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Republic of the Philippines
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
CENTRAL OFFICE
Manila

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SUBJECT: Standard Plan for Rural Water Supply for Level II and III

In line with the mandate of the Department on planning, designing, constructing and maintaining water resources development system and other public works in accordance with national development objectives, the new standard plan for rural water supply for level II and III is now available for reference.

The issuance of the said standard plan aims to ensure the safety, cost effectiveness and development of high-quality detailed design for rural water supply for level II and III incorporating the industry's best practice in design adaptable to local requirements. It shall also serve as a guide for District Engineering Offices, Regional Offices, Project Management Office Clusters and Engineering Consultants in the preparation of rural water supply for level II and III plans and reports.

The aforementioned plan (Rural Water Supply for Level II and III - 10 sheets) can be downloaded from the DPWH Intranet (http:dpwhnet) under Bureau of Design - Standard Design.

MANUEL M. BONOAN
Secretary

5.1 EBS/LLL/DLB/ECM

Department of Public Works and Highways
Office of the Secretary
WIN3R01585

GUIDELINES FOR THE DESIGN OF RURAL WATER SUPPLY FOR LEVEL II AND III

A. PERMIT APPLICATION

The permit application and registration of a water well shall conform to the requirements of the Water Code of the Philippines Amended Implementing Rules and Regulations by the National Water Resources Board (NWRB), and applicable local codes and ordinances of the local government units (LGU).

B. PRELIMINARY DESIGN REQUIREMENTS

B.1 Service Level

There are three (3) water service level classification in the Philippines depending on the method by which the water is made available to the consumers:

- Level I (Point Source) – This level provides a protected well or a developed spring with an outlet, but without a distribution system. The users go to the source to fetch water.

  This is generally adaptable for rural areas where affordability is low and the houses in the intended service area are not crowded. A level I facility normally serves an average of 15 households within a radius of 250 meters.

Source: © 2021 SciDev.Net

- Level II (Communal Faucet System or Stand Posts) - is adopted for the standard design. This type of system is composed of a source, a reservoir, a piped distribution network, and communal faucets. One faucet serves an average of five (5) households within a 25 meter radius. It is generally suited for rural and urban areas where houses are clustered in sufficient density to justify a simple piped system.

Source: USAID Safe Water

- Level III (Waterworks System or Individual House Connections) – this system includes a source, a reservoir, a piped distribution network, and individual household taps.

Source: Asian Development Bank

It is generally suited for densely populated urban areas where the population can afford individual connections.

B.2 Design Period

For small water utilities, a design period of 5-10 years is recommended.

B.3 Design Population

The design population is the targeted number of people that the project will serve.

There are two (2) ways of projecting the design population.

- **i.** Estimate the population that can be served by the sources. In this case, the supply becomes the limiting factor in the service level, unless a good abundant and proximate source is available in the locality.
- **ii.** Project the community of barangay population, and determine the potential service area and the served population

$$P_F = P_P(1 + GR)^n$$

Where:

PF = Projected Future Population
PP = Present Population
GR = Annual Growth Rate
N = Number of Years between the Two (2) Census

B.4 Water Consumptions

The water consumption adopted for this guidelines is of Domestic Use. For a Level II Public Faucet, water consumption ranges from 50 – 60 liters per capita per day (lpcd).

For a Level III House Connections, water consumption ranges from 80-100 lpcd. If there are public schools and health centers in the area, they will be supplied from the start of systems operation and be classified as an institutional connection with water demand of 1.0m^3/day. For commercial establishments a 0.8 m^3/day water demand is used.

B.5 Non-Revenue Water (NRW)

Non-revenue water is the amount of water that is produced but not billed as a result of leaks, pilferages, free water, utility usages, etc. The water demand projection should assume that the NRW of the new system will be fifteen percent (15%) of the estimated consumptions.

B.6 Water Demand

The water demand is a summation of all the consumptions given in the preceding sections and will determine the capacity needed from the source/s.

Demand Variations and Demand Factors

Demand Parameter	Demand Factor
Minimum Day Demand	0.3 of Average Day Demand
Average Day Demand	1.0
Maximum Day Demand	1.3 of Average Day Demand
Peak Hour Demand	2.5 of Average Day Demand (>1000 connections) 3.0 of Average Day Demand (<1000 connections)

i. Minimum Day Demand – the pipe network system is analyzed under a minimum demand condition to check on possible occurrence of excessive static pressures that the system might not be able to withstand. No point in the transmission and distribution system should be subjected to pressure more than 70m.

ii. Average Day Demand – Annual estimates and projections on production, revenues, non-revenue water, power costs, and other O&M costs are based on the average day demand.

iii. Maximum Day Demand – the total capacity of all existing and future water sources should be capable of supplying at least the projected maximum day demand at any year during the design period. The design of treatment plants, pump capacity and pipeline considers the maximum day demand supply rate as an option in the optimization analysis.

iv. Peak Hour Demand – the pipeline network should be designed to operate with no point in the system having pressure below 3 meters during peak hour conditions. If there is no reservoir, the power ratings of pumping stations should be sufficient for the operation of the facilities during peak hour demands.

C. CLASSIFICATION OF WELLS BASED ON AQUIFER TAPPED

C.1 Shallow Wells

Generally, a well is considered shallow if it is less than 20 meters deep. Shallow wells tap the upper water-bearing layer underground. This permeable layer, however, usually has limited safe yield due to its great dependence on seasonal rainfalls.

C.2. Deep Wells

Deep wells, which are over 20 meters deep, tap the deeper unconfined aquifer. This aquifer is not confined by an overlying impermeable layer and is characterized by the presence of a water table.

C.3 Artesian Wells

Artesian wells are much like deep wells except that the water extracted is from a confined aquifer. The confining impermeable layers are above and below the aquifer.

D. TYPES OF WELLS BASED ON DESIGN AND CONSTRUCTION METHODS

D.1 Dug Wells

Dug wells are holes or pits dug manually into the ground to tap the water table. The dug well may be up to 15 meters deep, with diameter usually ranging from 1 meter to 1.5 meters.

D.2 Driven Wells

Driven wells are like dug wells, in the sense that they tap the shallow portion of the unconfined aquifers. They are easy and relatively inexpensive to construct in locations with unconsolidated formations that are relatively free of cobbles or boulders. The wells are constructed by driving to the ground an assembly of G.I. pipe and a pointed metal tube called a "well point". The pointed end of the well point, which is the penetrating end, has screens or holes to allow the passage of water. The upper end of the G.I. pipe is hit at the top with a heavy weight, usually suspended from a block attached to a tripod. As the driving progresses, the well point sinks further into the ground and lengths of G.I.

pipes are added at the top. Wooden blocks or steel caps should be placed at the top to protect it from being damaged by the impact of the driving weight.

D.3 Bored Wells

Bored wells are constructed with hand or power augers, usually into soft cohesive or non-caving formations that contain enough clay to support boreholes. The depth of the bored wells could be up to 15 meters.

D.4 Drilled Wells

Wells drilled by professional drillers with the appropriate experience and equipment can extract groundwater from a much deeper level than the other types of wells.

Well construction usually comprises four or five distinct operations: drilling, installing the casing and screen, placing the filter pack, grouting to provide sanitary protection, and developing the well to insure sand-free operation at maximum yield.

There are two (2) common types of drilling methods, namely: cable tool and rotary drilling method.

Well drilling must be contracted to an experienced and competent well drilling company duly accredited by the NWRB. The driller's role goes beyond the physical drilling of an appropriate size borehole; it includes, importantly, the performance of standard practices and tests.

E. TEST OF WELL SUITABILITY

E.1 Pumping ("Safe Yield") Test

The well's safe yield test can be roughly determined by operating a test pump with capacity at least equal to the system peak demand and operating it for 24-48 hours. After 24 hours of pumping, the drawdown should be measured at several time intervals to determine if it has stabilized. The pumping rate at a stabilized pumping water level is the so called maximum pumping level and the safe yield is about 60%-80% of the figure. In water where incrustation is anticipated, the safety factor should be set low. In areas where water quality is good, with a sand and gravel aquifer and low seasonal water table fluctuation, a higher safety factor can be considered.

E.2 Water Quality Test

This is done to determine if the physical and chemical characteristics of the groundwater meet the required parameters for the intended use. For drinking water purposes, the characteristics of groundwater shall conform to the standards set by the PNSDW.

E.3 Estimated Well Yield

The production of the well should be at least equivalent to the projected maximum day demand of the water system by the design year. The hydro-geological study mentioned would indicate the estimated yield of a well.

F. WELL CONFIGURATION

F.1 Well Depth

The depth of the well depends on the water-bearing formation and the budgeted cost. The well must be designed to penetrate the aquifer as deep as possible within the budgeted cost.

During the test hole drilling, the drilling contractor will complete a formation log. Soil and rock samples are taken at various depths and the type of geologic material is recorded. This allows the driller to identify aquifers with the best potential for water supply. Some drillers also run an electric or gamma-ray log in the test hole to further define the geology.

Generally, a well is completed to the bottom of the aquifer. This allows more of the aquifer to be utilized and ensures the highest possible production from the well.

F.2 Casing Diameter

The well casing could be either a straight casing or telescopic casing. The diameter of a straight casing is the same from top to bottom of the well. Telescopic casing is a combination of a larger diameter casing/screen portion and a smaller diameter lower casing/screen portion.

The casing serves as a housing for the pumping equipment and as a conduit for the flow of groundwater from the screen opening to the suction of the pump. The housing portion of the casing should be located such that the pump will always be submerged in water. It should be set a few meters below the lowest drawdown level, considering seasonal fluctuations. The casing should be large enough to accommodate the pumping unit for the desired supply rate.

The minimum casing size must be equal to 50mm larger than the pump bowl but should not be less than 100mm.

F.3 Well Screen

The well screen is the intake portion of the well. The yield of a well depends greatly on the design and location of the screen. Wells can be screened continuously along the bore or at specific depth intervals.

Stainless steel screens are most widely used because they are strong and relatively able to withstand corrosive water.

A screen slot size that allows 60 percent of the aquifer material to pass through during the well development phase of drilling should be chosen. The remaining 40 percent, comprising the coarsest materials, will form a natural filter pack around the perforations or screens.

F.4 Wellhead Protection

The construction of the final well seal is intended to provide protection from leakage and to keep runoff from entering the wellhead. It is also important to install backflow prevention devices.

G. WATER TREATMENT

Water treatment ideally should be avoided. It is best to select sources with good water quality at the outset to reduce facility and operation cost.

The type of water treatment employed shall be based on the requirement of water use. Depending on the treatment method, the concentration of the undesirable particulates or contaminants may be reduced or even eliminated. These contaminants include suspended particles, dissolved elements and minerals, bacteria, and algae that degrade the raw water quality.

H. PUMP AND STORAGE SYSTEM

H.1 Pump Sizing

Pump types can vary depending on the required configuration of the system. Pump types used for water supply are either centrifugal pumps or positive displacement pumps. The pump capacity shall be selected based on the number of intended operation-hours for maximum day demand and reservoir size.

Pump selection can be based on the depth of the pumping water level:

a. If pumping water level (PWL) is less than 6 meters, use a centrifugal pump (maximum suction lift = 6 meters)
b. If the pumping water level is from 6-20 meters , use jet or submersible pumps
c. If the pumping water level is greater than 20 meters, use a submersible or a vertical line shaft turbine pump.

The pump stop is set at the elevation of the designated well yield where static water level is set.

Pump power is determined by calculating the total dynamic head of the pump considering friction losses in the pipes and fittings from the source to the maximum water level at the overhead tank.

Pumps are best selected using a pump curve where the duty point is plotted against. The pump characteristics must be examined for both shut-off and run-out point of the selected curve.

The standard plan shows a 5.0hp, 51m, 1Ø, 60Hz multi-stage pump with the given configuration. The well yield is set at 15.0m but may vary depending on site. The actual pump capacity shall be based on the actual data collected at site and on the configuration of the piping and storage system. Sizing and design of the forced main shall be undertaken by a qualified Mechanical Engineer.

H.2 Pipeline

The pipe material must be selected to withstand the highest possible pressure that can occur in the pipeline. Galvanized Iron (GI) Pipes or Plastic Pipes i.e., Polyvinyl Chloride (PVC) or Polyethylene (PE) can be used depending on the requirement of the system.

For the transmission line design, a maximum computed HGL based on a minimum supply rate equivalent to 0.3 times the average day demand should be examined. At any point in the transmission line, this maximum HGL should not be over the allowable maximum pressure of the line (70 m head).

To limit the maximum pressure, break pressure tanks or chambers could be installed along the main.

The distribution pipelines must be designed to handle the peak hour demand of the system:

1. Minimum pressure at the remotest end of the system = 3.0 m
2. Maximum velocity of flow in pipes
    a. Transmission Line = 3.0 m/s
    b. Distribution Line = 1.5 m/s
3. Minimum velocity of flow in pipes = 0.4 m/s
4. Demand Factor: varies from 0.3 (minimum demand) to 3.0 (peak demand)
5. Allowable head loss: minimum = 0.50m/1000m, maximum = 10m/1000m
6. Allowable pressure: minimum = 3m, maximum = 70m

H.2 Reservoirs

There are two (2) main types of reservoir used for water supply, elevated reservoirs and ground level reservoirs.

The standard plan utilizes an elevated reservoir to minimize the use of pump power and conserve energy produced through solar energy.

As a rule of thumb, the storage tank volume should be at least equal to one-fourth (25%) of average day demand of the community.

The structural design of reservoirs must meet the standards set by the National Structural Code of the Philippines. The reservoirs must be strong enough to withstand all loads, such as hydrostatic pressure, earth pressure, wind loads, seismic loads and other dead or live loads.

H.2.1 Inlet Line

The size of the inlet line must be determined by the supply and demand requirements. The inlet line on all reservoirs must have a shut-off valve located adjacent to the reservoir.

H.2.2 Outlet or Discharge Line

Like the inlet line, the size of the outlet line is determined by the supply and demand requirements. The upstream-end of the outlet pipe is usually installed at least 5 cm, above the floor of the reservoir to create a dead volume of water.

H.2.3. Drain Line

This is provided for draining and cleaning the reservoir. Draining could be done through the inlet-outlet line by shutting off the valve controlling the flow in the main line and opening the drain valve.

H.2.4 Ventilation Facilities

These are provided in reservoirs to allow the air to escape fast enough to prevent pressure from building up inside the reservoir during filling, and to prevent a vacuum from forming when water is being drawn out. The ventilation facilities should be designed to keep rain and surface water from entering, and they should be screened to keep out insects. Overflow and drainage pipes should be designed with a valve chamber to prevent rodents from entering the reservoir.

H.2.5 Overflow Line

Reservoirs should be provided with an overflow line large enough to allow the maximum anticipated overflow (pump or spring capacity) and should be properly screened and covered like an air vent.

H.2.6 Manhole and Covers

These are installed in reservoirs to serve as entrance during repair, cleaning and maintenance. To prevent the entry of surface water which may contain pollutants, manholes should be installed slightly raised above the roof level and must be equipped with an overlaying cover. The cover is also necessary to prevent the sun's rays from promoting algae growth.

H.2.7 Water Level Indicators

Depth gauges using a flow and wires are usually used.

H.2.8 Control Valves

The flow into the reservoir may be stopped manually or automatically.

I. SOLAR POWER SYSTEM

I.1 Solar Panels

The solar cell is the basic unit of a PV system. Solar panels shall be of mono-crystalline or poly-crystalline type with efficiency range of 14-19% and 12-15% respectively. Voltage rating of each panel varies from 12V, 24V or 48V.

The standard plan utilizes a 450 watts for a 1mx2m mono-crystalline solar panel.

