing adequate stock of expendable items, such as light bulbs, light tubes and supplies at all times to ensure proper and continuous functioning of all the Engineer's facilities. On completion of the Contract, the facilities provided by the Contractor shall be demolished. Construction program are listed below:

MINIMUM EQUIPMENT REQUIREMENT FOR SOLAR POWERED IRRIGATION PROJECT

| Description | No. of unit |
|----------------------------|-------------|
| 1. Concrete mixer 3 bagger | 1 unit |
| 2. Concrete vibrator | 2 unit |
| 3. Bar cutter and bender | 1 unit |
| 4. Welding machine | 1 unit |

METHOD OF MEASUREMENT

Lump-sum items shall be provided for the provision of Temporary Facility for the Engineers.

BASIS OF PAYMENT

The quantities determined as provided above shall be paid for at the appropriate contract unit or ce, for each of the particular pay items shown in the Bill of Quantities which price and payment shall constitute full compensation for furnishing and maintaining such items.

A.2. - MOBILIZATION & DEMOBILIZATION

SCOPE

The work consists of the mobilization and demobilization of the contractor's forces and equipment necessary for performing the work required under the contract. It does not include mobilization and demobilization for specific items of work for which payment is provided elsewhere in the contract. Mobilization will not be considered as work in fulfilling the contract requirements for commencement of work.

Mobilization shall include all activities and associated costs for transportation of contractor's personnel, equipment, and operating supplies to the site; establishment of offices, buildings, and other necessary general facilities for the contractor's operations at the site; premiums paid for performance and payment bonds including co-insurance and reinsurance agreements as applicable, and other items as approved by the MRCS representative. Demobilization shall include all activities and costs for transportation of personnel, equipment, and supplies not required or included in the contract from the site; including the disassembly, removal, and site cleanup of offices, buildings, and other facilities assembled on the site specifically for this contract. This work includes mobilization and demobilization required by the contract at the time of award. If additional mobilization and demobilization activities and costs are required during the performance of the contract as a result of changed, deleted, or added items of work for which the contractor is entitled to an adjustment in contract price, compensation for such costs will be included in the price adjustment for the item or items of work changed or added.



MEASUREMENT AND BASIS OF PAYMENT

Payment will be made as the work proceeds, after presentation of paid invoices or documentation of direct costs by the contractor showing specific mobilization and demobilization costs and supporting evidence of the charges of suppliers, subcontractors, and others. When the total of such payments is less than the lump sum contract price, the balance remaining will be included in the final contract payment. Payment of the lump sum contract price for mobilization and demobilization will constitute full compensation for completion of the work. Payment will not be made under this item for the purchase costs of materials having a residual value, the purchase costs of materials to be incorporated in the project, or the purchase costs of operating supplies.

A.3. - OCCUPATIONAL SAFETY AND HEALTH

As compliance to the requirements of RA 11058 and DOLE Department Order 156-18 (its Implementing Rules and Regulations) as applicable provisions of the Occupational Safety and Health Standards (OSHS). In line with project implementation, the contractor shall provide safety and health program that will be observed and implemented throughout the project duration, at the start of construction, on the site shall have an established construction of safety and health facilities with personnel including health officer and health personnel.

Personal Protective Equipment and Devices shall also be provided to the construction workers. All PPEs shall be in accordance with the requirement of the Occupational Safety and Health Standards (OSHS) and should pass the test conducted and/or standards set by the Occupational Safety and Health Center (OSHC). For general construction work, basic PPEs shall be provided including:

1. First Aid Kit

METHOD OF MEASUREMENT

Lump-sum items shall be provided for the occupational safety and health.

BASIS OF PAYMENT

The quantities determined as provided above shall be paid for at the appropriate contract unit price, for each of the particular pay items shown in the Bill of Quantities which price and payment shall constitute full compensation for furnishing and maintaining such items.

A.4. - PAINTED DA LOGO & PROJECT TITLE, PROJECT MARKER & SIGNBOARD/BILLBOARD (1-4'x4' and 1-8'x8')

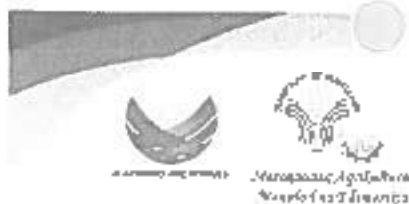
SCOPE

The Contractor shall furnish all materials, labor, equipment, tools and install such signages and billboard as necessary until the completion of the Contract Work. Establishment of Project Sign Board and COA Sign Boards prior to the start of project construction and it shall be located near the project site and visible to the community. Standard materials, size and dimension of such signages are specified in the Plans. It shall be made of painted canvas (Tarpaulin/Matensals) and stick-on the plywood with wooden frame and batten board.

MEASUREMENT AND BASIS OF PAYMENT

The item measured as provided above shall be paid at the contract unit price in Lump Sum in the Bill of Quantities which price and payment shall constitute full compensation for furnishing all labor, tools, equipment, supplies and all incidentals or subsidiary works.

| Pay Item Number | Description | Unit of Measurement |
|-----------------|-------------|---------------------|
|-----------------|-------------|---------------------|



SPL1

PAINTED DA LOGO & PROJECT
 TITLE, PROJECT MARKER &
 SIGNBOARD/BILLBOARD (1-4x8
 and 1-8x8)

Square Meter

B.1 - SITE CLEARING AND LAYOUT

SCOPE

The work under this Section shall include cleaning, grubbing and disposal, in a manner approved by DA Western Visayas, of all vegetation, trees, stumps, roots, brush, rubbish and all objectionable or undesirable matters within the entire dam site, construction camp site borrow areas, road surfacing materials sources, stockpile areas and elsewhere as may be directed by the Project Engineer; all in accordance with Drawings and their Specifications or as directed by the Project Engineer.

METHOD

The areas over which the structure and appurtenances shall be constructed, site borrow areas, borrow haul areas, aggregate sources and stockpile areas shall be cleared of all vegetation, trees and all other matters except such trees or shrubs which the DA-WV may ordered to preserve. All trees or shrubs ordered to be preserved including all existing adjacent shall be protected from injury or damage resulting from the Contractor's operations. All combustible materials from clearing operations shall be burned thoroughly or removed from the site of work or otherwise disposed to designated areas as directed by the Project Engineer.

All materials to be burned shall be piled nearby and when in a suitable condition shall be burned thoroughly. Piling for burning shall be done in such a manner and in such locations as to cause the least fire risk. The Contractor shall at all times take special precautions to prevent fire from spreading and shall have available at all times suitable equipment and supplies for use in preventing and fighting fires. No clearing shall be done on any areas where there are standing crops until such crops have been harvested or unless the Contractor shall have secured written permission from DA-WV.

Grubbing shall consist of the removal of all trees, stumps, roots, brush and rubbish from the above-mentioned work areas. It shall include to a surface to a depth not more than 10cm by effective means to remove all objectionable materials or organic matters from the said work areas. Skipping beyond the 10cm limit shall be subject to approval by the Project Engineer. And payment thereof shall be considered under Excavation.