The type of solar power produced by a photovoltaic solar cell is a direct current (DC) power. Most commercially available photovoltaic solar cells have solar power ratings which indicate the maximum deliverable solar power that the cell can provide in watts and is equal to the product of the cell voltage multiplied by the maximum cell current.

The number of solar panel needed for a given installation can be determined by dividing the estimated hourly energy requirement by the peak sunlight hours for the specific area and dividing it by the panel's wattage considering efficiencies of the electrical system.

The designer shall also take note of the string size or how many group of panels can be wired to account for the specific input voltage range of the selected inverter. The minimum string size shall correspond to the minimum range of the inverter specification. The string shall not exceed the specified maximum DC input voltage to protect the inverter from overloading. For the given standard plan, an 8 strings of 3 is adopted.

I.2 Inverters

Inverters are also known as power conditioning units used to convert direct current (DC) electricity from batteries and solar panels into alternating current (AC) electricity. The specifications of the inverter shall be based on the input battery voltage, maximum load, the maximum surge required, variations in voltage and any optional features needed.

The size of the inverter shall account for the power conversion efficiency to about 88-92% from DC to AC.

I.3 Charger Controller

The primary function of a charge controller is to prevent overcharging of the batteries or limiting excessive discharge.

There are four types of Charge Controllers namely: Shunt, Series, Pulse Width Modulation (PWM), and Maximum Power Point Tracking (MPPT) Controller:

a. Shunt controllers has a switch that is open when the battery is charging and closes when the battery is fully charged
b. Series controllers disconnect the PV array when the battery voltage reaches the high voltage level.
c. Pulse Width Modulation (PWM) Controllers uses a transistor instead of a relay to open the array, which maintains a constant voltage, and act like a rapid on/off controller.
d. Maximum Power Point Tracking (MPPT) allows the array voltage to vary from the battery voltage, by varying the array input, the charge controller can find the point at which the solar array produces the maximum power.

I.4 Batteries

Batteries are used both as storage and back-up energy for the solar powered system. These are classified into two (2): Lead Acid and Lithium Ion Batteries. These varies in the depth of discharge with 50% and 80% respectively. The number of batteries in the system shall be determined based on the utilization limit of the battery and the number of autonomy days designed for the system considering efficiencies.

DESIGN CONSIDERATIONS FOR RURAL WATER SUPPLY FOR LEVEL II AND III STANDARD PLAN

Design Data:

Sample Size Population: 1000 individuals
Design Period: 5-10 years
Service Level: Level II (Communal faucet System or Stand Posts)
Communal Faucet Service = 4-6 households (5 households average)
Per Capita Water Consumption: 50-60 liters per capita/ day (55 lpcd average)
Water Demand:

- Average Day Demand = 55,000 liters/day
- Minimum Day Demand = 0.3(ADD) = 16,500 liters/day
- Maximum Day Demand = 1.3(ADD) = 71,500 liters/day
- Peak Hour Demand = 3.0(ADD) = 165,000 liters/day (upper limit)
- Non-Revenue Water = 0.15(ADD) = 8,250 liters/day

Shallow Well Depth <20m (typical dug well depth = 15 m)
Typical Tank Elevation above ground = 10.0 meters

Other Assumptions/Considerations

Pumping "Safe Yield" Test Elevation = 15.0 m below NGL
Minimum Pumping Level (after drawdown) = Pumping "Safe Yield" Test Elevation
Pump Type: Submersible Pump (6-20 m depth)

Reservoir Sizing

An elevated water tank is considered for this standard plan. The size of the reservoir shall account for about 25% of the Maximum Day Demand.

Reservoir Capacity = 0.25(MDD) = 17,875 liters/day

Typical commercial tank size is 20,000 liters

Pump Sizing

Pump capacity shall deliver the required water demand for the day considering the results of the pumping test for the subject well as to limits in pumping duration and rate. Typically, aquifer properties are estimated from a constant rate pumping test by fitting mathematical models to drawdown data through a procedure known as curve matching. Diagnostic tools such as derivative analysis are useful for identifying flow regimes and aquifer boundaries from a pumping test prior to performing curve matching.

This standard plan considers that the pump shall operate for 4 hours daily with a pump capacity of 5.0 liters/second or 80 gal/min.

Reservoir Capacity: 20,000 Liters
Tank Filling Time: 1.11 hours
Total Dynamic Head: 50.836 m or 51.0 m

- Actual Head – <u>30.0 m</u>
  - 15.0 m (NGL-Min. Pumping Level)
  - 10.0 m (Tank Frame Elevation)
  - 5.0 m (Tank Height)
- Friction Losses – <u>20.836 m</u>
  - Pipes and Fittings
  - Velocity Head
  - 10% Allowance

Pump Power: 3.625 kW or 4.860 HP
Commercial Pump Size: 5.0 HP
Pump Specifications:

- Design Head: 51.0 m
- Maximum Head: 82.0 m
- Pump Speed: 3450.0 rpm
- Discharge Port Size: 2.0 in. or 50mm
- Stages: 5
- Pump Material: SS 304
- Electrical Data: 230V, 1Ø, 60Hz
- Recommended Well Size: 4.0 in. or 100mm

The pump specifications may vary depending on the designation of the minimum pumping level after drawdown based on the pumping "safe yield" test. This also corresponds to the configuration of the system, the pipes and fittings used, and the efficiencies considered by the designer in sizing.

The initial size of the system shall be coordinated with the manufacturer under the close supervision of a Registered Mechanical Engineer.

Initial Solar System Sizing

The solar panels selected for this standard plan is of 450 Watt, 48V, Monocrystalline Type.

Solar Panel Wattage: 450 Watts
Electrical Load: 5 HP or 3.73 kW
Daily Operations: 4 Hours
kW-hr Requirement for the Day: 3.73 kW (4Hrs) = 14.92 kW-hr
Total Energy Requirement: 22.62 kW-hr
80% Inverter Efficiency
85% Battery Efficiency
97% Wire Losses
Maximum Peak Sunlight Hours per Day (Philippines): 3 Hours
Total kW Load Requirement: 22.62 kW-hr / 3hrs = 7.54 kW say 8kW
Required Number of Solar Panels: 24 Panels

The Electrical Engineer shall also account for the string connections of the panels taking into consideration the limit in the charge controller's rating.

For the given standard plan, the selected charge controller is rated at 225A, 150V and the inverter is rated at 20kW to accommodate at least three (3) times the starting current.

8 strings of 3, 450W Solar Monocrystalline Panels is designed to meet this requirement.

Solar Panel: 150V (constant voltage per string)
48V – string 1
48V – string 2
48V – string 3

The initial size of the system shall be coordinated with the manufacturer under the close supervision of a Registered Electrical Engineer.

Civil Works

The design criteria and considerations used are based on the National Structural Code of the Philippines (NSCP) 2015.

Structural Loading

Occupancy Category	=	Standard Occupancy Structures
Seismic Zone Factor	=	Zone IV
Basic Wind Velocity	=	250 kph

Material Strength

Concrete Strength at 28 days	=	21 MPa
Reinforcement Yield Strength		
Diameter 12 and below	=	230 MPa (Grade 33)
Diameter 16 and above	=	276 MPa (Grade 40)

Allowable soil bearing capacity to be used must be based actual site geotechnical investigation.

Actual sizes of structural members must be supported by a structural analysis.

Elevated Water Tank (EWT)
The tank will sit on a 4-legged support system. The steel columns are connected to the tank through full weld connection and to concrete pedestals through anchor bolts and base plate. Pedestals are then supported by isolated footings provided with tie beam both horizontally and diagonally.

Horizontal bracing and diagonal tie rods must be provided for the structure's stability for external lateral loads.

On-ground Solar Panel Module Support
Solar Panels connected on module rail will be supported by truss system composed of U-Channels. The truss is then connected to concrete pedestals through u-bolts and baseplate with isolated footings.

On-roof Solar Panel Module Support
Solar Panels connected on module rail will be attached to the roofing/c-purlin by hanger bolts. The angle of tilt for solar panels will reflect the angle of the roofing system.

Power House
Minimum dimensions were set at 4 meter x 5 meter.

REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
BUREAU OF DESIGN
MANILA

STANDARD PLAN FOR RURAL WATER SUPPLY FOR LEVEL II & III

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REPUBLIC OF THE PHILIPPINES DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS BUREAU OF DESIGN MANILA	SHEET TITLE: INDEX OF DRAWING	SHEET CONTENTS: INDEX OF DRAWING	PREPARED: GIAN PAULO G. RABACAL, ENGINEER II MARK JOSEPH L. RIVERA, ENGINEER III DRAFTED: JOSELITO P. DELA ROSA, JR, ENGINEERING ASSISTANT REVIEWED: CRISSA RICA E. BARIL, ENGINEER IV	SUBMITTED: LEONARDO L. LINGAN CHIEF, WATER PROJECTS DIVISION BUREAU OF DESIGN DATE:	RECOMMENDING APPROVAL: EDWIN C. MATANGUIHAN OIC-DIRECTOR BUREAU OF DESIGN DATE: FEB 06 2023	(SEE COVER SHEET) ERIC A. AYAPANA ASSISTANT SECRETARY FOR INFORMATION MANAGEMENT AND TECHNICAL SERVICES DATE:	APPROVED: (SEE COVER SHEET) MAXIMO L. CARVAJAL UNDERSECRETARY FOR INFORMATION MANAGEMENT AND TECHNICAL SERVICES DATE:	SET NO. STD 01 10	SHEET NO. 1

GENERAL NOTES :

THIS STANDARD PLAN IS ONLY A GUIDE FOR RURAL WATER SUPPLY FOR LEVEL II & III.

I. GENERAL

1. THESE NOTES SHALL APPLY UNLESS SPECIFICALLY OTHERWISE INDICATED IN THE PLANS. IN CASE OF CONFLICT BETWEEN PLANS AND SPECIFICATION, SPECIFICATION SHALL GOVERN.
2. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE NOTED IN THE PLANS.
3. ALL ELEVATION ARE IN METERS UNLESS OTHERWISE NOTED IN THE PLANS.
4. ALL DIMENSIONS AND ELEVATION SHOWN IN THE PLANS SHALL BE VERIFIED BEFORE COMMENCEMENT OF THE WORKS.
5. ALL DIMENSIONS, ELEVATIONS AND LOCATION OF OPENING RELATED TO THE EQUIPMENT ARE TENTATIVE AND SUBJECT TO CHANGE AFTER THE EQUIPMENT DIMENSIONS HAVE BEEN ESTABLISHED.

II. DESIGN CRITERIA AND SPECIFICATIONS

1. DPWH DESIGN GUIDELINES, CRITERIA, AND STANDARDS (DGCS) - VOLUME 3 2015 EDITION
2. DPWH STANDARD SPECIFICATIONS FOR HIGHWAYS, BRIDGES, AND AIRPORTS - VOLUME II, LATEST EDITION
3. DPWH STANDARD SPECIFICATIONS FOR PUBLIC WORKS STRUCTURES (BUILDINGS, PORTS AND HARBORS, FLOOD CONTROL AND DRAINAGE STRUCTURES AND WATER SUPPLY SYSTEMS) - VOLUME III, 2019 EDITION
4. RURAL WATER SUPPLY VOLUME I DESIGN MANUAL.
5. PHILIPPINE SOCIETY OF MECHANICAL ENGINEERING CODE.
6. PHILIPPINE ELECTRICAL CODE.
7. NATIONAL STRUCTURAL CODE OF THE PHILIPPINES, VOLUME I (BUILDING, TOWERS AND OTHER VERTICAL STRUCTURES) 7TH EDITION 2015, (NSCP).

III. CIVIL AND STRUCTURAL DESIGN

1. REINFORCED CONCRETE

SCHEDULE OF STRUCTURAL CONCRETE

LOCATION	STRUCTURAL ELEMENTS	28-DAY COMPRESSIVE STRENGTH	DENSITY	MAX SLUMP
FOUNDATION	FOOTINGS, WALL FOOTINGS	3000 PSi= 21 MPa	24 KPa	4"(100mm)
GROUND TO ROOF	SLAB, BEAMS COLUMNS, RAMPS R.C. WALLS RETAINING WALLS	3000 PSi= 21 MPa	24 KPa	4"(100mm)
	SLAB ON GRADE	2500 PSi=17.24 MPa	24 KPa	4"(100mm)

1.1. LOCATION OF ALL CONSTRUCTION OR COLD JOINTS MUST BE APPROVED BY THE ENGINEER.
1.2. REINFORCING BARS, ANCHOR BOLTS, AND OTHER INSERTS SHALL BE SECURED IN PLACE BEFORE POURING CONCRETE, BAR PLACEMENT AND SUPPORTS SHALL BE IN ACCORDANCE WITH THE RECOMMENDED ACI PRACTICE.

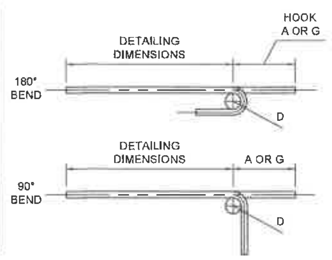
2. REINFORCING STEEL

SCHEDULE OF REINFORCING BARS

DIAMETER OF BARS	GRADE (fY)	ASTM
ø12 AND SMALLER	GRADE 33 (33,000psi)	A615/A615M DEFORMED
ø16 AND LARGER	GRADE 40 (40,000psi)	A615/A615M (DEFORMED)

MINIMUM REINFORCING LAP SPLICE AND BEND

BAR SIZE	LAP (cm)	BEND Ø (mm)	A OR G 180°	A OR G 90°
D10	30	57	13	13
D12	45	76	15	18
D16	53	95	18	23
D20	61	114	20	25
D25	76	152	25	36
D28	91	229	31	41
D32	99	260	33	46
D36	114	285	36	51



3. STRUCTURAL STEEL

3.1. ALL STRUCTURAL MILL SECTIONS AND BUILT UP PLATE SECTIONS SHALL BE DESIGNED IN ACCORDANCE WITH AISC'S LATEST SPECIFICATION FOR THE DESIGN, FABRICATION AND ERECTION OF STRUCTURAL STEEL FOR BUILDINGS.
3.2. DESIGN LOADS SHALL MEET THE REQUIRED STRUCTURAL DESIGN CRITERIA.
3.3. STEEL PLATES, SHAPES, BARS AND METAL FABRICATION: ASTM A-36.
3.4. STRUCTURAL BOLTS AND NUTS: ASTM A-325, GALVANIZED. 7/8Ø AND BELOW.

IV. MECHANICAL NOTES

1. ALL MECHANICAL WORKS SHALL BE IN ACCORDANCE WITH THE LATEST EDITION OF THE PHILIPPINE MECHANICAL ENGINEERING CODE.
2. THE TOTAL SCOPE OF WORKS SHALL INCLUDE ALL WORKS DESCRIBED IN PLANS AND LISTED IN TECHNICAL SPECIFICATIONS FOR MECHANICAL WORKS.
3. THE WORK SHALL BE EXECUTED IN CLOSE COORDINATION WITH OTHER TRADES.
4. THE CONTRACTOR SHALL SUBMIT SHOP DRAWINGS, TECHNICAL DATA / SPECIFICATION (BROCHURES/CATALOGUE) SUBJECT FOR FURTHER TECHNICAL EVALUATION OF THE CONCERNED AUTHORITY PRIOR TO PROCUREMENT / INSTALLATION OF THE EQUIPMENT / UNIT.
5. PROVIDE SEISMIC RESTRAINTS FOR ALL RIGIDLY & RESILIENTLY SUPPORTED EQUIPMENT FOR APPLICABLE CODE & AS SPECIFIED DESIGN & PROVIDE RESTRAINTS FOR PUMPS, FANS, TANKS, ALL PIPING WORKS, GENERATORS ENGINE EXHAUST PIPES, ETC. RESTRAINTS SHALL BE DESIGNED TO PREVENT PERMANENT DISPLACEMENT IN ANY DIRECTION CAUSE BY LATERAL MOTION.
6. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL TESTING AND COMMISSIONING OF ALL EQUIPMENT INSTALLED.
7. PROVIDE PIPE SLEEVES FOR ALL PIPING PASSING THROUGH BUILDING STRUCTURES.
8. PROVIDE GUIDES, HANGER AND SUPPLEMENTAL SUPPORT STEEL FOR ALL PIPING.
9. ALL STEEL PIPE SUPPORTS SHALL BE PHOSPHATED PRIOR TO APPLICATION OF TWO COATS OF RED LEAD AND A COAT OF ENAMEL PAINT FOR FINISHING.
10. THE QUANTITY OF EACH EQUIPMENT INDICATED IN THE SCHEDULE IS FOR GUIDANCE ONLY. FOR QUANTITY TAKE OFF COUNT THE NUMBER OF UNITS IN THE PLANS.
11. ALL MECHANICAL WORKS SHALL BE DONE UNDER THE DIRECT AND IMMEDIATE SUPERVISION OF A DULY REGISTERED MECHANICAL ENGINEER.

V. ELECTRICAL NOTES

1. ALL ELECTRICAL WORKS SHALL BE DONE IN ACCORDANCE AND IN STRICT COMPLIANCE WITH THE PROVISIONS OF THE LATEST EDITION OF THE PHILIPPINE ELECTRICAL CODE (PEC) EXISTING APPLICABLE LAWS, ORDINANCES, REQUIREMENTS, RULES AND REGULATIONS OF THE LOCAL GOVERNMENT AND LOCAL POWER COMPANY.
2. WHEREVER REQUIRED AND NECESSARY, JUNCTION BOXES OR PULL BOXES SHALL BE INSTALLED AT INCONSPICUOUS LOCATIONS ALTHOUGH SUCH BOXES ARE NOT SHOWN ON THE PLANS NOR MENTIONED IN THE SPECIFICATIONS.
3. ALL NON-CURRENT CARRYING METAL PARTS/ ENCLOSURES OF ELECTRICAL EQUIPMENT AND OVERCURRENT PROTECTIVE DEVICES SHALL BE PROPERLY GROUNDED IN ACCORDANCE WITH ARTICLE 2.50 OF THE PHILIPPINE ELECTRICAL CODE PART 1, 2000 EDITION
4. THE ELECTRICAL SYSTEM SHALL HAVE A GROUND RESISTANCE NOT EXCEEDING 5 OHMS.
5. STANDARD TYPE OF ACCESSORIES, SPLICING DEVICES, TERMINATIONS AND OTHER APPURTENANCES FOR THE ENTIRE ELECTRICAL INSTALLATION SHALL BE USED.
6. ALL MATERIALS TO BE USED AND INSTALLED SHALL BE BRAND NEW AND OF THE APPROVED TYPE FOR THE LOCATION AND PURPOSE.
7. SOLAR CONTRACTOR SHALL PROVIDE FINAL QUANTITY AND RATING OF SOLAR PANEL (PHOTOVOLTAIC PANEL), SOLAR CHARGE CONTROLLERS, BATTERIES, AND INVERTERS BASED ON ACTUAL ROOF AND SITE ORIENTATION AND SPACES
8. SOLAR CONTRACTOR SHALL PROVIDE FINAL DRAWINGS, SHOP SPECIFICATIONS AND OTHER RELATED DOCUMENTS FOR SOLAR POWER SYSTEM
9. DESIGN OF DISTRIBUTION SYSTEM IS NOT INCLUDED IN THIS STANDARD PLAN AS IT VARIES DEPENDING ON THE SITE LOCATION.
10. ALL ELECTRICAL WORKS SHALL BE DONE UNDER THE DIRECT AND IMMEDIATE SUPERVISION OF A DULY REGISTERED ELECTRICAL ENGINEER.

VI. SOLAR PANELS

1. BASIC WIND VELOCITY IN THE DESIGN, V = 250 kph
2. SOLAR PANEL ORIENTATION SHALL GENERALLY BE FACING TRUE SOUTH FOR MAXIMUM OUTPUT OF POWER BUT OPTIMUM RADIATION EXPOSURE SHALL BE CONSIDERED AT ALL TIMES BASED ON PROJECT LOCATION.
3. SOLAR PANEL MODULES SHALL BE OF MONO CRYSTALLINE OR POLY-CRYSTALLINE TYPE.
4. ALL ROOF PENETRATIONS SHALL BE SEALED WITH A HIGH PERFORMANCE ROOF SEALANT.
5. THE SOLAR PHOTOVOLTAIC INSTALLATION SHALL NOT OBSTRUCT ANY PLUMBING, MECHANICAL, OR BUILDING ROOF VENTILATION.
6. APPROPRIATE CAUTION AND WARNING ELECTRICAL SIGNS AND SIGNAGES SHALL BE POSTED AT CONSPICUOUS LOCATION AT THE SITE.

VII. AQUIFER / PUMP WELL

1. WELL DRILLING WILL COMMENCE UPON SECURING OF DRILLING PERMIT FROM THE NWRB AND MUST BE CONTRACTED TO AN EXPERIENCED AND COMPETENT WELL DRILLING COMPANY DULY ACCREDITED BY THE NWRB.
2. THE CONDUCT OF GEO-RESISTIVITY TEST SHALL BE PERFORMED IN THE TARGET AREA TO IDENTIFY THE LOCATION AND DEPTH OF AQUIFER OF THE PROPOSED WELL SITE.
3. THE DESIGNER SHALL CONDUCT A PUMPING ("SAFE YIELD") TEST AT LEAST EQUAL TO THE SYSTEM PEAK DEMAND AND OPERATE IT FOR 24-48 HOURS.
4. THE CONTRACTOR SHALL BE RESPONSIBLE FOR WELL HEAD PROTECTION TO PROVIDE SEAL FROM LEAKAGE AND RUNOFF ENTERING THE WELL HEAD.

VIII. TRANSMISSION AND DISTRIBUTION SYSTEMS

1. TRANSMISSION AND DISTRIBUTION SYSTEMS VARY IN SIZE AND COMPLEXITY BUT ALL HAVE THE SAME BASIC PURPOSE TO DELIVER WATER, HENCE, SOURCE TO HOUSEHOLD DISTRIBUTION SHALL BE UNDERTAKEN BY THE IMPLEMENTING OFFICE.
2. METHODS OF WATER TRANSMISSION AND DISTRIBUTION SHALL BE BASED ON THE GUIDELINES PROVIDED IN RURAL WATER SUPPLY, VOLUME I (DESIGN MANUAL).

IX. ABBREVIATIONS

BOTT.	BOTTOM BARS
C	COLUMN
C.H.B.	CONCRETE HOLLOW BLOCK
CONC.	CONCRETE
cm	CENTIMETER
DWG	DRAWING
D	DOOR
DS	DOWNSPOUT
EA	EACH
E.F	EACH FACE
E.W	EACH WAY
EL, ELEV	ELEVATION
FLR	FLOOR
F.T.G.	FOOTING TIE BEAM
G.I.	GALVANIZED IRON
GRD, GRND	GROUND
HOR.	HORIZONTAL
L	LENGTH
m	METER
mm	MILLIMETER
ND	NOMINAL DIAMETER
N	NORTH
NGL	NATURAL GRADE LEVEL
N.T.S.	NOT TO SCALE
PV	PHOTOVOLTAIC
R.C.	REINFORCED CONCRETE
STD	STANDARD
STL	STEEL
t, THK	THICKNESS
TDH	TOTAL DYNAMIC HEAD
TYP	TYPICAL
T.B.	TOP BAR
VERT	VERTICAL
W/	WITH
W/O	WITHOUT
W.P	WATER PROOFING

REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
BUREAU OF DESIGN
MANILA

SHEET TITLE: GENERAL NOTES

SHEET CONTENTS: CIVIL AND STRUCTURAL, MECHANICAL, ELECTRICAL, SOLAR PANEL, AQUIFER/PUMP WELL

PREPARED: GIAN PA[illegible] RABACAL, ENGINEER II; MARK JOSEPH L. RIVERA, ENGINEER III

DRAFTED: JOSELITO F. DELA ROSA, JR, ENGINEERING ASSISTANT

REVIEWED: CRISSA RICA E. BARIL, ENGINEER IV

SUBMITTED: LEONARDO L. LINGAN, CHIEF, WATER PROJECTS DIVISION, BUREAU OF DESIGN, DATE:

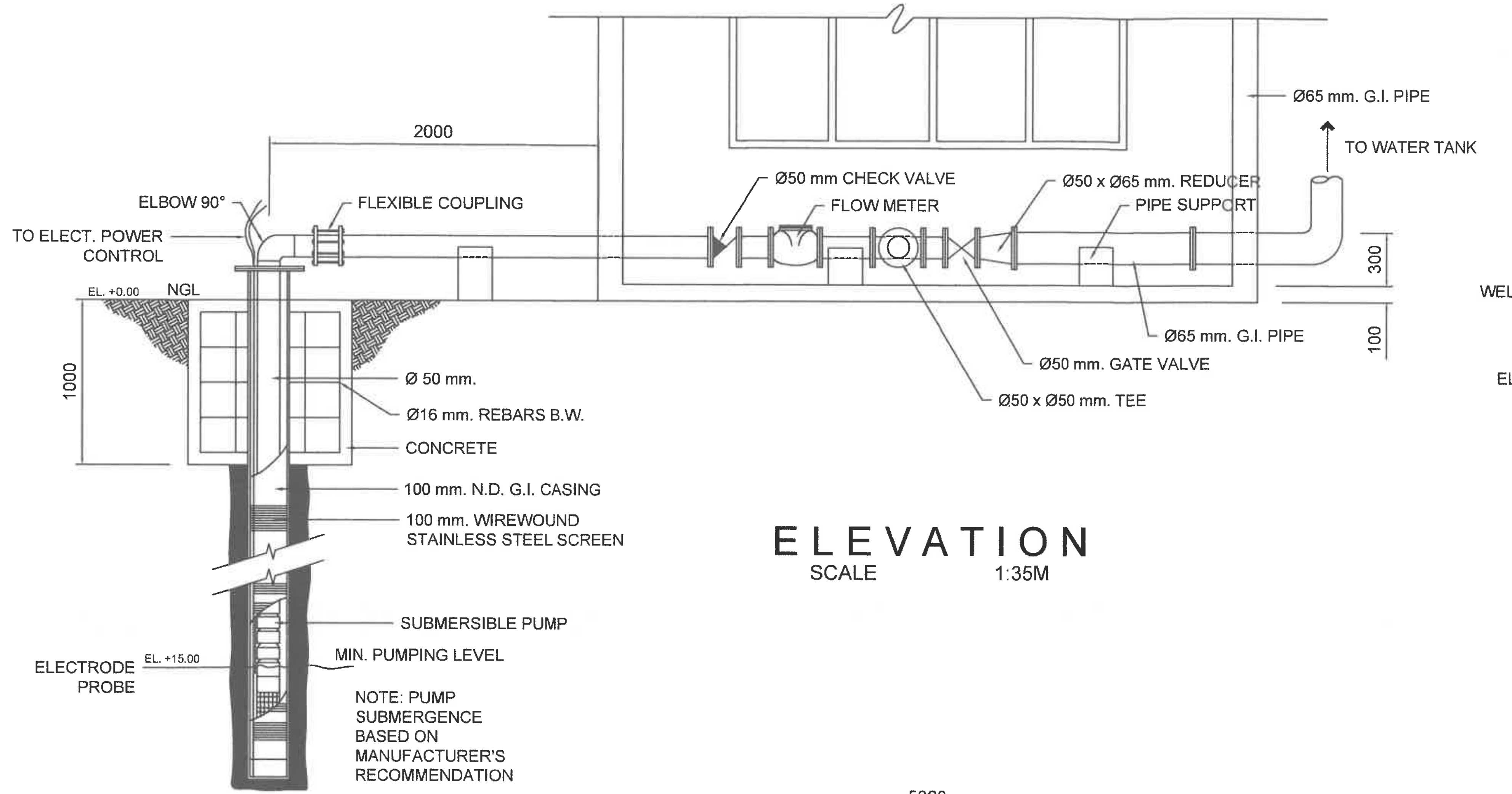
RECOMMENDING APPROVAL: ED[illegible]IN C. MATANGUI[illegible]N, OIC-DIRECTOR, BUREAU OF DESIGN, DATE: FEB 06 2023

(SEE COVER SHEET) ERIC A. AYAPANA, ASSISTANT SECRETARY FOR INFORMATION MANAGEMENT AND TECHNICAL SERVICES, DATE:

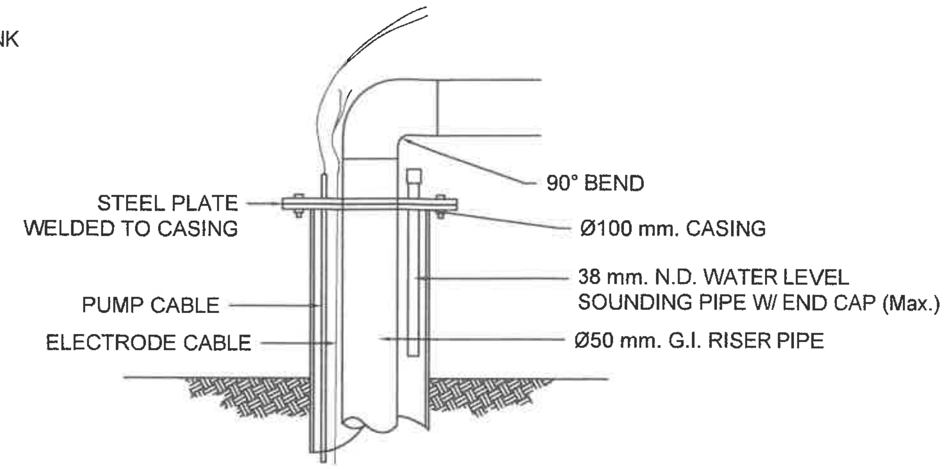
APPROVED: (SEE COVER SHEET) MAXIMO L. CARVAJAL, UNDERSECRETARY FOR INFORMATION MANAGEMENT AND TECHNICAL SERVICES, DATE:

SET NO.: STD 02 10

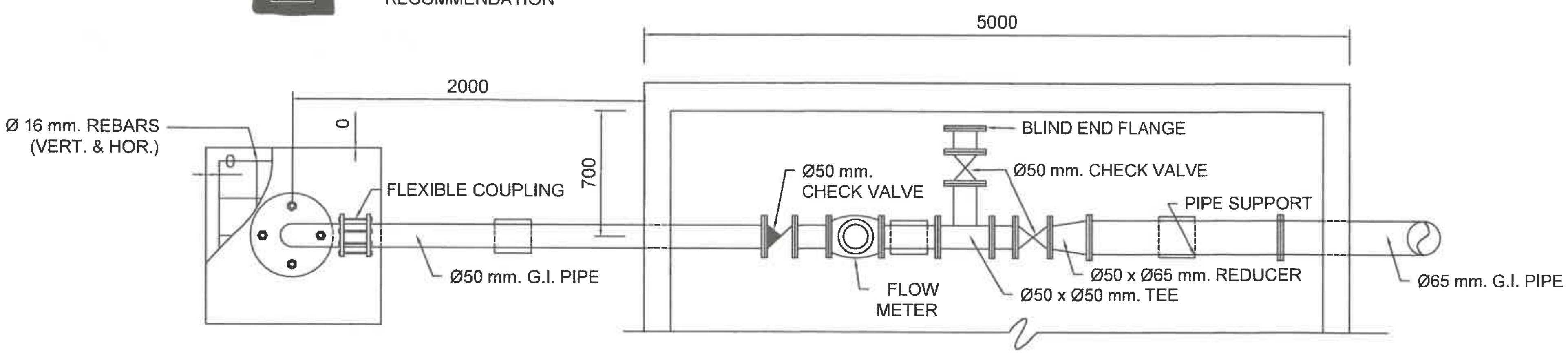
SHEET NO.: 2

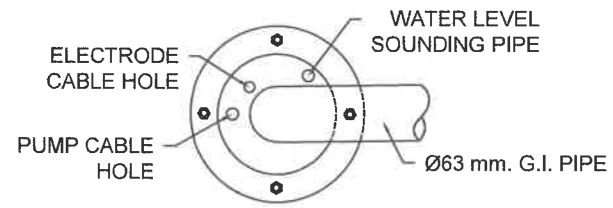


ELEVATION
SCALE 1:35M



DETAIL A





DETAIL B

PLAN
SCALE 1:35M

1 SUBMERSIBLE PUMP DETAILS

SCHEDULE OF EQUIPMENT

DESIGNATION	QTY	CAPACITY (gpm)	TYPE	TDH (m)	SPEED (rpm)	MOTOR RATING			
						POWER (HP)	VOLTS	PHASE	HERTZ
PUMP	1	80	SUBMERSIBLE	51	3450	5	230	SINGLE	60

NOTE: PUMP RATING IS SIZED ACCORDING TO STANDARD MAX. WELL DEPTH AND MIN. PUMPING LEVEL OF 15.00M.
PUMP SIZE SHALL BE ADJUSTED ACCORDING TO PUMP WELL CONFIGURATION AND SET PUMPING WATER LEVEL AS DETERMINED DURING PUMPING "SAFE YIELD" TEST.

REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
BUREAU OF DESIGN
MANILA

SHEET TITLE: SUBMERSIBLE PUMP DETAILS

SHEET CONTENTS: SUBMERSIBLE PUMP DETAIL

PREPARED: GIAN PAOLO C. RABACAL, ENGINEER II; MARK JOSEPH L. RIVERA, ENGINEER III

DRAFTED: JOSELITO P. DELA ROSA, JR, ENGINEERING ASSISTANT

REVIEWED: CRISSA RICA E. BARIL, ENGINEER IV

SUBMITTED: LEONARDO L. LINGAN, CHIEF, WATER PROJECTS DIVISION, BUREAU OF DESIGN
DATE:

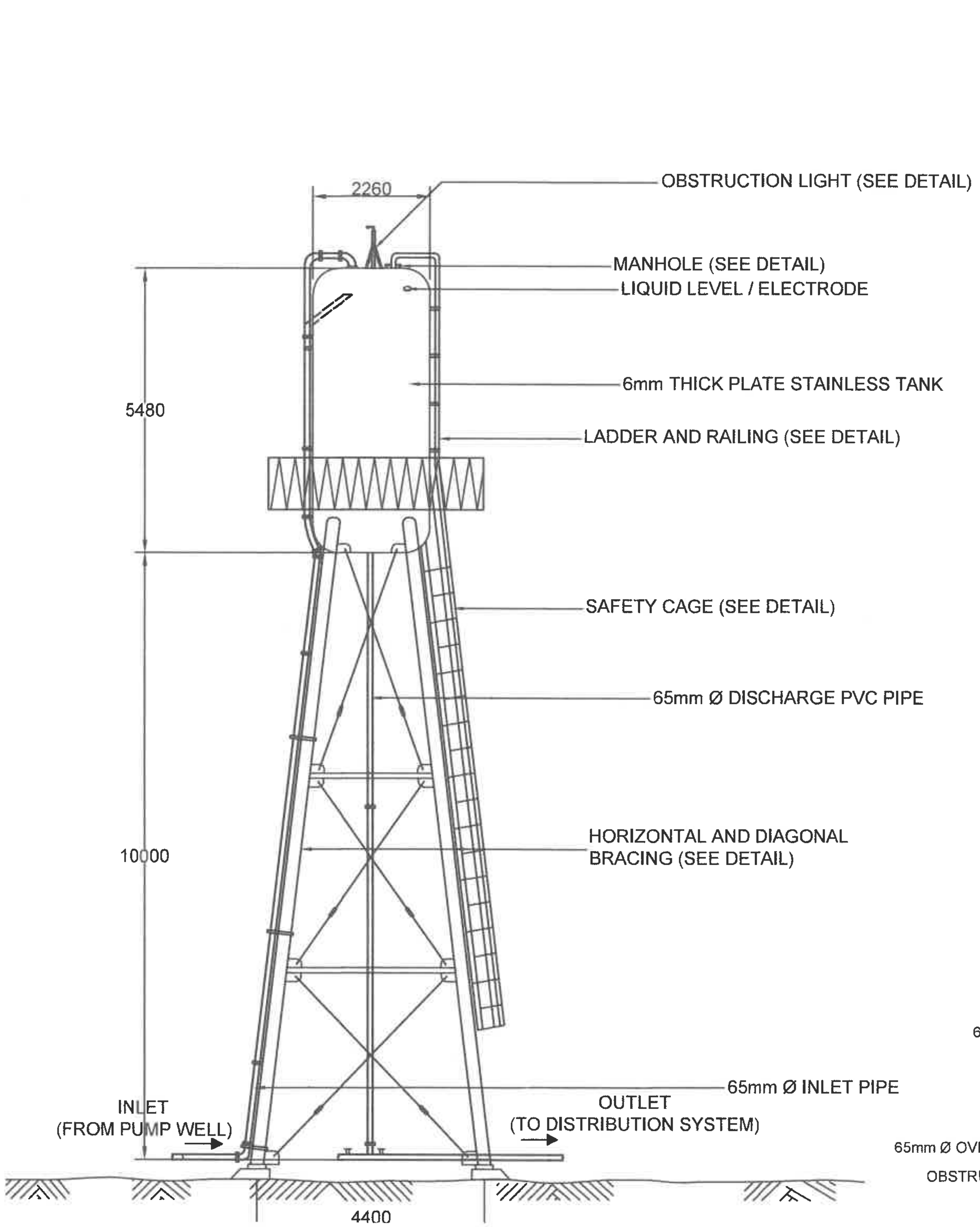
RECOMMENDING APPROVAL: EDWIN C. MATANGUIHAN, OIC-DIRECTOR, BUREAU OF DESIGN
DATE: FEB 06 2023

(SEE COVER SHEET) ERIC A. AYAPANA, ASSISTANT SECRETARY FOR INFORMATION MANAGEMENT AND TECHNICAL SERVICES
DATE:

APPROVED: (SEE COVER SHEET) MAXIMO L. CARVAJAL, UNDERSECRETARY FOR INFORMATION MANAGEMENT AND TECHNICAL SERVICES
DATE:

SET NO.: STD 03 | 10

SHEET NO.: 3



1 **ELEVATION**
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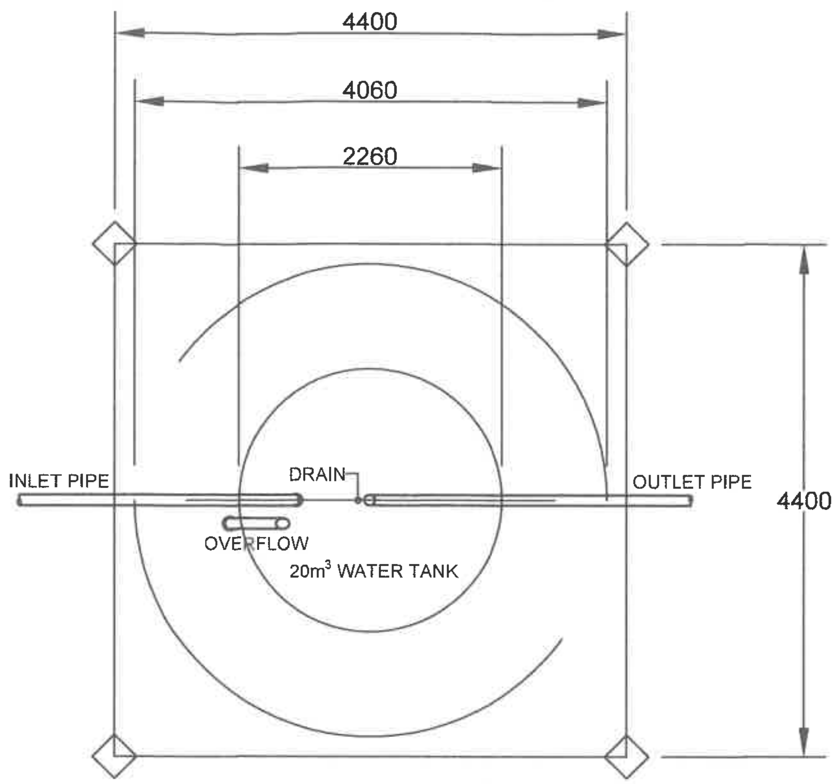

2 **PLAN**
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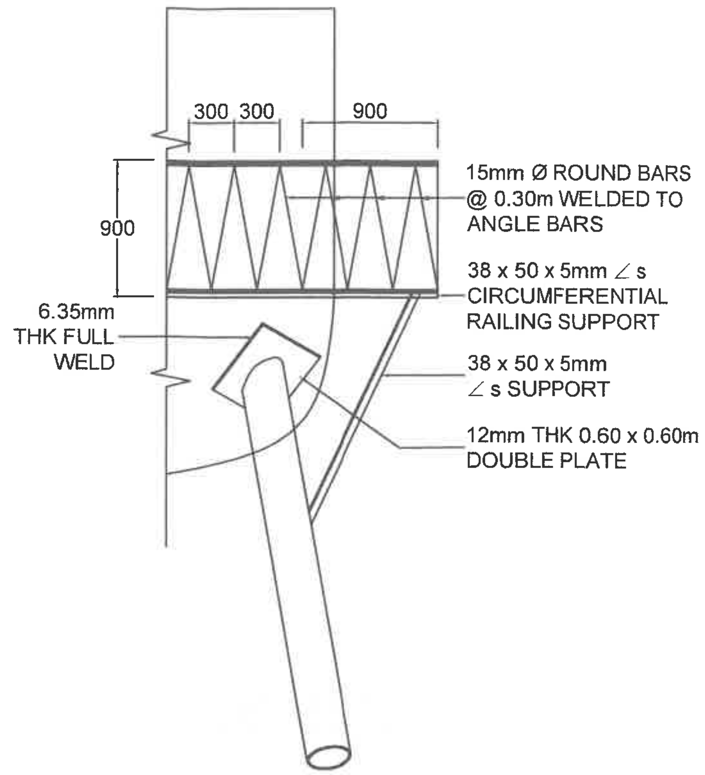

4 **RAILING DETAIL**
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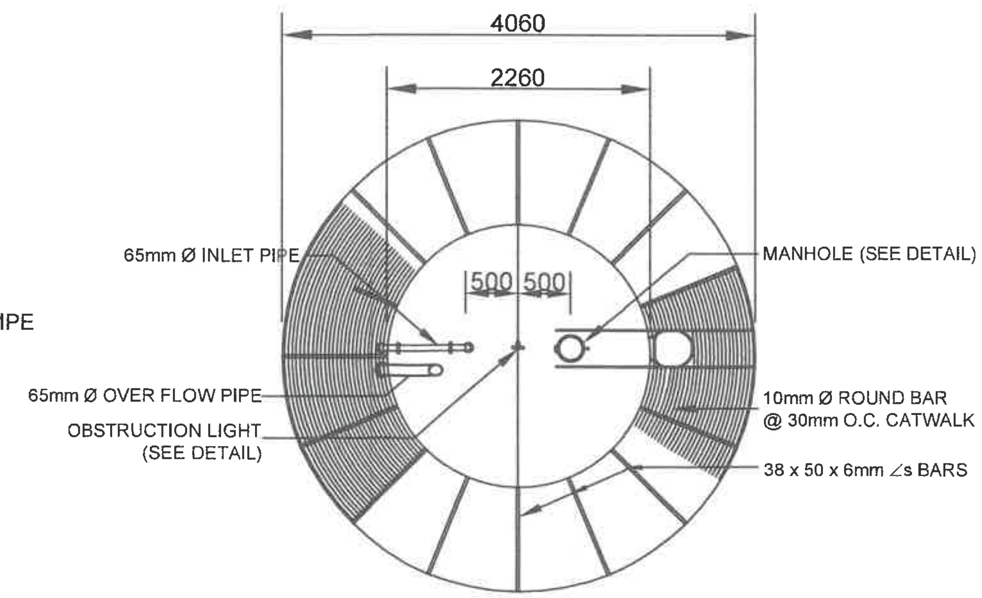

3 **TOP PLAN**
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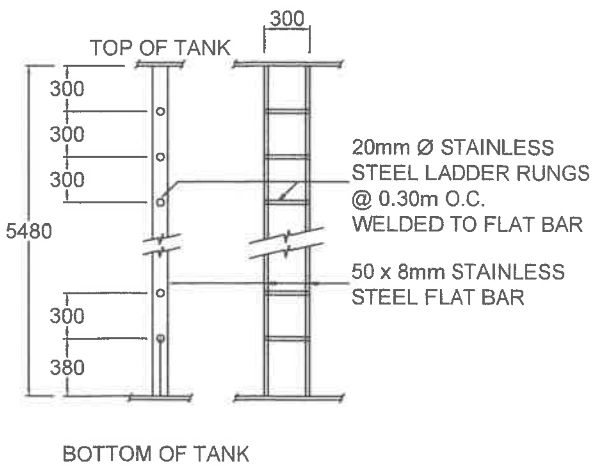
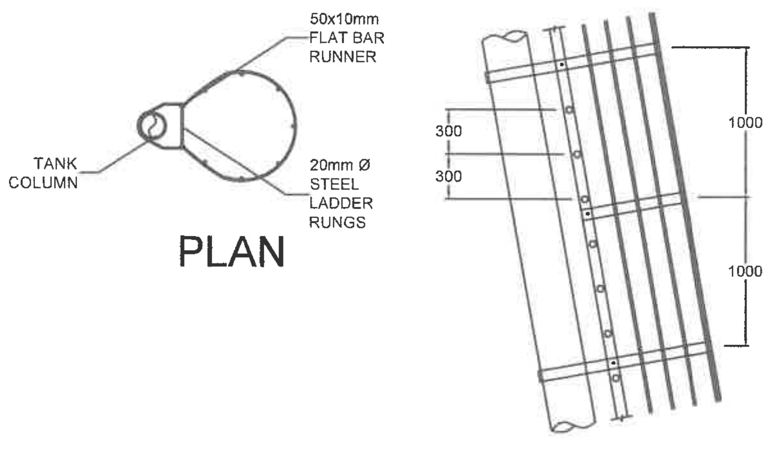