METHOD OF MEASUREMENT

The area to be measured for payment shall be within the limit of the entire right-of-way as shown on the Drawings or as stated during construction operations. Measurement shall be made by the square meters and shall be computed based on the projection on a horizontal plane of the dimension of all acceptably cleared and grubbed areas.

BASIS OF PAYMENT

The cleared and grubbed areas measured as provided above shall be paid at the contract unit price per square meter in the Bill of Quantities which price and payment shall constitute full compensation for furnishing all labor, tools, equipment, supplies and all incidentals or subsidiary work.

| | Description | Unit of Measurement |
|-----------------|-------------------------------|---------------------|
| Pay Item Number | | |
| B.1 | Clearing, Grubbing and Layout | Square Meter |

B.2- STRUCTURAL EXCAVATION

SCOPE

The work under this Section shall include excavation and trimming of foundation as required for the construction of permanent structure foundation, lined canal or pipes and other structure specified in the plans. It shall also include whenever necessary all coffer-damming temporary diversions and protection works.

Foundations shall be excavated using according to the outline of the footings and floors of structure as shown on the Drawings or as directed by the DA-WV Project Engineer, and shall be of sufficient size to permit free movement of workers.

On excavation of common materials, the foundation bed upon which structures are to be placed shall be finished accurately to the established lines and grades after a thorough compaction and trimming of the foundation with the use of suitable tools and equipment.

If at any point, material is excavated beyond the lines and grades any part of the structure, the over excavation shall be filled with selected materials approved by the DA-WV Project Engineer and shall be placed in layers of not more than 10 cm thick, moistened and thoroughly compacted by special roller, mechanical tampers or by other approved methods. The cost of filling over-excavation ordered by the DA-WV Project Engineer shall be borne by the Contractor.

On excavation of rock materials, the bottom and side surfaces of excavated rock excavation upon or against which concrete and weep holes are to be placed shall conform to the required grades and dimensions as shown on the drawing or as established by the DA-WV Project Engineer. If at any point, materials are excavated beyond the required limits, the over excavation shall be filled with concrete at the expense of the Contractor including the cost of all materials required.

All foundations for other types of structures on soft ground not requiring piling shall be excavated to a depth of 50 centimeters below the proposed bottom of concrete shown on the Drawings and to a maximum width of 60 centimeters of the outermost lines of said base and should be backfilled with selected materials in layers not exceeding fifteen (15) centimeters in thickness. Such layers shall be rammed firmly in place and the final surface shall be thoroughly welled before any concrete is placed thereon.

METHOD OF MEASUREMENT

The cost of excavation of material which is incorporated in the Works or in other areas of fill shall be deemed to be included in the Items of Work where the material is used. Measurement of Unsuitable or Surplus Material shall be the net volume in its original position. For measurement purposes, surplus suitable material shall be calculated as the difference between the net volume of suitable material required to be used in embankment corrected by applying a shrinkage factor or a swell factor in case of rock excavation, determined by laboratory tests to get its original volume measurement, and the net volume of suitable material from excavation in the original position. Separate pay items shall be provided for surplus common, unclassified and rock material. The Contractor shall be deemed to have included in the contract unit prices all costs of obtaining land for the disposal of unsuitable or surplus material.

BASIS OF PAYMENT

The accepted quantities measured shall be paid for at the contract unit price for each of the Pay Items listed below that is included in the Bill of Quantities which price and payment shall be full compensation for the removal and disposal of excavated materials including all labor, equipment, tools, and incidentals necessary to complete the work prescribed in this Item.

Payment will be made under:

| Pay Item Number | Description | Unit of Measurement |
|-----------------|-----------------------|---------------------|
| B.2 | Structural Excavation | Cubic Meter |

B.3- STRUCTURAL BACKFILL

SCOPE

Work under this item shall consist of furnishing, placing, blending, conditioning and compaction of random fill and structural backfill where required for the various structures included in the works.

MATERIAL REQUIREMENTS

Materials for the various fills and backfills shall be obtained from required excavations and from borrow areas designated by the DA-WV Project Engineer. There is no guarantee that all the materials in any borrow area will be suitable for use in the fills and the Contractor shall move or modify his operations, as directed, to avoid unsuitable material. The Contractor shall move or modify his operations as directed to avoid unsuitable material. The Contractor shall maintain and operate sufficient excavating and hauling equipment so that an adequate amount of fill material from all sources will be available as required. Operations in borrow areas should not endanger roads, buildings and other existing structures. Borrow areas shall be graded to provide ready drainage from all parts of the excavated areas. When operations in a borrow area have terminated, the area shall be dressed to a neat appearance with adequate drainage to the satisfaction of the DA-WV Project Engineer.

Materials for structural backfill shall consist of compactable soil taken from foundation or channel excavations. Any additional materials needed shall be obtained from borrow areas mentioned above.

The suitability of fill or backfill materials shall be subject to the approval of the Project Engineer. Materials containing brush, roots, and others organic matter will not be considered suitable for fill or backfill. Unsuitable material to be wasted will be specifically designated by the DA-WV Project Engineer at the time the material is excavated. Materials for structural backfill shall consist of compactable soil approved by the DA-WV Project Engineer. It shall not contain individual particles larger than ten (10) centimeters.

Vibratory Plate Compactor/Power Tampers. Compaction of material where it is impractical to use vibratory rolled shall be performed by the use of Vibratory/Power Tampers weighing not less than 80 kilograms.

METHOD OF MEASUREMENT

Structural backfill will be measured by the number of cubic meters of approved materials satisfactorily compacted and acceptably placed and computed based on the net firms of construction drawings prepared by the Contractor and approved the Project Engineer.

BASIS OF PAYMENT

Payment for structural backfill will be made at the contract unit price per cubic meter, backfill in the Bid Proposal, which payment shall constitute full compensation for furnishing all labor, equipment, and other materials necessary to complete the item.

| Pay Item Number | Description | Unit of Measurement |
|-----------------|---------------------|---------------------|
| B.3 | Structural Backfill | Cubic Meter |

B.4 – LEVELING COURSE

SCOPE

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 piers.

MATERIALS AND METHOD OF CONSTRUCTION

The leveling course shall be of coarse aggregate of sizes laid 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. Course 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:

| Sieve Size (mm) | Requirements for Grading | | |
|-----------------|---------------------------|-----------|-----------|
| | Percent by Weight Passing | | |
| | Grading A | Grading B | Grading C |
| 75.00 | 100 | 100 | 100 |
| 5.00 | 15-70 | 40-90 | 50-100 |
| 0.075 | 0-25 | 0-25 | 0-30 |

After the unsuitable material has been removed as required by the DA-WV 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.

METHOD OF MEASUREMENT

Leveling Course will be measured by the number of cubic meter of materials acceptably placed and computed based on the net lines of construction drawings prepared by the Contractor and approved the Project Engineer.

BASIS OF PAYMENT

The volume measured as provided above will be paid for at the contract unit price per cubic meter, which price and payment shall constitute full compensation for furnishing all labor, tools, equipment, supplies and materials and all incidentals or subsidiary works necessary for the successful completion of the work.