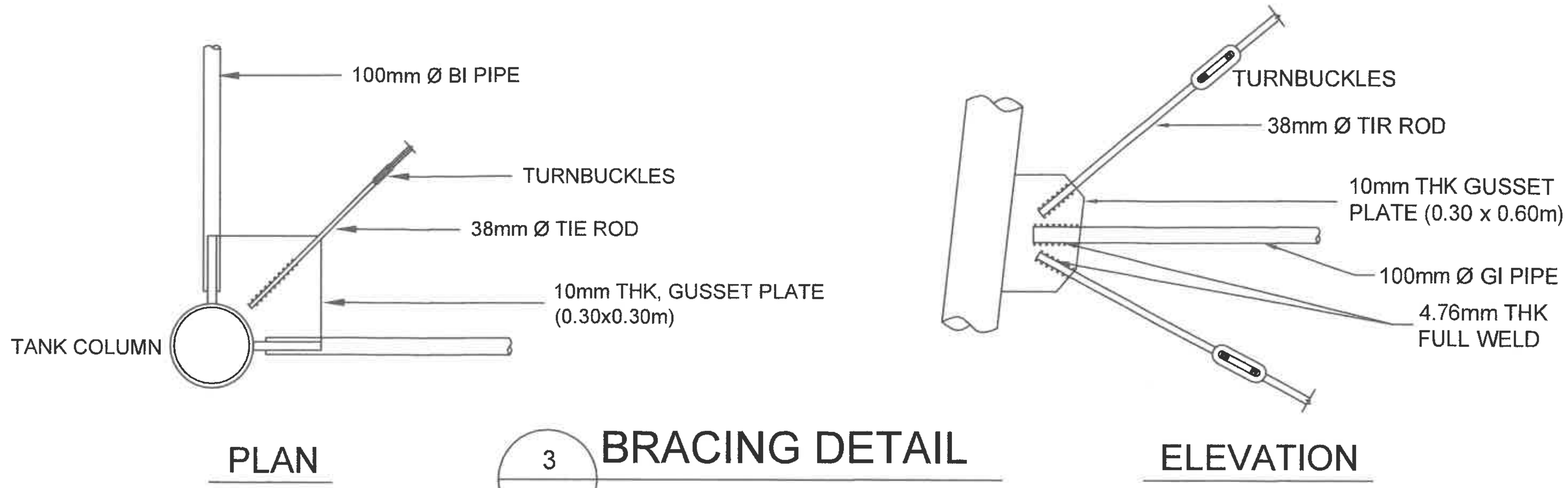
5 **INSIDE TANK LADDER DETAIL**
SCALE: 1:50m

REPUBLIC OF THE PHILIPPINES DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS BUREAU OF DESIGN MANILA	SHEET TITLE: ELEVATED WATER TANK DETAILS (1)	SHEET CONTENTS: INSIDE TANK LADDER DETAIL RAILING DETAIL	PREPARED: GIAN PAOLO C. RABACAL, ENGINEER II MARK JOSEPH L. RIVERA, ENGINEER III DRAFTED: JOSELITO P. DELA ROSA, JR, ENGINEERING ASSISTANT REVIEWED: CRISSA RICA E. BARIL, ENGINEER IV	SUBMITTED: LEONARDO L. LINGAN CHIEF, WATER PROJECTS DIVISION BUREAU OF DESIGN DATE:	RECOMMENDING APPROVAL: EDWIN C. MATANGUIHAN OIC-DIRECTOR BUREAU OF DESIGN DATE: FEB 06 2023	(SEE COVER SHEET) ERIC A. AYAPANA ASSISTANT SECRETARY FOR INFORMATION MANAGEMENT AND TECHNICAL SERVICES DATE:	APPROVED: (SEE COVER SHEET) MAXIMO L. CARVAJAL UNDERSECRETARY FOR INFORMATION MANAGEMENT AND TECHNICAL SERVICES DATE:	SET NO. STD 04 10	SHEET NO. 4



1 SAFETY CAGE DETAIL

SCALE: 1:20m



3 BRACING DETAIL

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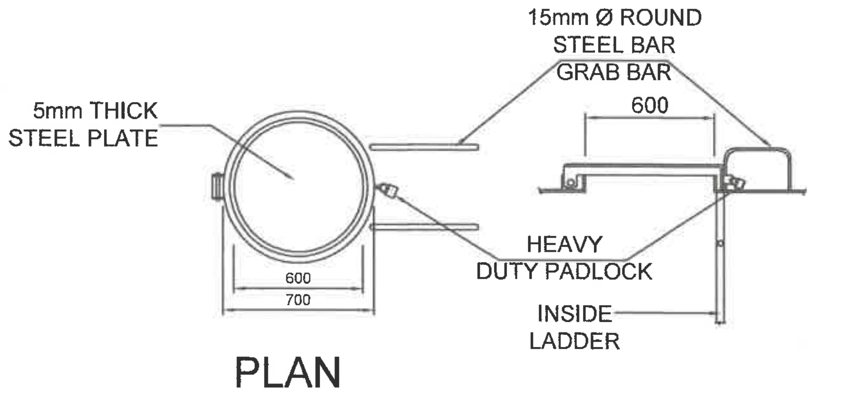

2 MANHOLE DETAIL

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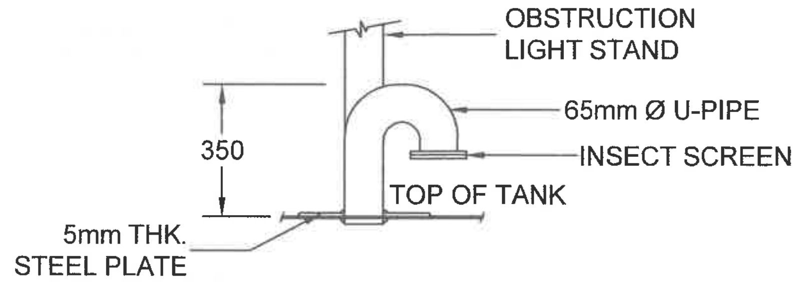

4 AIR VENT DETAIL

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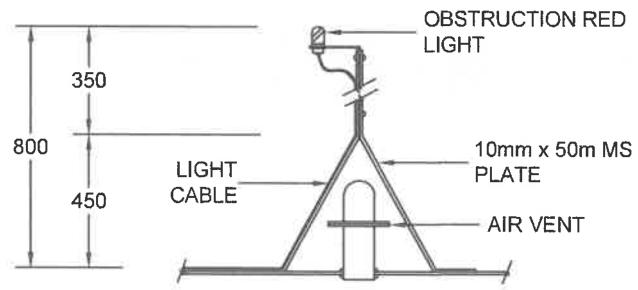

5 OBSTRUCTION LIGHT INSTALLATION DETAIL

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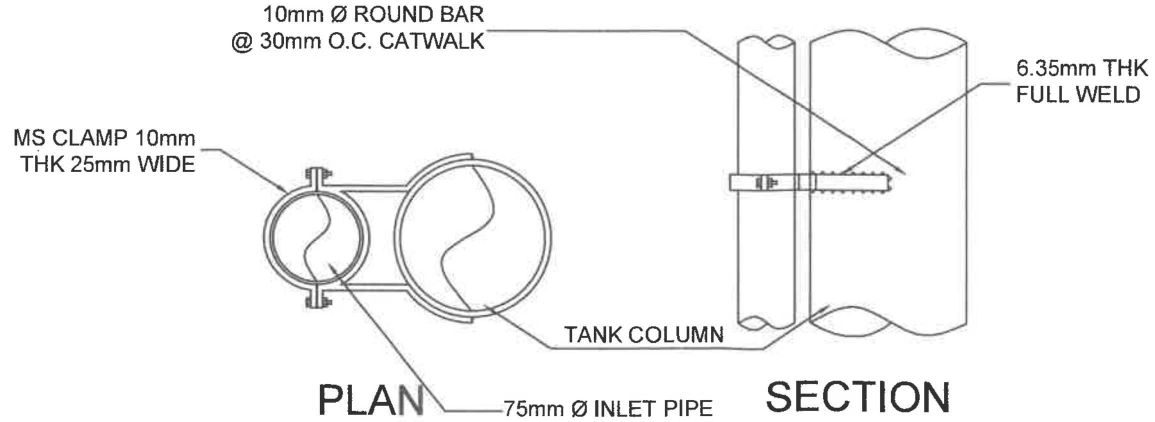
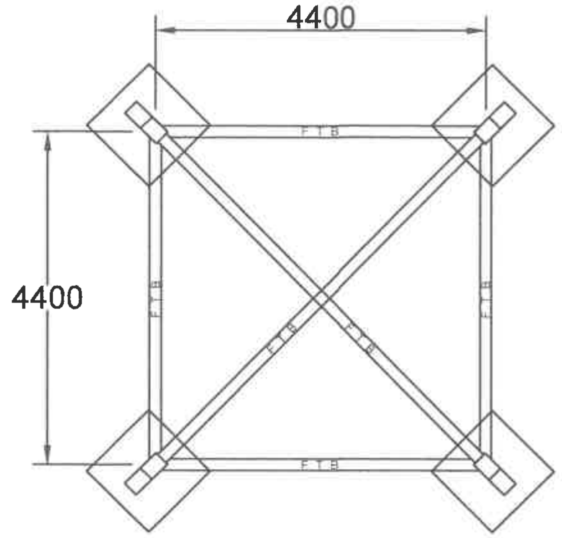


6 INLET PIPE CLAMP DETAILS

SCALE: 1:120m

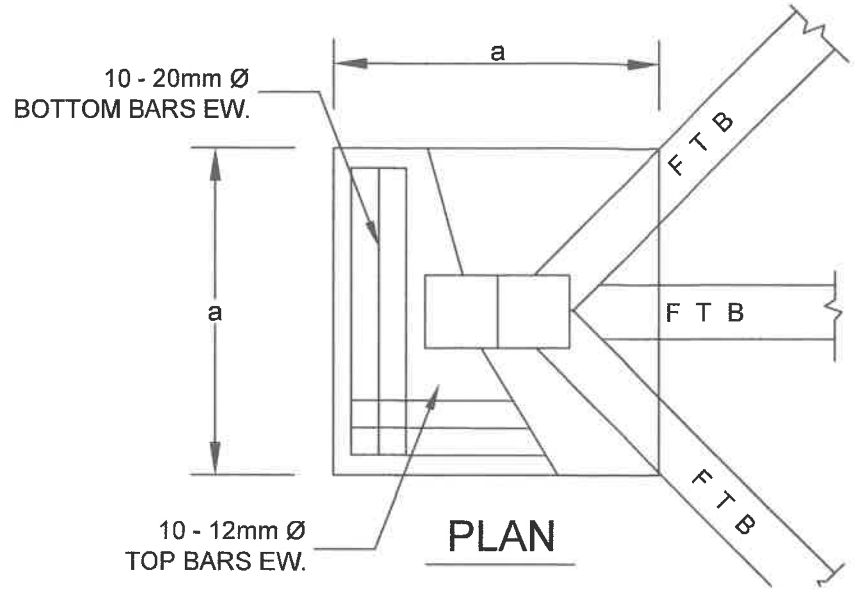
NOTE:
THE CONTRACTOR SHALL SUBMIT SHOP DRAWINGS TO BE APPROVED BY THE ENGINEER PRIOR TO FABRICATION

REPUBLIC OF THE PHILIPPINES DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS BUREAU OF DESIGN MANILA	SHEET TITLE: ELEVATED WATER TANK DETAILS (2)	SHEET CONTENTS: MANHOLE DETAIL, SAFETY CAGE DETAIL, INLET PIPE CLAMP DETAIL, AIR VENT DETAIL	PREPARED: GIAN PAOLO C. RABACAL, ENGINEER II; MARK JOSEPH L. RIVERA, ENGINEER III. DRAFTED: JOSELITO P. DELA ROSA, JR, ENGINEERING ASSISTANT. REVIEWED: CRISSA RICAFE BARIL, ENGINEER IV	SUBMITTED: LEONARDO L. LINGAN, CHIEF, WATER PROJECTS DIVISION, BUREAU OF DESIGN. DATE:	RECOMMENDING APPROVAL: EDWIN C. MATANGUIHAN, OIC-DIRECTOR, BUREAU OF DESIGN. DATE: FEB 06 2023	(SEE COVER SHEET) ERIC A. AYAPANA, ASSISTANT SECRETARY FOR INFORMATION MANAGEMENT AND TECHNICAL SERVICES. DATE:	APPROVED: (SEE COVER SHEET) MAXIMO L. CARVAJAL, UNDERSECRETARY FOR INFORMATION MANAGEMENT AND TECHNICAL SERVICES. DATE:	SET NO. STD 05 10	SHEET NO. 5

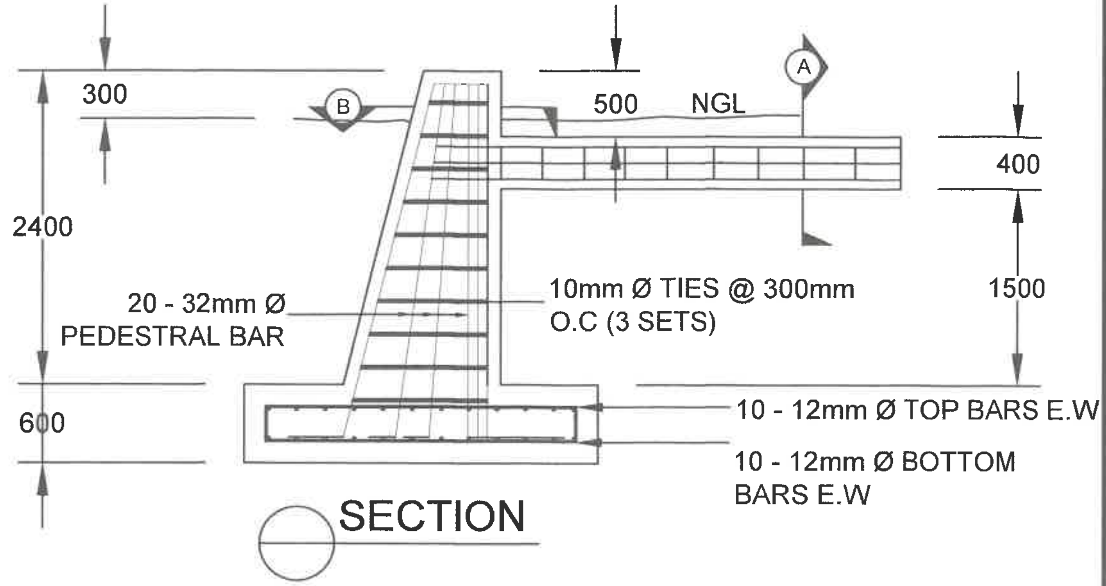


1 FOUNDATION PLAN

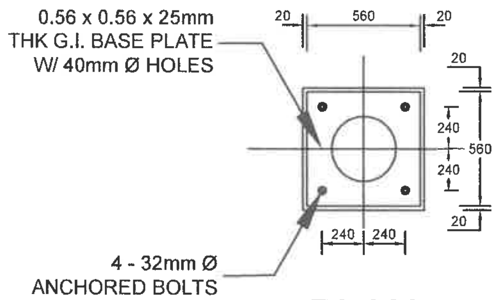
SCALE: 1:100m



PLAN



SECTION



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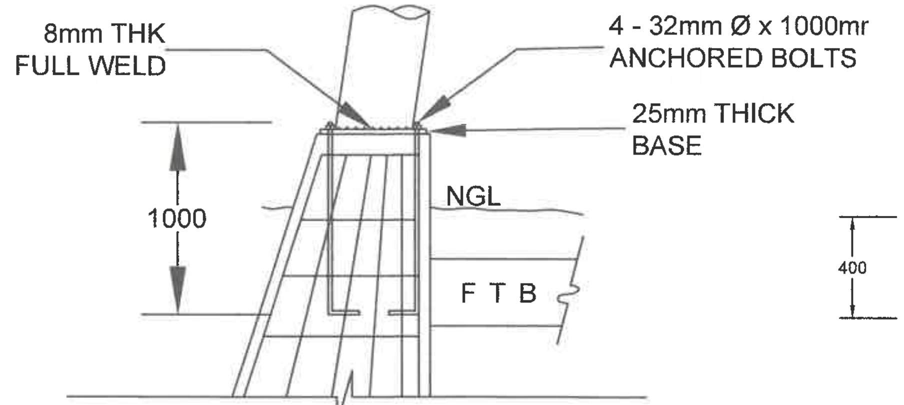

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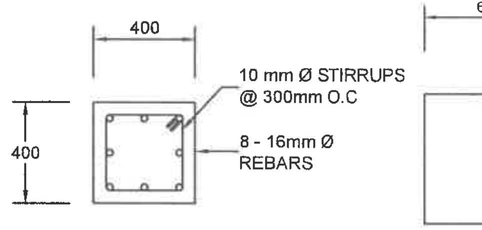
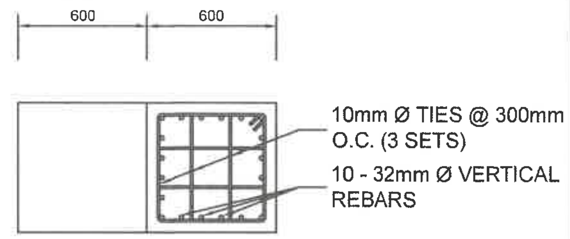
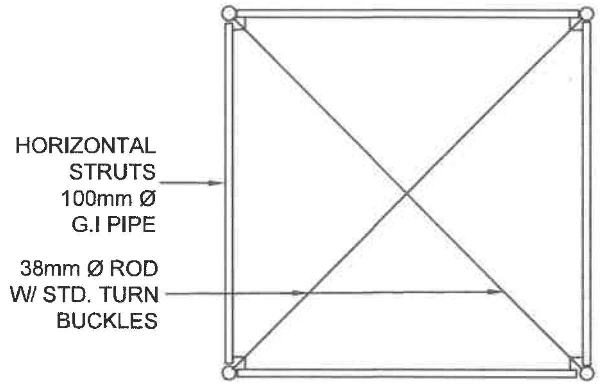


SECTION-A

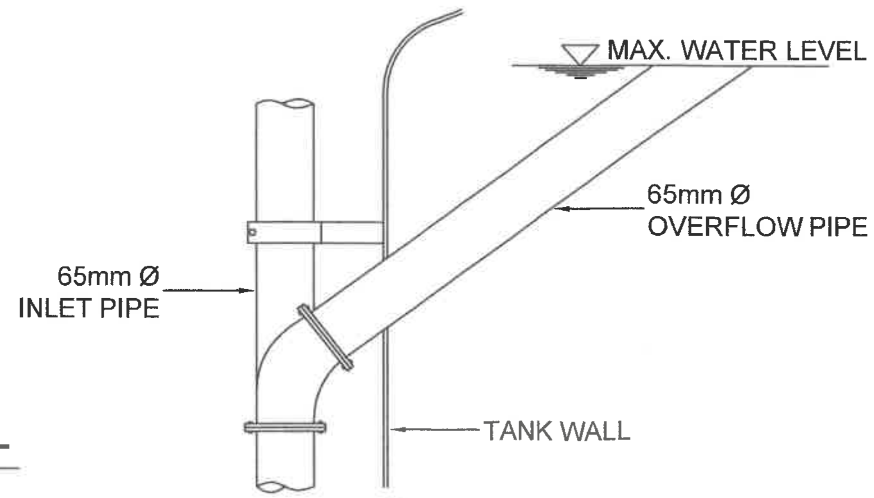


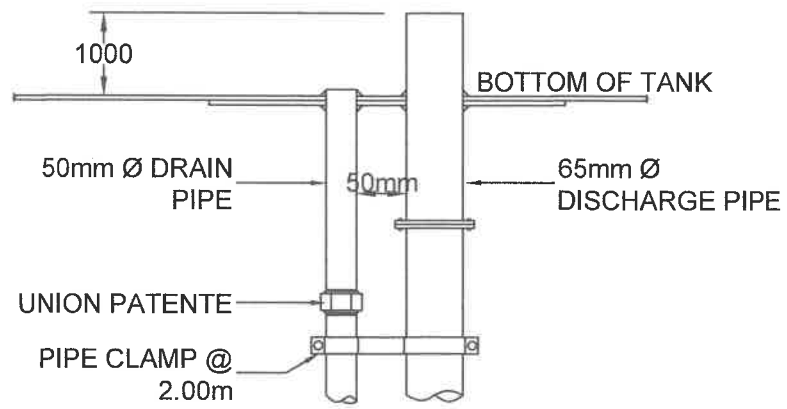
SECTION-B



2 HORIZONTAL BRACING DETAIL

NOTE: SIZES OF FOOTING AND OTHER STRUCTURAL MEMBERS SHALL BE SUPPORTED BY STRUCTURAL ANALYSIS BASED ON THE GEOTECHNICAL INVESTIGATION REPORT.

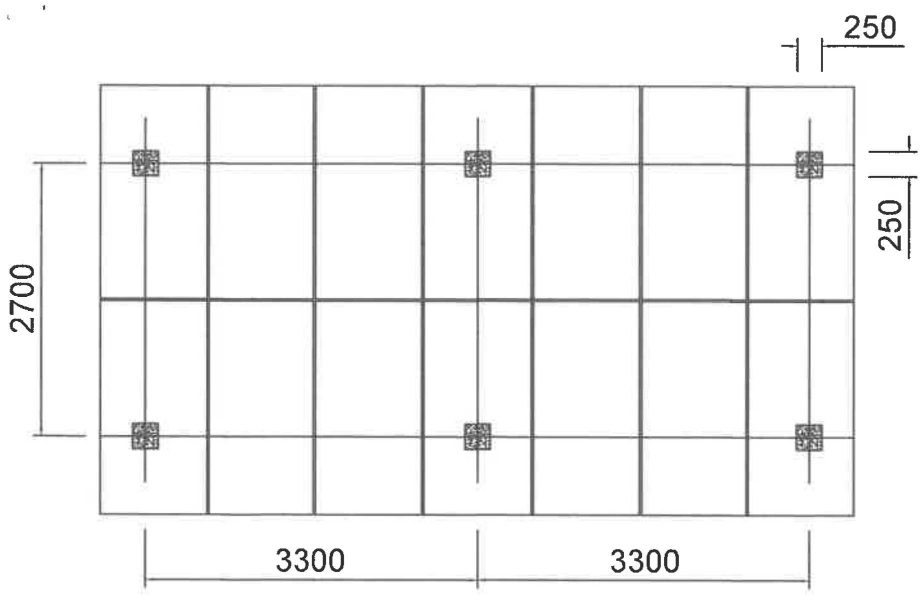




3 INLET, OUTLET AND DRAIN PIPE DETAILS

SCALE: 1:100m

REPUBLIC OF THE PHILIPPINES DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS BUREAU OF DESIGN MANILA	SHEET TITLE: ELEVATED WATER TANK DETAILS (3)	SHEET CONTENTS: FOUNDATION PLAN HORIZONTAL BRACING DETAIL INLET, OUTLET AND DRAIN PIPE DETAIL	PREPARED: GIAN PAOLO G. RABACAL, ENGINEER II MARK JOSEPH L. RIVERA, ENGINEER III DRAFTED: JOSELITO P. DELA ROSA, JR, ENGINEERING ASSISTANT REVIEWED: CRISSA RICHE, BARIE, ENGINEER IV	SUBMITTED: LEONARDO L. LINGAN CHIEF, WATER PROJECTS DIVISION BUREAU OF DESIGN DATE:	RECOMMENDING APPROVAL: EDWIN C. MATANGUIHAN OIC-DIRECTOR BUREAU OF DESIGN DATE: FEB 06 2024	(SEE COVER SHEET) ERIC A. AYAPANA ASSISTANT SECRETARY FOR INFORMATION MANAGEMENT AND TECHNICAL SERVICES DATE:	APPROVED: (SEE COVER SHEET) MAXIMO L. CARVAJAL UNDERSECRETARY FOR INFORMATION MANAGEMENT AND TECHNICAL SERVICES DATE:	SET NO. STD 06 10 SHEET NO. 6



STANDARD ARRAY PV MODULE SUPPORT LAYOUT

1

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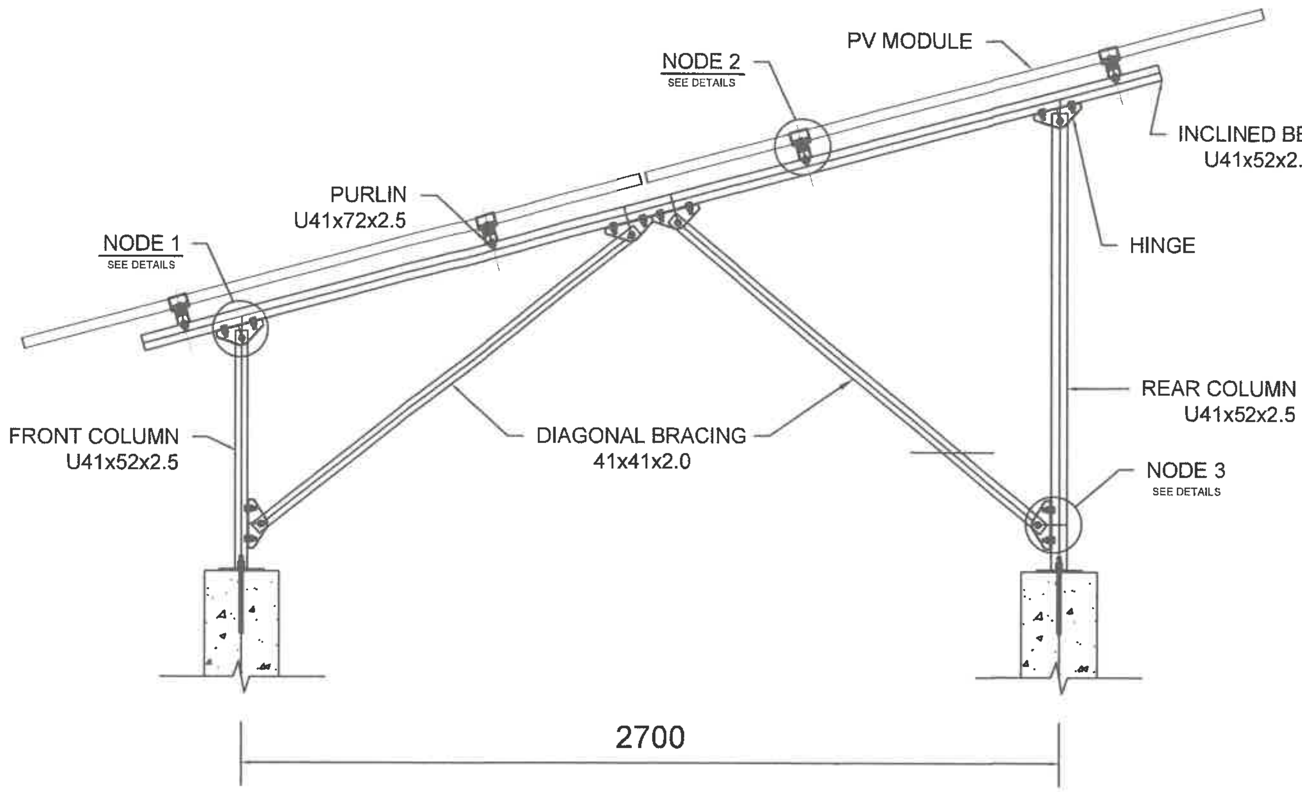
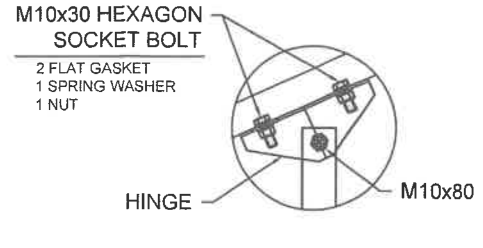