Payment will be made under:

| Payment Number | Description | Unit of Measurement |
|----------------|-----------------|---------------------|
| B.4 | Leveling Course | Cubic Meter |

B.5 - CONCRETE WORKS (CLASS A)

SCOPE

This Item shall consist of the general description of the materials, equipment, workmanship and construction requirements of concrete structures and the concrete portions of composite structures conforming to the alignment, grades, design, dimensions and details shown on the Plans and in accordance with the Specifications for reinforcing steel, structural steel, structural concrete and other items which constitute the completed structure. The class of concrete to be used in the structure or part of the structure shall be as specified in Item

MATERIAL REQUIREMENTS

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 tamponess. 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 (16 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 produce 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 of concrete and concrete materials shall conform to the requirements in Structural Concrete. Unless otherwise shown on the Plans or specified in Special Provisions, concrete shall be of Class A or 3500psi 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-WV all available tools and labor as may be required. Concrete sampling shall be done 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 unloading. 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.

METHODS OF CONSTRUCTIONS

Handling and Placing Concrete

Concrete shall not be placed until forms and reinforcing steel have been checked and approved by the Engineer. In preparation for the placing of concrete all sawdust, chips and other construction debris and extraneous matter shall be removed from inside the formwork, shoring, stays and braces, serving temporarily to hold the forms in correct shape and alignment, pending the placing of concrete at their locations, shall be removed when the concrete placing has reached an elevation rendering their service unnecessary. These temporary members shall be entirely removed from the forms and not buried in the concrete. The concrete shall be placed as nearly as possible in its final position and the use of vibrations for moving of the mass of fresh concrete shall not be permitted.

Compaction of Concrete

Concrete during and immediately after placing shall be thoroughly compacted. The concrete in walls, beams, columns and the like shall be placed in horizontal layers not more than 30 cm thick except as hereinafter provided. When less than a complete layer is placed in one operation, it shall be terminated in a vertical bulkhead. Each layer shall be placed and compacted before the preceding layer has taken initial set to prevent injury to the green concrete and avoid surfaces of separation between the layers. Each layer shall be compacted so as to avoid the formation of a construction joint with a preceding layer.

Casting Columns, Skids and Beams

Concrete in columns shall be placed in one continuous operation, unless otherwise directed. The concrete shall be allowed to set for at least 20 hours before the caps are placed. Unless otherwise permitted by the Engineer, no concrete shall be placed in the superstructure until the column forms have been stripped sufficiently to determine the condition of the concrete in the column. The load of the superstructure shall not be allowed to come upon the beams until they have been in place at least 14 days, unless otherwise permitted by the Engineer.

Concrete in slab spans shall be placed in one continuous operation for each span unless otherwise provided.



Concrete in Beam spans shall be placed in one continuous operation unless otherwise directed. If it is permitted to place the concrete in two separate operations, each of the operations shall be continuous: first, to the top of the beam stems, and second, to completion. If the contractor wishes to place the concrete in two separate operations, he shall, with his request for permission to do so, submit plans and proposals of the required changes to the reinforcement, which plans and proposals shall be subject to the approval of the Project Engineer. The concrete in the webs and the top slab shall be placed in one continuous operation unless otherwise specified. If it is permitted to place the concrete in more than one operation, the requirements for beam shall apply.

Construction Joints

Construction joints shall be made only where shown on the Plans or called for in the pouring schedule, unless otherwise approved by the Project Engineer. Shear keys or reinforcement shall be used, unless otherwise specified, to transmit shear or to bond the two sections together. Before depositing new concrete on or against concrete which has hardened, the forms shall be redesigned. The surface of the hardened concrete shall be roughened as required by the Project Engineer, in a manner that will not leave loose particles of aggregate or damaged concrete at the surface. It shall be thoroughly cleaned of foreign matter and laitance. When directed by the Project Engineer, the surface of the hardened concrete which will be in contact with new concrete shall be washed with water to his satisfaction, and to insure an excess of mortar at the juncture of the hardened and the newly deposited concrete, the cleaned and saturated surfaces, including vertical and inclined surfaces shall first be thoroughly covered with a coating of mortar of the same proportion of sand and cement as the class of concrete used against which the new concrete shall be placed before the grout or mortar has attained its initial set. The placing of concrete shall be carried continuously from joint to joint. The face edges of all joints which are exposed to view shall be carefully finished true to line and elevation.

Immediately following the removal of forms, all fins and irregular projection shall be removed from all surface except from pieces which are not to be exposed or are not to be waterproofed. On all surfaces the cavities produced by form ties and all other holes, honeycomb spots, broken corners or edges and other defects shall be thoroughly cleaned, and after having been kept saturated with water for a period of not less than three hours shall be carefully pointed and made true with a mortar of cement and fine aggregate mixed in the proportions used in the grade of the concrete being finished. Mortar used in pointing shall not be more than one hour old. The mortar patches shall be cured. All construction and expansion joints in the completed work shall be left carefully tooled and free of all mortar and concrete. The joint filler shall be left exposed for its full length with a clean and true edges. The resulting surface shall be true and uniform. All repaired surfaces, the appearance of which is not satisfactory to the Project Engineer shall be rubbed.

Curing Concrete

All newly placed concrete shall be cured in accordance with this Specification, unless otherwise directed by the Engineer. The water curing method shall apply. The concrete shall be kept continuously wet by the application of water for a minimum period of 7 days after the concrete has been placed. The entire surface of the concrete shall be kept damp by applying water with an atomizing nozzle. Cotton mats, rugs, carpets, or earth or sand blankets may be used to retain the moisture. At the expiration of the curing period the concrete surface shall be cleaned of the curing medium.

Acceptance of Concrete

The strength of concrete shall be deemed acceptable if the average of 3 consecutive strength test results is equal to or exceed the specified strength and no individual test result falls below the specified strength by more than 15 %. Concrete deemed to be not acceptable using the above criteria may be rejected unless contractor can provide evidence, by means of core tests, that the quality of concrete represented by the failed test result is acceptable in place. Three (3) cores shall be obtained from the affected area and cured and tested in accordance with ASTM C 424. Concrete in the area represented by the cores will be deemed acceptable if the average of cores is equal to or at least 85 % and no sample core is less than 75 % of the specified strength otherwise it shall be rejected.

METHOD OF MEASUREMENT

The quantity of concrete to be paid shall be the quantity shown in the Bid Schedule, unless changes in design are made in which case the quantity shown in the Bid Schedule will be adjusted by the amount of the change for the purpose of payment. No deduction will be made for the volume occupied by the pipe less than 101 mm (4") in diameter nor for reinforcing steel, anchors, or expansion materials.



BASIS OF PAYMENT

The accepted quantities of structural concrete completed in place will be paid for at the contract unit price for cubic meter as indicated on the Bid Schedule.

Payment will be made under:

| Payment Number | Description | Unit of Measurement |
|----------------|--------------------------|---------------------|
| B.5 | Concrete Works (Class A) | Cubic Meter |

B.6 – REINFORCING STEEL BARS

SCOPE

All reinforcing steel bars required for the works as detailed in the Construction Drawings or as directed by the Project Engineer shall be furnished by the DA Western Visayas unless otherwise specified in the Bill of Quantities.