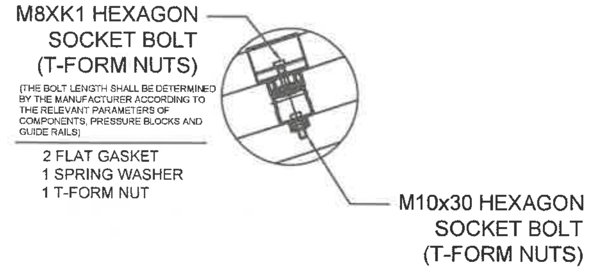
STANDARD ARRAY PV SIDE VIEW DOUBLE ROW VERTICAL

2

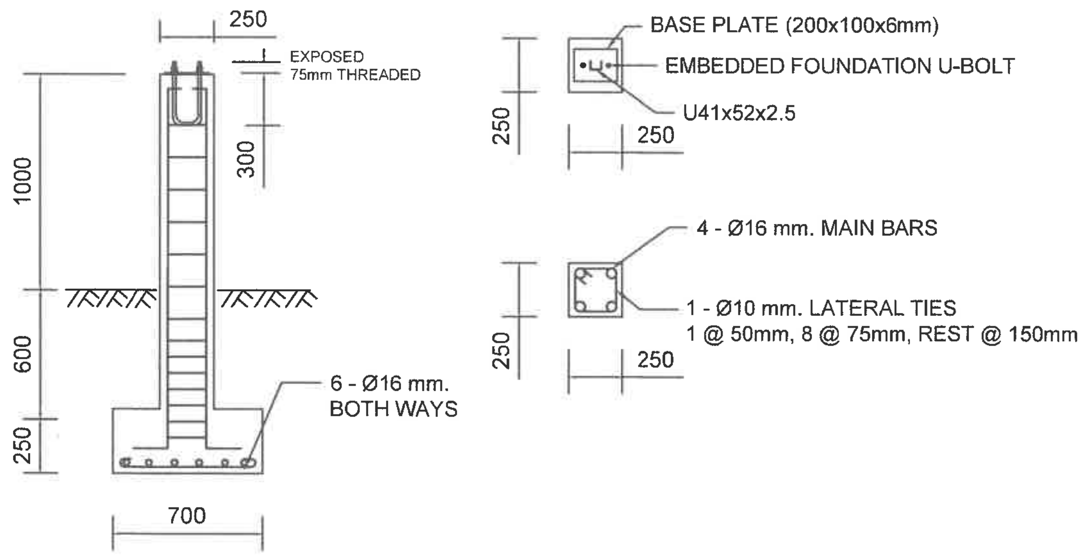
SCALE: 1:25m

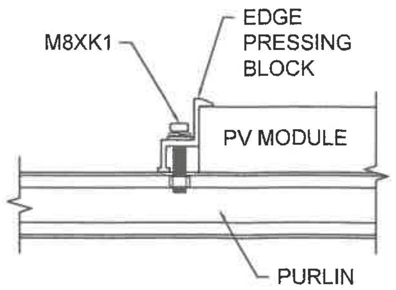


NODE 1

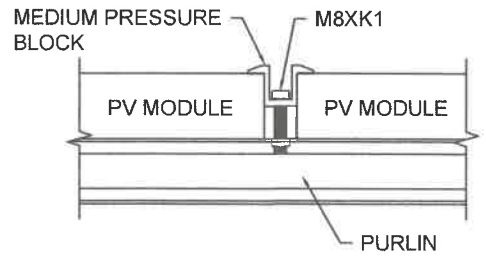


NODE 2

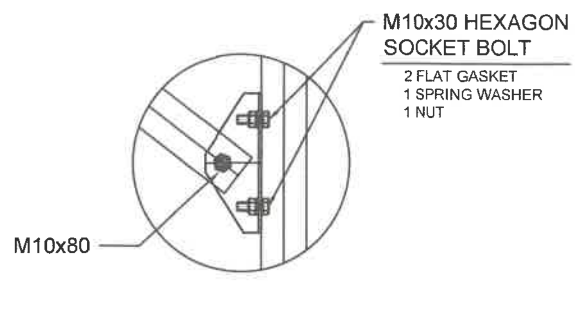




EDGE PRESSING BLOCK NODE



MEDIUM PRESSURE BLOCK NODE



NODE 3

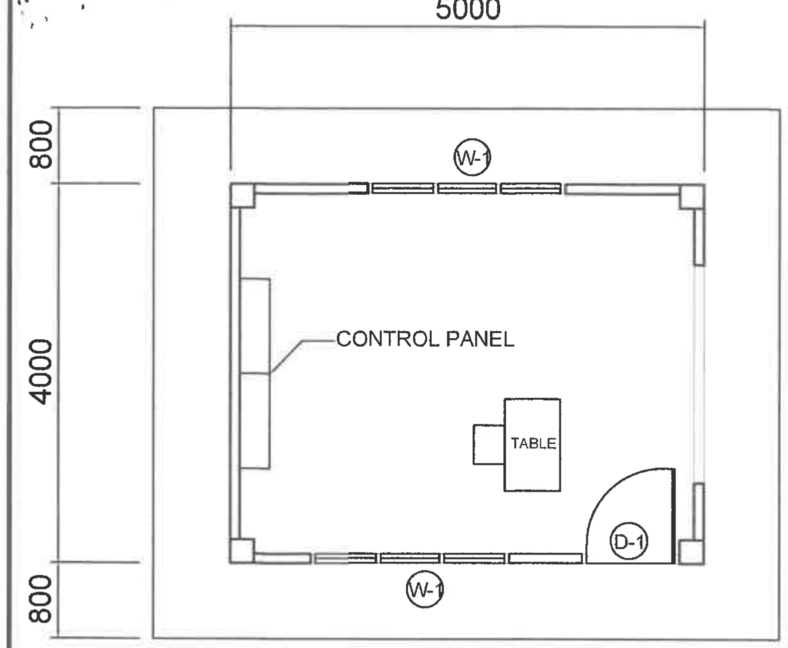
SOLAR PANEL CONCRETE PEDESTAL DETAILS

3

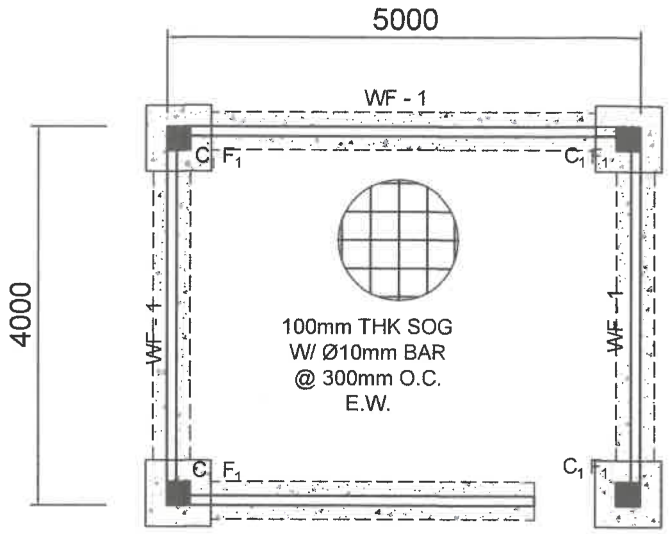
SCALE: 1:35m

NOTE: SIZES OF FOOTING AND OTHER STRUCTURAL MEMBERS SHALL BE SUPPORTED BY STRUCTURAL ANALYSIS BASED ON THE GEOTECHNICAL INVESTIGATION REPORT.

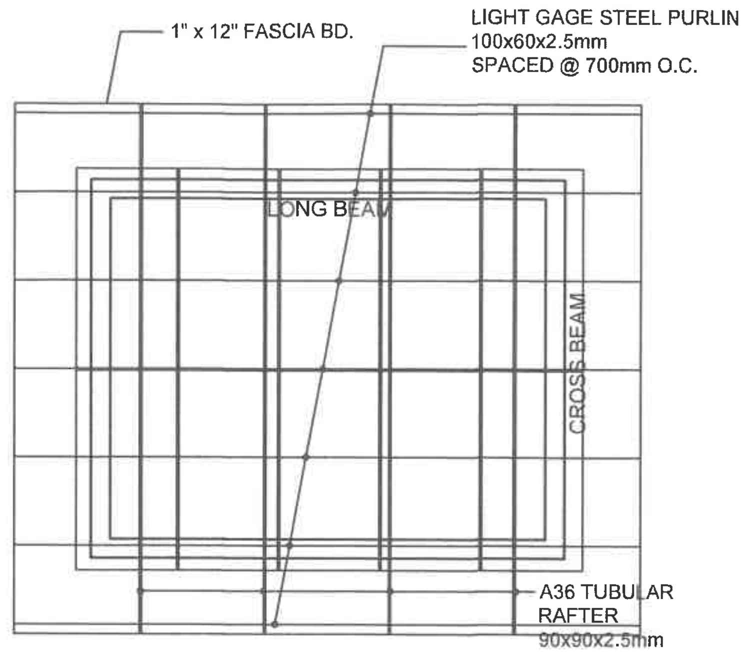
REPUBLIC OF THE PHILIPPINES DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS BUREAU OF DESIGN MANILA	SHEET TITLE: SOLAR PANEL DETAILS	SHEET CONTENTS: ARRAY PV MODULE SUPPORT LAYOUT CONCRETE PEDESTAL CONNECTION DETAILS	PREPARED: GIAN PAOLO G. RABACAL, ENGINEER II MARK JOSEPH L. RIVERA, ENGINEER III DRAFTED: JOSELITO P. DELA ROSA, JR, ENGINEERING ASSISTANT REVIEWED: CRISSA RICA E. BARIL, ENGINEER IV	SUBMITTED: LEONARDO L. LINGAN CHIEF, WATER PROJECTS DIVISION BUREAU OF DESIGN DATE:	RECOMMENDING APPROVAL: EDWIN C. MATANGUIHAN OIC-DIRECTOR BUREAU OF DESIGN DATE: FEB 06 2023	(SEE COVER SHEET) ERIC A. AYAPANA ASSISTANT SECRETARY FOR INFORMATION MANAGEMENT AND TECHNICAL SERVICES DATE:	APPROVED: (SEE COVER SHEET) MAXIMO L. CARVAJAL UNDERSECRETARY FOR INFORMATION MANAGEMENT AND TECHNICAL SERVICES DATE:	SET NO. STD 07 | 10 SHEET NO. 7



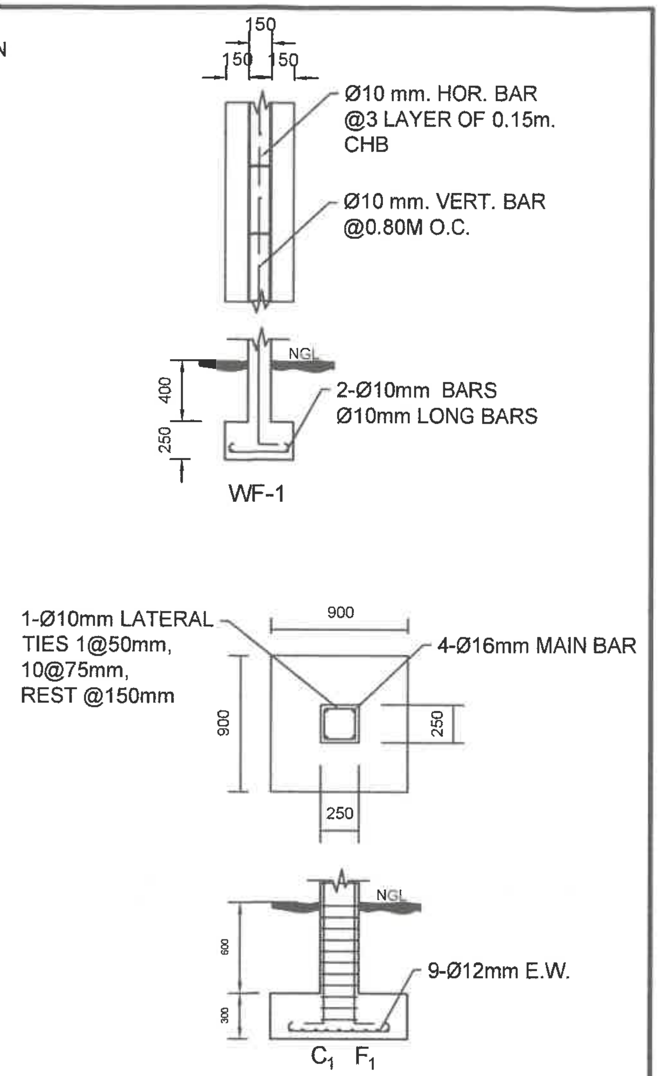
1 FLOOR PLAN
SCALE: 1:80m



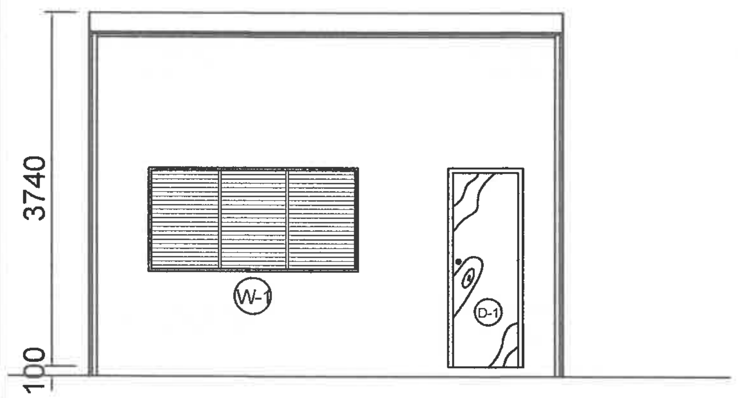
2 FOUNDATION PLAN
SCALE: 1:80m



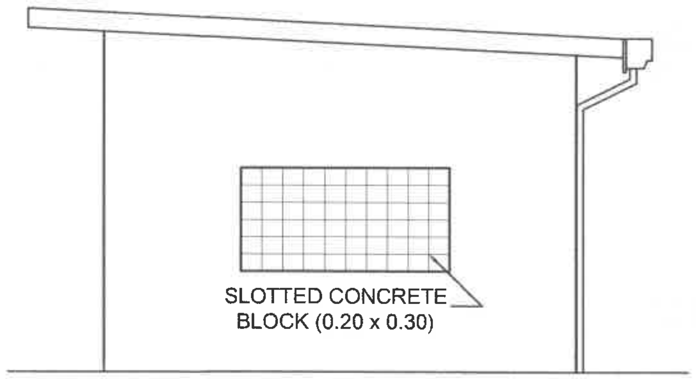
3 ROOF FRAMING PLAN
SCALE: 1:80m



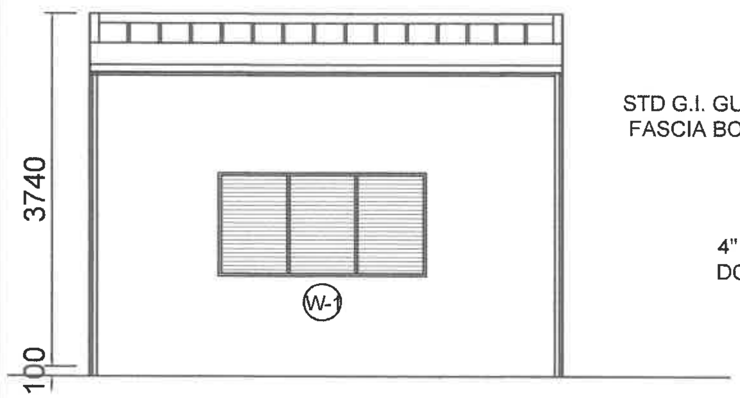
4 FOOTING-COLUMN DETAIL
SCALE: 1:50m



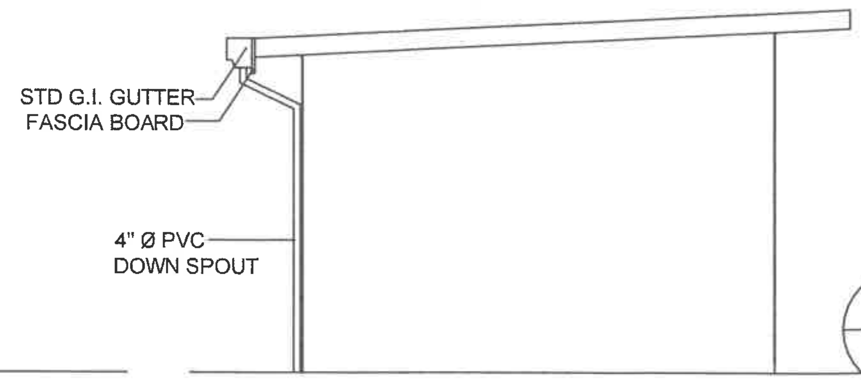
6 FRONT ELEVATION
SCALE: 1:80m



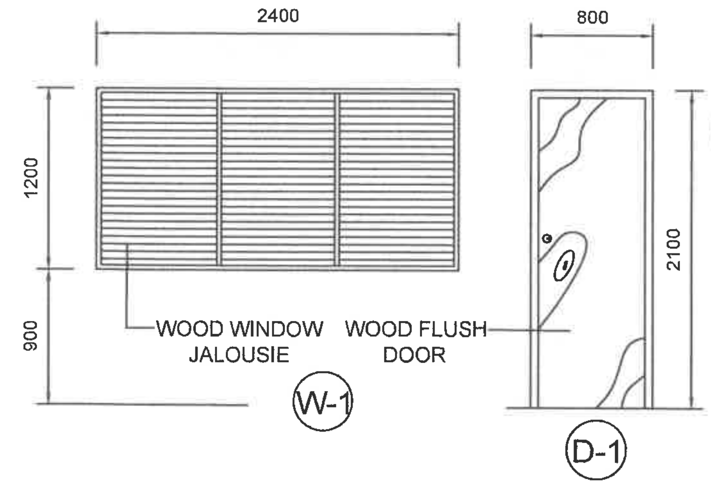
7 RIGHT SIDE ELEVATION
SCALE: 1:80m



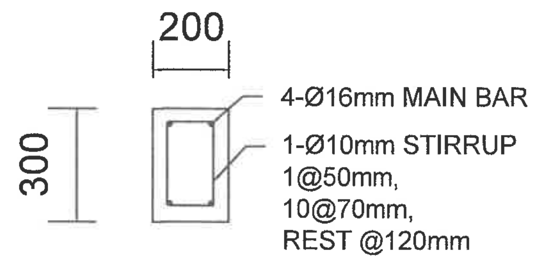
8 REAR ELEVATION
SCALE: 1:80m



9 LEFT SIDE ELEVATION
SCALE: 1:80m



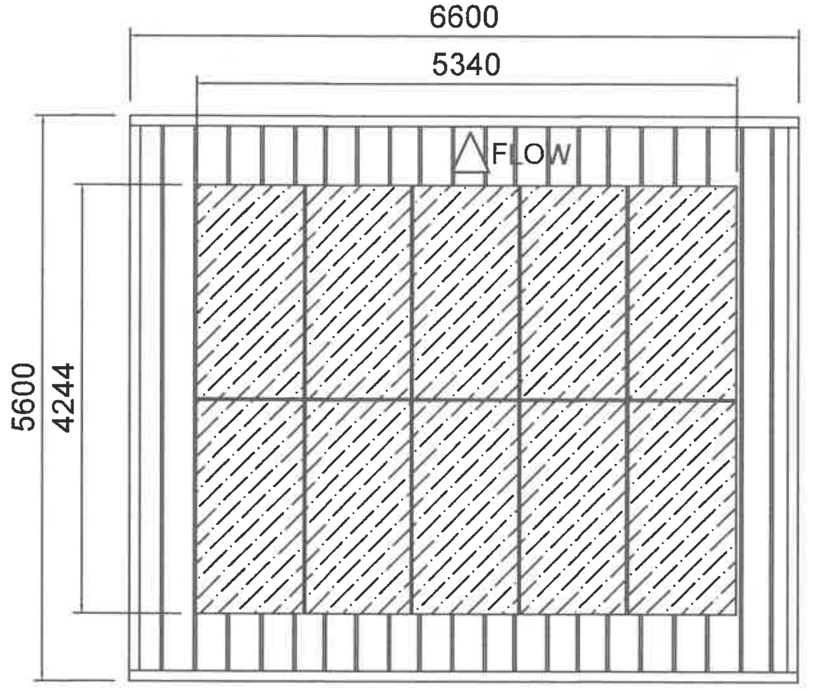
10 DOOR & WINDOWS SCHEDULE
SCALE: 1:50m



5 BEAM DETAIL
SCALE: 1:50m

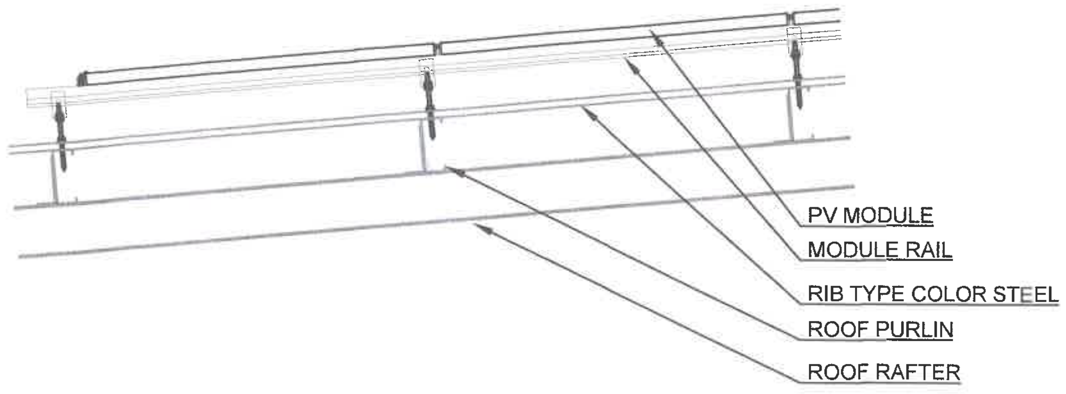
NOTE: THE PROVIDED POWER HOUSE DIMENSIONS ARE JUST THE MINIMUM. DIMENSIONS MAY VARY BASED ON THE ACTUAL LOT AREA. SIZES OF FOOTING AND OTHER STRUCTURAL MEMBERS SHOULD BE SUPPORTED BY STRUCTURAL ANALYSIS BASED ON GEOTECHNICAL INVESTIGATION REPORT.