MATERIAL REQUIREMENTS

All reinforcing steel bars shall be Grade 33, deformed type and conforming to the requirements of ASTM Designation A-315 or its latest revision. The nominal dimensions and unit weights of bar designation shall be in accordance with the following table:

| Bar Designation Number | Unit Wt. (kg/m) | Diameter (mm) | Nominal Dimensions Cross-Section Area (mm ²) | Perimeter (mm) |
|------------------------|-----------------|---------------|--|----------------|
| 10 mm | 0.816 | 10 | 78.54 | 31.42 |
| 12 mm | 0.888 | 12 | 113.1 | 37.7 |
| 16 mm | 1.578 | 16 | 201.1 | 50.27 |

Bar number are based on the number of weights of a millimeter included in the nominal diameter of bars. The nominal diameter of a deformed bar is equivalent to the diameter of a plain bar having the same kilogram per meter of the deformed bar.

All reinforcing steel bars will be furnished in commercial standard lengths and the Contractor shall cut and bend reinforcing steel bars to the details and dimensions shown on the Drawings.

METHODS OF CONSTRUCTION

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 fast so that the bars are properly braced around which they are intended to fit. The Length of each size of reinforcing steel bars to be furnished is computed by taking the theoretical length of steel bars shown in the Drawings multiplied by 1.07.

to get the actual length required for the work. Placed correctly in position and are fixed where necessary to prevent displacement before or during the process of tamping and ramming the concrete in place.

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.

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 manner shall be placed and then inspected and approved by the Engineer before the placing of concrete begins. All steel reinforcement shall be accurately placed at 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.



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METHOD OF MEASUREMENT

Measurement for payment for reinforcing steel bars will be made on the weight of reinforcing steel bars actually placed with the concrete structure in accordance with the Drawings and Bar Schedule approved by DA-WV or as directed by the Project Engineer and weights will be computed based on the published manufacturer's weights or in the absence thereof, on the weights specified in the table presented on these items.

Steel bars in laps or splices indicated in the approved reinforcement Drawings as required by DA-WV will be measured for payment. Additional steel bars in laps which are authorized for the convenience of the Contractor and such items as wires, clips, chairs, or other devices for securing the steel bars in place will not be measured for the payment. Where weld splices are specified on the Drawings, weld splices will not be measured for payment but the weight for its equivalent lap splices will be measured for payment instead.

Where Contractor chooses to weld reinforcement bars for his convenience and welding is not specified, no separate payment will not be made for such welds, but instead the weight for the lapped splices shown on the Drawings will be measured for payment.

BASIS OF PAYMENT

Payment for installation of reinforcing steel bars measured as provided above, will be paid for at the contract unit price per kilogram of material installed which price and payment shall constitute full compensation for furnishing all materials, labor, tools, equipment, and all incidentals and subsidiary works necessary for the successful handling and placing the materials.

Payment will be made under:

| Payment Number | Description | Unit of Measurement |
|----------------|------------------------|---------------------|
| B.6 | Reinforcing Steel Bars | Kilograms |

B.7 - FORMWORKS & SCAFFOLDS

SCOPE

The work under this item shall include furnishing and placing appropriate forms and scaffolds in accordance with these Specifications and as directed by the DA-WV Project Engineer.

METHODS OF CONSTRUCTION

All forms and scaffolds shall be of wrought plywood, lumber and bamboo poles and shall be built light 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 maintained at all times. 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 portions 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 uniformly and gradually take the stresses due to its own weight.

METHOD OF MEASUREMENT

The quantity of forms and scaffolds installed shall be measured in square meter. 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 the same.

BASIS OF PAYMENT

The area measured as provided above will be paid for at the contract unit price per square meter, which price and payment shall constitute full compensation for furnishing all labor, tools, equipment, supplies and materials and all incidents or subsidiary works necessary for the successful completion of the work.

Payment will be made under:

| Pay Item Number | Description | Unit of Measurement |
|-----------------|---------------------|---------------------|
| B.7 | Forms and Scaffolds | Cubic Meter |

B.8 - POWER MODULE MOUNTING STRUCTURE

B.2 - STRUCTURAL EXCAVATION

[Refer to Item No. B.2 Structural Excavation on these Specifications]

B.3 - STRUCTURAL BACKFILL

[Refer to Item No. B.3 Structural Backfill on these Specifications]

B.4 - LEVELLING COURSE

[Refer to Item No. B.4 Levelling Course on these Specifications]

B.5 - CONCRETE WORKS (Class A)

[Refer to Item No. D.5 Concrete Works (Class A) on these Specifications]

B.6 - REINFORCING STEEL BAR

[Refer to Item No. B.6 Reinforcing Steel Bar on these Specifications]

B.7 - FORMWORKS

[Refer to Item No. B.7 Formworks on these Specifications]

B.8. - POWER MODULE MOUNTING STRUCTURE

B.8.1- POST

SCOPE

Work under this item shall consist of furnishing, placing, welding, aligning all structural steel required for the mounting structures included in the works.

MATERIALS AND METHOD OF CONSTRUCTION



The Post shall be of 100mm diameter galvanized iron pipe schedule 40 with specified length as shown in the Plans. The post shall be welded to the reinforcement and imbedded in the concrete pedestal at the minimum depth of 0.90 meter. The post should be filled with concrete to make it more rigid.

All post, unless otherwise specified, shall be primed with epoxy primer and before a final coat of coal tar epoxy paint is applied. Welded members or metal members or parts have started to rust before paint is applied. Such areas shall be thoroughly cleaned with steel brush or sand-blasting before the primer is applied.

METHOD OF MEASUREMENT

The accepted quantities of Post completed in place will be paid for at the contract per unit as indicated on the Bid Schedule.

BASIS OF PAYMENT

Payment of works under this item shall be in unit of assembly of works installed as shown in the Bid Proposal of the Contractor which price shall constitute the cost of labor, equipment and all other incidentals incurred by the Contractor in the fabrication, delivery and installation of these items of works.

Payment will be made under:

| Pay Item Number | Description | Unit of Measurement |
|-----------------|-------------|---------------------|
| B.9.1 | Post | Unit |

B.9.2 – RACK AND RACK SUPPORT

SCOPE

Work under this item shall consist of furnishing, placing, welding, aligning of structural rack and rack support required for the mounting structures included in the works.

MATERIALS AND METHOD OF CONSTRUCTION

The Rack and Rack Support shall be of 5mm thk. 50mm x 100mm (h) rolled channel bar and 6mm thk. 50mm x 50mm (h) rolled channel bar respectively. The specified length as shown in the Plans, unless otherwise vary at the actual installation.

Preparation for Welding.

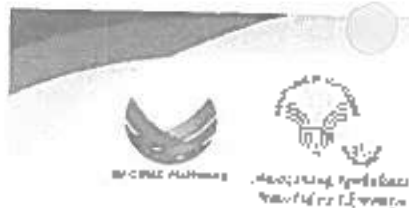
Members to be joined by welding shall be cut accurately to size and where required, shall be rolled or pressed to the proper curvature. The edges of the members shall be sheared, flame cut end machined to suit the required type of welding and to allow thorough penetration. The cut surfaces shall expose sound metal free from laminations, surface defects caused by shearing and flame-cutting operations and other injurious defects. The surfaces of the members to be welded shall be free from grease, rust and other foreign matter.