REPUBLIC OF THE PHILIPPINES DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS BUREAU OF DESIGN MANILA	SHEET TITLE: POWER HOUSE DETAILS	SHEET CONTENTS: FLOOR PLAN, FOUNDATION PLAN, ROOF FRAMING PLAN, FRONT/REAR/LEFT/RIGHT ELEVATION, FOOTING AND COLUMN DETAIL, BEAM DETAIL, DOOR & WINDOWS SCHEDULE
PREPARED: GIAN PAOLO C. RABACAL, ENGINEER II; MARK JOSEPH L. RIVERA, ENGINEER III	DRAFTED: JOSELITO P. DELA ROSA, JR, ENGINEERING ASSISTANT	REVIEWED: CRISSA RICA E. BARIL, ENGINEER IV
SUBMITTED: LEONARDO L. LINGAN, CHIEF, WATER PROJECTS DIVISION, BUREAU OF DESIGN; DATE:	RECOMMENDING APPROVAL: EDWIN C. MATANGUIHAN, OIC-DIRECTOR, BUREAU OF DESIGN; DATE: FEB 06 2023	(SEE COVER SHEET) ERIC A. AYAPANA, ASSISTANT SECRETARY FOR INFORMATION MANAGEMENT AND TECHNICAL SERVICES; DATE:
APPROVED: (SEE COVER SHEET) MAXIMO L. CARVAJAL, UNDERSECRETARY FOR INFORMATION MANAGEMENT AND TECHNICAL SERVICES; DATE:	SET NO.: STD 08 10	SHEET NO.: 8



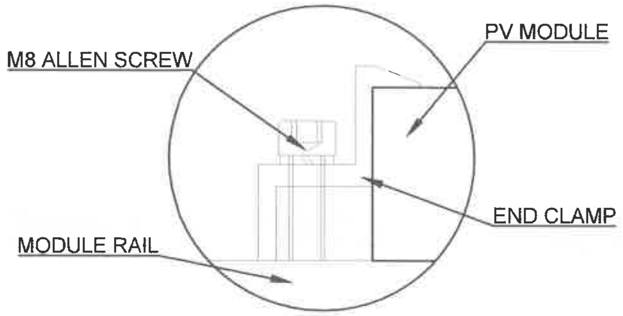
1 ON ROOF PV SOLAR PANEL PLAN

SCALE: 1:75m

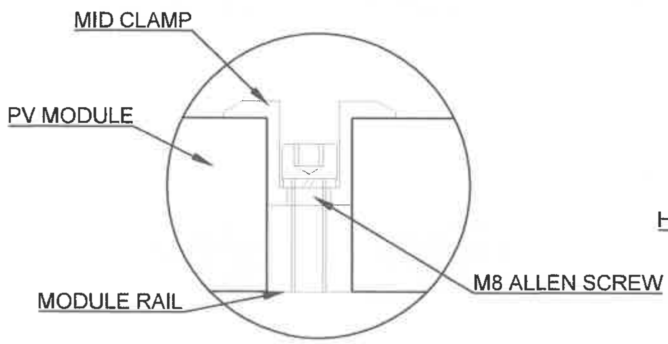


2 ON ROOF PV SOLAR PANEL CONNECTION

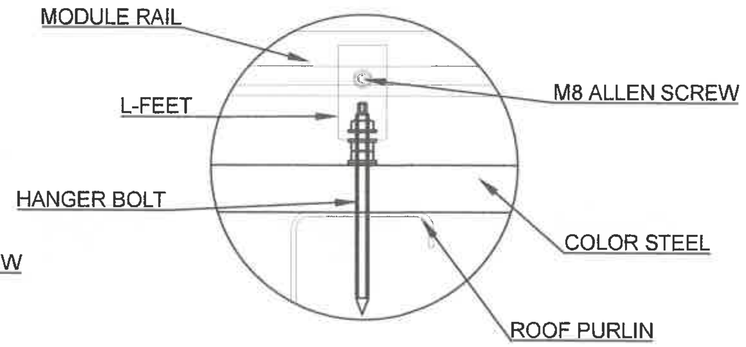
SCALE: 1:75m



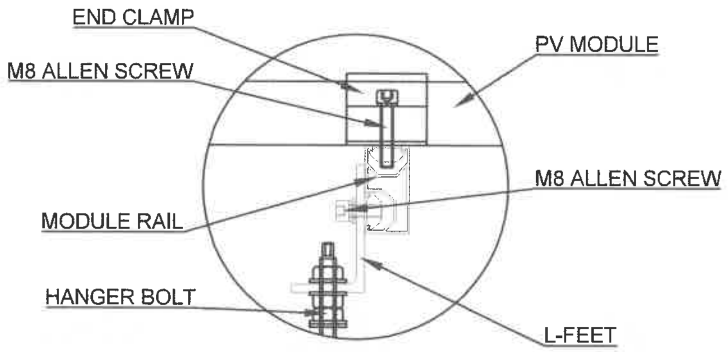
Detail "1"



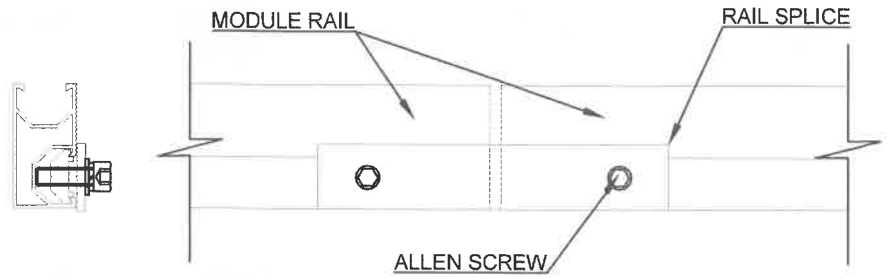
Detail "2"



Detail"3"



Detail "4"



Detail "Rail Splice"

3 MOUNTING BRACKET DETAILS

SCALE: 1:100m

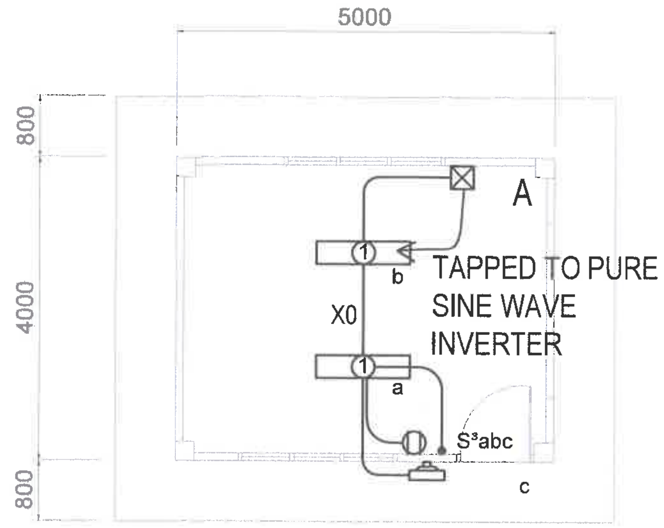
REPUBLIC OF THE PHILIPPINES DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS BUREAU OF DESIGN MANILA	SHEET TITLE: ROOF PV SOLAR PANEL DETAILS	SHEET CONTENTS: ON ROOF PV SOLAR PANEL PLAN CONNECTION DETAIL MOUNTING BRACKET DETAILS	PREPARED: GIAN PAULO G. ABACAL, ENGINEER II MARK JOSEPH L. RIVERA, ENGINEER III DRAFTED: JOSELITO P. DELA ROSA, JR, ENGINEERING ASSISTANT REVIEWED: CRISSA RICA E. BARIL, ENGINEER IV	SUBMITTED: LEONARDO L. LINGAN CHIEF, WATER PROJECTS DIVISION BUREAU OF DESIGN DATE:	RECOMMENDING APPROVAL: EDWIN C. MATANGUIHAN OIC-DIRECTOR BUREAU OF DESIGN DATE: FEB 06 2023	(SEE COVER SHEET) ERIC A. AYAPANA ASSISTANT SECRETARY FOR INFORMATION MANAGEMENT AND TECHNICAL SERVICES DATE:	APPROVED: (SEE COVER SHEET) MAXIMO L. CARVAJAL UNDERSECRETARY FOR INFORMATION MANAGEMENT AND TECHNICAL SERVICES DATE:	SET NO. STD 09 10	SHEET NO. 9

LEGEND:

- A - AUTOMATIC AC CIRCUIT BREAKER 20AF, 2P, 240 VOLTS, 15AT IN NEMA 1 ENCLOSURE
- B - AUTOMATIC AC CIRCUIT BREAKER 225AF, 2P, 240 VOLTS, 125AT IN NEMA 1 ENCLOSURE
- C - AUTOMATIC DC CIRCUIT BREAKER 225AF, 2P, 240 VOLTS, 150AT IN NEMA 1 ENCLOSURE
- D - AUTOMATIC DC CIRCUIT BREAKER 400AF, 2P, 240 VOLTS, 300AT IN NEMA 1 ENCLOSURE
- 450W SOLAR MONOCRYSTALLINE PANELS OR APPROVED EQUAL
- SOLAR CHARGE CONTROLLER (MAXIMUM POWER POINT TRACKING) OR APPROVED EQUAL
- PURE SINE WAVE INVERTER OR APPROVED EQUAL
- LITHIUM-ION BATTERY OR APPROVED EQUAL
- MANUAL TRANSFER SWITCH
- 5HP, 1Ø, 230V, 60Hz., AC, SUBMERSIBLE PUMP MOTOR
- ONE (1) - 18W, 230V, T5 LED TUBE & BOX TYPE SET
- ONE (1) - 20W, 230V, LED FLOODLIGHT
- DUPLEX CONVENIENCE OUTLET, GROUNDING TYPE (20AMPS, 250VOLTS)
- S³abc - 3 SINGLE-POLE WALL SWITCHES ON ONE SWITCH PLATE (10AMPS, 250VOLTS)

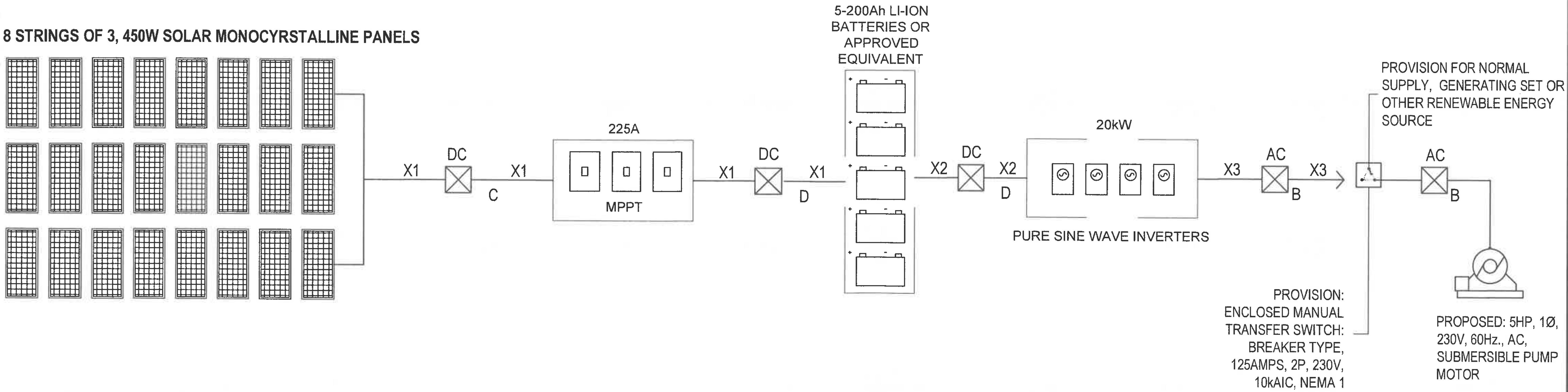
SCHEDULES OF WIRES IN CONDUIT

X0	2- 3.5 mm² THHN IN 15mm Ø PVC.
X1	1- 50 mm² PV CABLE
X2	1 - 60 mm² PV CABLE
X3	2 - 30 mm² THHN + 1-8.0mm² THHN (G) IN 40mm Ø RSC.



1 POWER HOUSE LIGHTING LAYOUT

SCALE: 1:100m



1 SINGLE LINE DIAGRAM

SCALE: NTS

REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
BUREAU OF DESIGN
MANILA

SHEET TITLE:	SHEET CONTENTS:	PREPARED:	SUBMITTED:	RECOMMENDING APPROVAL:		APPROVED:	SET NO.	SHEET NO.
SINGLE LINE DIAGRAM	LINE DIAGRAM SCHEDULE OF WIRES IN CONDUIT PUMP HOUSE LIGHTING LAYOUT	...ERAN, ENGINEER III DRAFTED: ...BRYAN T. ...LAN, ENGINEER REVIEWED: ...ELIO T. EVANGELISTA, JR., OIC-SECTION CHIEF	ERIBERTO B. SIOSON CHIEF, BUILDINGS DIVISION BUREAU OF DESIGN DATE:	EDWIN C. MATANGUIHAN OIC-DIRECTOR BUREAU OF DESIGN DATE: FEB 06 20..	(SEE COVER SHEET) ERIC A. AYAPANA ASSISTANT SECRETARY FOR INFORMATION MANAGEMENT AND TECHNICAL SERVICES DATE:	(SEE COVER SHEET) MAXIMO L. CARVAJAL UNDERSECRETARY FOR INFORMATION MANAGEMENT AND TECHNICAL SERVICES DATE:	STD 10 | 10	10