Welding Procedure.

Unless otherwise authorized, all welding shall be fusion welding by the electric arc welding processes, using a method which excludes the atmosphere from the molten metals. Welding shall conform to the provisions of the ASME Boiler and Pressure Vessel Code, Section VIII, "Rules for Construction of Unfired Pressured Vessels", latest edition applicable to the work, except that thermal stress relief, stamping with the code symbol and reports will not be required.

All metal surfaces, shall be primed with epoxy primer and before a final coat of coal tar epoxy paint is applied. Welded members or metal members or parts have started to rust before paint is applied, such areas shall be thoroughly cleaned with steel brush or sand-blasting before the primer is applied.

METHOD OF MEASUREMENT



The accepted quantities of rack and rack support completed in place will be paid for at the contract in kilograms as indicated on the Bid Schedule.

BASIS OF PAYMENT

Payment of works under this item shall be in kilograms of assembly of works installed as shown in the Bid Proposal of the Contractor which price shall constitute the cost of labor, equipment and all other incidentals incurred by the Contractor in the fabrication, delivery and installation of these items of works.

Payment will be made under:

| Pay Item Number | Description | Unit of Measurement |
|-----------------|-----------------------|---------------------|
| B.8.2 | Rack and Rack Support | Kilograms |

B.8.3 - RAIL AND CLAMPS

SCOPE

Work under this item shall consist of furnishing, placing, fixing, signing of rail required for the mounting structures included in the works.

MATERIALS AND METHOD OF CONSTRUCTION

the Rail should be of Aluminum 6005 T-5 1.4mm thick, 70mm x 95mm or its equivalent. The rail shall be fixed using aluminum fixing clamp and bolted side by side to the rack structure as shown in the plan.

METHOD OF MEASUREMENT

The accepted quantities of rail and clamps completed in place will be paid for at the contract in Lump Sum as indicated on the Bid Schedule.

BASIS OF PAYMENT

Payment of works under this item shall be in Lump Sum of assembly of works installed as shown in the Bid Proposal of the Contractor which price shall constitute the cost of labor, equipment and all other incidentals incurred by the Contractor in the fabrication, delivery and installation of these items of works.

Payment will be made under:

| Pay Item Number | Description | Unit of Measurement |
|-----------------|-----------------|---------------------|
| B.8.3 | Rail and Clamps | Lump Sum |

B.8.4 - PAINTING WORKS

SCOPE

This item shall consist of furnishing all paint materials and other related products, labor, tools, equipment and plant required in undertaking the proper application of painting, varnishing and related works indicated on the Plans and in accordance with this Specification.

MATERIALS AND METHODS

All types of paint material, varnish and other related product shall be subject to random test as to material composition by the Bureau of Research and Standard, DPWH or the National Institute of Science and Technology (Use the following approved and tested brand name: Boyesen, Davies, Dutch Boy, Fuller O'Brien, or any approved equal).



Tinting colors shall be first grade quality, pigment ground in alkyl resin that disperses and mixes easily with paint to produce the color desired. Use the same brand of paint and tinting color to affect good paint body.

The Contractor prior to commencement of the painting and related work shall examine the surfaces to be applied in order not to jeopardize the quality and appearances of the painting, finishing and related works.

Paints when applied by brush shall become non-fluid, thick enough to lay down an adequate film of wet paint. Brush marks shall wear out after application of paint. Paints made for application by roller must be similar to brushing paint. It must be non-stick when thinned to spraying viscosity so that it will break up easily into droplets. Paint is atomized by high pressure pumping rather than broken up by the large volume of air mixed with it. These procedures change the required properties of the paint.

Mixing and Thinning

At the time of application paint shall show no sign of deterioration. Paint shall be thoroughly stirred, strained and kept at a uniform consistency during application. Paints of different manufacture shall not be mixed together. When thinning is necessary, this may be done immediately prior to application in accordance with the manufacturer's directions, but not in excess of 1 part of suitable thinner per gallon of the paint.

Metal

All metal works except cast-iron unless otherwise specified, shall be primed with epoxy primer paint before a final coat of coal tar epoxy paint is applied. Metal members to be immersed in water or metal members or parts have stayed to rust before paint is applied, such areas shall be thoroughly cleaned with steel brush or sand-blasting before the primer is applied.

METHODS OF MEASUREMENT

The accepted quantities of item completed in place will be paid for at the contract per unit as indicated on the Bid Schedule in Lump Sum.

BASIS OF PAYMENT

Payment of works under this item shall be in unit of assembly of works installed as shown in the Bid Proposal of the Contractor which price shall constitute the cost of labor, equipment and all other incidentals incurred by the Contractor in the fabrication, delivery and installation of these items of works.

Payment will be made under:

| Pay Item Number | Description | Unit of Measurement |
|-----------------|----------------|---------------------|
| U-6 | Painting works | Lump Sum |

B.0.3- BREAKERS, WRINGS, PANELS AND CONDUITS, COMBINE BOX AND METAL INVERTER ENCLOSURE

SCOPE

This item shall consist of the furnishing and installation of all junction boxes, pull boxes, utility boxes, octagonal and square boxes, wires and wiring devices consisting of electric wires and cables, wall switches, convenience receptacles, heavy duty receptacles and other materials and devices needed to complete the item work of this project.

MATERIAL REQUIREMENTS

All materials shall be brand new and shall be of the approved type meeting all the requirements of the Philippine Electrical Code and bearing the Philippine Standard Agency (PSA) mark.



Conduits

Conduits shall be standard mild steel, zinc coated or galvanized. Intermediate metal conduit may be used if shown or specified on the approved Plans. PVC conduit if required shall be Schedule 40. Enamel coated steel conduits and conduits with rough inner surfaces are not acceptable.

Conduit Boxes

All conduit boxes shall be Code gauge steel and galvanized. Outlet boxes shall be galvanized pressed steel of standard make. In general, outlet boxes shall be at least 100 mm square or octagonal, 53 mm deep and 16 mm minimum gauge.

Conduit Fillings

All conduit fillings such as locknuts and bushings shall be galvanized of standard make.

Wires and Cables

Wires and cables shall be of the approved type meeting all the requirements of the Philippine Electrical Code and bearing the PSA mark. Unless specified or indicated otherwise, all power and lighting conductors shall be insulated for 600 volts. All wires shall be copper, soft drawn and annealed, smooth and of cylindrical form and shall be centrally located inside the insulation. All wiring devices shall be standard products of reputable electrical manufacturers. Wall switches shall be rated at least 10A, 250 volts and shall be spring operated, flush, rocker type. Duplex convenience receptacles shall be rated at least 15A, 250 volts, flush, parallel slots. Single heavy-duty receptacles shall be rated at least 20A, 250 volts 3-wire, flush, polarized type.

Combiner box

Wiring consolidation and manages direct current (DC) output of solar panels. Includes surge protection. Provide real-time data on individual panel performance for proactive maintenance troubleshooting. Must comply with local electrical codes and industry standards.

Inverter enclosure cabinet box

Outdoor metal enclosure to protect the inverter from rodents, precipitation, water splash and other particles from the surroundings.

METHODS OF CONSTRUCTION

All works throughout shall be executed in the best practice in a workmanlike manner by qualified and experienced electricians under the immediate supervision of a duly licensed Electrical Engineer.

Conduits

Conduits should be cut square with a hacksaw and reamed. Bends shall be made with the required radius. In making bends only conduit bending apparatus will be used. The use of a pipe tee or vice for bending conduits shall not be permitted. Conduits which have been crushed, deformed or flattened shall not be installed. No running thread shall be allowed. Conduit runs crossing construction joints of the building shall be provided with standard expansion fillings of the approved type.

No conduits shall be used in any system smaller than 12 mm diameter electric trade size nor shall have more than four (4) 90-degree bends in anyone run and where necessary, pull boxes shall be provided. All ends of conduits which are left empty in cabinets and conduit boxes shall be plugged with lead or approved pipe caps so as to prevent the entrance of white ants and dirt within the conduit system. Pull wires shall be inserted in the empty ducts before they are closed with lead or pipe caps and shall be left therein for future use.

On exposed work, all pipes and outlet boxes shall be secured by means of galvanized metal clamps which shall be held in place by means of machine screws. When running over concrete surfaces, the screws shall be held in place by means of expansion sleeves for big pipes and rolled lead sheet for small pipes. All pipes shall be run at right angles to and parallel with the surrounding walls. No diagonal run shall be allowed and all bends and offsets shall be avoided as much as possible. Conduits shall be supported at 1,500 mm intervals maximum.

Conduit Boxes & Fillings

Provide conduit boxes for pulling and splicing wires and outlet boxes for installation of wiring devices. As a rule, provide junction boxes or pull boxes in all runs greater than 30 meters in length, for horizontal runs. For other lengths,



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provide boxes as required for splices or pulling. Pull boxes shall be installed in inconspicuous but accessible locations. Support boxes independently of conduits entering by means of bolts, rod hangers or other suitable means.

Conduit boxes shall be installed plumb and securely fastened. They shall be set flush with the surface of the structure in which they are installed where conduits are run concealed. At convenience and wall switch outlet boxes for concealed conduit work shall be deep, rectangular flush type boxes. Four-inch octagonal flush type boxes shall be used for ceiling light outlets and shall be of the deep type where three or more conduits connect to a single box. Floor mounted outlet boxes required shall be waterproof type with flush brass floor plate and brass bell nozzle.

All boxes shall be painted with anti-rust red lead paint after installation. All conduits shall be filled with approved standard galvanized bushing and locknuts where they enter cabinets and conduit boxes. Junction and pull boxes of code gauge steel shall be provided as indicated or as required to facilitate the pulling of wires and cables.

Conductors or wires shall not be drawn in conduits until after the cement plaster is dry and the conduits are thoroughly cleaned and free from dirt and moisture. In drawing wires into conduits, sufficient slack shall be allowed to permit easy connections for fixtures, switches, receptacles and other wiring devices without the use of additional splices.

All conductors of convenience outlets and lighting branch circuit home runs shall be wired with a minimum of 3.5 mm in size. Circuit home runs to panel boards shall not be smaller than 3.5 mm but all home runs to panel board more than 30 meters shall not be smaller than 5.5 mm. No conductor shall be less than 2 mm in size.

No splices or joints shall be permitted in either feeder or branch conductors except within outlet boxes or accessible junction boxes or pull boxes. All joints in branch circuit wiring shall be made mechanically and electrically secured by approved splicing devices and taped with rubber and PVC tapes in a manner which will make their insulation as that of the conductor.

All wall switches and receptacles shall be fitted with standard Bakelite face plate covers. Device plates for flush mounting shall be installed with all four edges in continuous contact with finished wall surfaces without the use of coated wire or similar devices. Plaster fillings will not be permitted. Plates installed in wet locations shall be gasketed. When more than one switch or device is indicated in a single location, gang plate shall be used.

METHOD OF MEASUREMENT

The accepted quantities of breakers, wirings, panels and conduits completed in place will be paid for at the contract in lump sum as indicated on the Bid Schedule.

BASIS OF PAYMENT

All work performed and measured and as provided for in the Bid of Quantities shall be paid for at the Unit Bid or Contract Unit Price in Lump Sum which payment shall constitute full compensation including labor, materials, tools and incidentals necessary to complete this item.

Payment will be made under:

| Pay Item Number | Description | Unit of Measurement |
|-----------------|--|---------------------|
| 3.8 | Breakers, Wirings, Panels and Conduits | Lump Sum |

B.9 – SOLAR POWER MODULE

SCOPE

Work under this item shall consist of furnishing, placing, fixing, aligning of solar modules required for the solar array included in the works.

MATERIALS AND METHOD OF CONSTRUCTION

The Solar Modules shall be aligned, fixed and bolted on the aluminum rail using aluminum mid-clamps and end clamps as shown in plans. The solar modules should have the minimum specifications as follows:





1. 5,500 WP (watt) Brand New Solar Power Modules, Solar Modules @ 550 Wp, or its equivalent (minimum)
2. Manufactured in ISO 9001-Certified Factories
3. Must be CE marked
4. Must have TUV Certification (IEC 61215)
5. Cell type: Mono crystalline
6. The Solar Power Modules shall have a minimum of Five years warranty from the date of acceptance by the DA-Western Visayas

METHOD OF MEASUREMENT

The accepted quantities of solar modules completed in place will be paid for at the contract in per unit as indicated on the Bid Schedule.

BASIS OF PAYMENT

Payment of works under this item shall be in Lump Sum of assembly of works installed as shown in the Bid Proposal of the Contractor which price shall constitute the cost of labor, equipment and all other materials incurred by the Contractor in the fabrication, delivery and installation of these items of works. Payment will be made under:

| Pay Item Number | Description | Unit of Measurement |
|-----------------|---------------|---------------------|
| B.9 | Solar Modules | unit |

B.10 - INVERTER CONTROLLER

SCOPE

Work under this item shall consist of furnishing, placing, fixing, signing of inverter controller and other materials and devices needed to complete the item work of this project.

MATERIALS AND METHOD OF CONSTRUCTION

The Inverter Controller shall be aligned, fixed on the pump power house wall as specified by the Project Engineer. The inverter controller should have the minimum specifications as follows:

1. Unit Brand New - 4 Kw (minimum), Single phase, DC 450-750V, AC 220/380/400V, 60Hz
Inverter with system monitoring (may vary/change if the pump power used change.)
2. Pump is running
3. Input power and alarm protection indication for, overvoltage, over temperature and overload
4. Maximum Power Point Tracking (MPPT)
5. AC/DC compatibility
6. Overcurrent Protection
7. No load protection
8. Operating History Memory
9. Sine wave Filter
10. RS485 / Ethernet Capability
11. The pump controller and the PV array controller shall be insect-proofed and weather-proofed by using double-proof box and sealants.
12. A minimum of IP56 (splash proof) rating shall be used as per IEC 60529:2019 (Degree of protection provided by enclosures (IP Code)) the controller shall be fully automated based on manufacturers' specifications

Motor protection:

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

1. Over and under voltage
2. Overload
3. Over-temperature



WARRANTY

1. Inverters shall have at least a five year warranty
2. Warranty shall cover those specified under PWSBAGS 192-2016 (Conferencing on after-sales service); in addition, pool installation is not covered in the warranty.

METHOD OF MEASUREMENT

The accepted quantities of inverter controller completed in place will be paid for at the contract in per set as indicated on the Bid Schedule.

BASIS OF PAYMENT

Payments of works under this item shall be in set of assembly of works installed as shown in the Bid Proposal of the Contractor which price shall constitute the cost of labor, equipment and all other incidentals incurred by the Contractor in the fabrication, delivery and installation of these items of works.

Payment will be made under:

| Pay Item Number | Description | Unit of Measurement |
|-----------------|-------------------------|---------------------|
| B.9 | Inverter and Controller | Unit |

B.11 – PUMP (SUBMERSIBLE)

B.2 – STRUCTURAL EXCAVATION

[Refer to Item No. B.2 Structural Excavation on these Specifications]

B.3 – STRUCTURAL BACKFILL

[Refer to Item No. B.3 Structural Backfill on these Specifications]

B.11- SOLAR PUMP (SUBMERSIBLE PUMP) – 3 Hp

SCOPE

Work under this item shall consist of installation, placing, fixing, aligning of solar pumps and other materials and devices needed to complete the item work of this project. The whole systems of SPIS shall be tested by the AMTEC prior to turn-over and acceptance by the recipient or O.A.W.V. All expenses incurred during testing shall be the expense of the contractor.

MATERIALS AND METHOD OF CONSTRUCTION

The solar pumps shall be installed, aligned, fixed on the pump/power house as specified in the plans and as directed by the Project Engineer. The solar pumps (surface pumps) should have the minimum specifications as follows:

1. 1 unit Brand new Submersible Pump - 3 Hp, 60 HZ Electric Submersible (groundwater pump (Single Phase))
 (Pump power may change/variant based on the pumping test result, rating and actual total dynamic head).
2. Capacity : 13.85 m³/hr pump Ave. discharge (minimum)
3. Total Dynamic Head : 34.177 m minimum
4. Pump Efficiency : 78%
5. AMTEC Tested

The design system for the 1 unit 3 Hp pump is correspond to the minimum Watt Peak (WP) of Solar Power Module at 170% Factor of Safety. Any design higher than these specifications require additional WP and inverter capacity in correspond to the minimum design of 170% Factor of Safety. The additional requirements to meet the minimum 170% Factor of Safety shall be at the expense of the contractor.



WARRANTY

1. Submersible pump shall have at least a five year warranty.
2. Warranty shall cover those specified under PNS/BAFS 192-2016 (Guidelines on after-sales service). In addition, post installation is not covered in the warranty.

METHOD OF MEASUREMENT

The accepted quantities of solar pumps completed in place will be paid for at the contract in per set as indicated on the Bid Schedule.

BASIS OF PAYMENT

Payment of works under this Item shall be in set of assembly of works installed as shown in the Bid Proposal of the Contractor which price shall constitute the cost of labor, equipment and all other incidentals incurred by the Contractor in the fabrication, delivery and installation of these items of works.

Payment will be made under:

| Pay Item Number | Description | Unit of Measurement |
|-----------------|------------------|---------------------|
| B.11 | Submersible pump | Unit |

B.12 – DISCHARGE PIPES AND FITTINGS

B.12.1 DISCHARGE PIPES

SCOPE

Work under this Item shall consist of installation, placing, laying, aligning of pipes and other materials and devices needed to complete this item work of this project.

MATERIALS AND METHOD OF CONSTRUCTION

The Contractor before any installation work is started shall carefully examine the Plans and shall investigate actual work condition affecting all his work. Where actual condition necessitates a rearrangement of the approved pipe layout, the Contractor shall prepare Plan(s) of the proposed pipe layout for approval by the Project Engineer. The following are the pipe specifications to be used.

Discharge Pipe shall be of HDPE pipe SDR 11 2" diameter.

METHOD OF MEASUREMENT

The work done under this Item shall be quantified per length as provided in the Bill of Quantities, listed and accepted to the satisfaction of the Engineer.

BASIS OF PAYMENT

The quantified items, installed in place shall be the basis for payment based from the unit bid price for which prices and payments shall constitute full compensation including labor, materials and incidentals necessary to complete this item.

Payment will be made under:

| Pay Item Number | Description | Unit of Measurement |
|-----------------|-------------------|---------------------|
| B.12 | Pipes (discharge) | Linear Meter |

B.2.2 – FITTINGS, FLANGES AND VALVES

SCOPE

Work under this item shall consist of installation, placing, fixing, aligning of pipes and other materials and devices needed to complete the item work of this project.

MATERIALS AND METHOD OF CONSTRUCTION

All fittings, flanges and valves shall be connected to the piping system unless otherwise indicated on the Plans. All connections shall be watertight seal using applicable sealant that includes rubber or tynlon tape. The flanges shall have the size of 2" or may vary on the actual pipe size install or as directed by the Project Engineer.
All gate valves shall be of 2" MRS Gate Valve and elbows – Cast iron – Flanged Type.

METHOD OF MEASUREMENT

The work done under this item shall be quantified in lump sum as provided in the Bill of Materials, tested and accepted to the satisfaction of the Engineer.

BASIS OF PAYMENT

The quantified items installed in place shall be the basis for payment based from the unit bid price for which prices and payments shall constitute full compensation including labor, materials and incidentals necessary to complete this item.

Payment will be made under:

| Pay Item Number | Description | Unit of Measurement |
|-----------------|------------------------------|---------------------|
| B.2.2 | Fittings, Flanges and Valves | Lump Sum |

C. CONSTRUCTION OF WELL WYCASING (10 m.)

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

Coreing 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 10 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 10.00m (10.00 m.) 4" dia.
- f. Reaming from 0 m. to 10.00m (10.00 m.) 6" dia.
- g. Installation of Casing and Screen with Contractor
- h. Installation of Gravel Pack Materials
- i. Development by Bailing
- j. Treatment with Sodium Hexametaphosphate
- k. Development by High Velocity Jetting
- l. Development by Surging including Bailing Out of Sediments
- m. Development by Air-Lift Method Using Air Compressor
- n. Well Development by Pumping
- o. Stop-drawdown pumping test with five (5) steps at one hour duration each
- p. Discharge rate increasing in equal fraction of the expected maximum yield
- q. Continuous Constant Discharge Pumping Test
- r. Grouting
- s. Cemented pit

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 pumping test.
- * Must be AMTEC Tested (System Test).

METHODS OF MEASUREMENT

The accepted quantities of item completed in place will be paid for at the contract per unit as indicated on the Bidding Schedule in Lump Sum.

BASIS OF PAYMENT

Payment of works under this item shall be in unit of assembly of works installed as shown in the Bid Proposal of the Contractor which price shall constitute the cost of labor, equipment and all other incidentals incurred by the Contractor in the fabrication, delivery and installation of these items of works.

Payment will made under:

| Pay Item Number | Description | Unit of Measurement |
|-----------------|-----------------------------------|---------------------|
| C | Construction of Deepwell retaking | Lump Sum |



D – TANK

B.2 – STRUCTURAL EXCAVATION

[Refer to Item No. B.2 Structural Excavation on these Specifications]

B.3 – STRUCTURAL BACKFILL

[Refer to Item No. B.3 Structural Backfill on these Specifications]

B.4 – LEVELING COURSE

[Refer to Item No. B.4 Leveling Course on these Specifications]

B.5 – CONCRETE WORKS (Class A)

[Refer to Item No. B.5 Concrete Works (Class A) on these Specifications]

B.6 – REINFORCING STEEL BAR

[Refer to Item No. B.6 Reinforcing Steel Bar on these Specifications]

B.7 – FORMWORKS

[Refer to Item No. B.7 Formworks on these Specifications]

B.12.1 DISCHARGE PIPES

[Refer to Item No. B.12.1 Discharge pipes and fittings on these Specifications]

B.12.2 – FITTINGS, FLANGES AND VALVES

[Refer to Item No. B.12.2 Fittings, Flanges and Valves on these Specifications]

D 6.0 – PAINTING WORKS

SCOPE

This Item shall consist of furnishing all paint materials and other related products, labor, tools, equipment and plant required in undertaking the proper application of painting, varnishing and related works indicated on the Plans and in accordance with this Specification.

MATERIALS AND METHODS

All types of paint material, varnish and other related product shall be subject to random test as to material composition by the Bureau of Research and Standard, CPWH or the National Institute of Science and Technology. (Use the following approved and tested brand name: Bayseal, Davies, Dutch Boy, Fuler D'Brien, or any approved equal).

Tinting colors shall be first grade quality, pigment ground in alkyl resin that disperses and mixes easily with paint. In produce the color desired. Use the same brand of paint and tinting color to effect good paint body.

The Contractor prior to commencement of the painting and related work shall examine the surfaces to be applied in order not to jeopardize the quality and appearances of the painting varnishing and related works.

Paints when applied by brush shall become non-fluid, thick enough to lay down an adequate film of wet paint. Brush marks shall flow out after application of paint. Paints made for application by roller must be similar to brushing paint. It must be nonsick when thinned to spraying viscosity so that it will break up easily into droplets. Paint is atomized by high pressure pumping rather than broken up by the large volume of air mixed with it. These procedures change the required properties of the paint.



Mixing and Thinning

At the time of application paint shall show no sign of deterioration. Paint shall be thoroughly stirred, strained and kept at a uniform consistency during application. Paints of different manufacture shall not be mixed together. When thinning is necessary, this may be done immediately prior to application in accordance with the manufacturer's directions, but not in excess of 1 pint of suitable thinner per gallon of the paint.

Metal

All metal works except cast-iron unless otherwise specified, shall be primed with epoxy primer paint before a final coat of coal tar epoxy paint is applied. Metal members to be immersed in water or metal members or parts have slanted to rust before paint is applied, such areas shall be thoroughly cleaned with steel brush or sand-blasting before the primer is applied.

METHODS OF MEASUREMENT

The accepted quantities of item completed in place will be paid for at the contract per unit as indicated on the Bid Schedule in Lump Sum.

BASIS OF PAYMENT

Payment of works under this item shall be in unit of assembly of works installed as shown in the Bid Proposal of the Contractor which price shall constitute the cost of labor, equipment and all other incidentals incurred by the Contractor in the fabrication, delivery and installation of these items of works.

Payment will be made under:

| Pay Item Number | Description | Unit of Measurement |
|-----------------|----------------|---------------------|
| 0.6 | Painting works | Lump Sum |

D.7. TANK

SCOPE

Work under this item shall consist of installation, placing, fixing, aligning of pipes and other materials and devices needed to complete the item work of this project.

MATERIALS AND METHOD OF CONSTRUCTION

The Contractor before any installation work is started shall carefully examine the Plans and shall investigate actual work condition affecting all his work. Where actual condition necessitates a rearrangement of the approved pipe layout, the Contractor shall prepare Plan(s) of the proposed pipe layout for approval by the Project Engineer. The following are the pipes specifications to be used:

Tank shall be of Polyethylene Water Storage Tank @ 2000 liters capacity

Gate valve shall be NRS 1 1/4" Gate Valve – Cast iron

Pipes and fittings and elbows shall be Galvanized Iron made

METHOD OF MEASUREMENT

The work done under this item shall be quantified per length as provided in the Bill of Quantities, verified and accepted to the satisfaction of the Engineer.

BASIS OF PAYMENT

The quantified items, installed in place shall be the basis for payment based from the unit bid price for which prices and payments shall constitute full compensation including labor, materials and incidentals necessary to complete this item.

Payment will be made under:

| Pay Item Number | Description | Unit of Measurement |
|-----------------|-------------|---------------------|
| D 7 | Tank | Lump Sum |



D.8- MAIN PIPES, DISTRIBUTION PIPES AND FITTINGS

SCOPE

Work under this item shall consist of installation, placing, fixing, aligning of pipes and other materials and devices needed to complete the item work of this project.

MATERIALS AND METHOD OF CONSTRUCTION

The Contractor before any installation work is started shall carefully examine the Plans and shall investigate actual work condition affecting all his work. Where actual condition necessitates a rearrangement of the approved pipe layout, the Contractor shall prepare Plan(s) of the proposed pipe layout for approval by the Project Engineer. The following are the pipes specifications to be used:

Main Pipe shall be of HDPE Pipe SDR11 1 1/2" diameter.

Distribution pipes shall be of SDR 11 1 1/2" diameter with valves and fittings that is supported by concrete structure.

METHOD OF MEASUREMENT

The work done under this item shall be quantified per length as provided in the Bill of Quantities, tested and accepted to the satisfaction of the Engineer.

BASIS OF PAYMENT

The quantified items, installed in place shall be the basis for payment based from the unit bid price for which prices and payments shall constitute full compensation including labor, materials and incidentals necessary to complete this item.

Payment will be made under:

| Pay Item Number | Description | Unit of Measurement |
|-----------------|-------------|---------------------|
| D.8 | Tank | Lump Sum |

E. SOLAR LIGHT

SCOPE

Work under this item shall consist of installation, placing, fixing, aligning of pipes and other materials and devices needed to complete the item work of this project.

MATERIALS AND METHOD OF CONSTRUCTION

The Contractor before any installation work is started shall carefully examine the Plans and shall investigate actual work condition affecting all his work. Where actual condition necessitates a rearrangement of the approved pipe layout, the Contractor shall prepare Plan(s) of the proposed pipe layout for approval by the Project Engineer. The following are the pipes specifications to be used:

Pipe support shall be of G.I. pipe 2" diameter

Solar light shall be 1000 Wp (minimum)

METHOD OF MEASUREMENT

The work done under this item shall be quantified per length as provided in the Bill of Quantities, tested and accepted to the satisfaction of the Engineer.

BASIS OF PAYMENT

The quantified items, installed in place shall be the basis for payment based from the unit bid price for which prices and payments shall constitute full compensation including labor, materials and incidentals necessary to complete this item.



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Payment will be made under:

Pay Item Number
 E

Description
 Solar Light

Unit of Measurement
 Lump Sum

REFERENCES:

STANDARD SPECIFICATIONS FOR PUBLIC WORKS STRUCTURES VOLUME III