Republic of the Philippines
ZAMBOANGA CITY WATER DISTRICT
Pilar Street, Zamboanga City

TECHNICAL SPECIFICATIONS

FOR THE

PROPOSED 300 CU.M REINFORCED CONCRETE GROUND TANKS AT BALUNO & BANDERA-DULIAN FOR DUMALON WATER SYSTEM

DESIGN DIVISION
ENGINEERING & CONSTRUCTION DEPARTMENT
TECHNICAL SERVICES GROUP

JULY 2024

VER. 1.0

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BACKGROUND

The Dumalon Water System Project aims to provide clean and potable water supply services for the waterless barangays located in elevated areas in the west coast of the city particularly at Barangays Baluno, Capisan, Dulian as well as the improvement of services at its neighboring barangays such as Calarian, Cawit, Malagutay, San Roque, Sinunuc and Cabatangan. In the Dumalon Water System project was constructed in phase, the other phase of the water system is the construction of Storage Facility. The purpose of the proposed storage facilities or the storage tanks is to store water during off-peak and distribute during peak demand or during intermittent of water supply/source due to maintenance or high turbidity and the other purpose is to release air in the system and to provide pressure to its distribution areas.

The ZCWD management conceptualized this project – the construction of two units - three hundred cubic meter (300 cu.m.) reinforced concrete ground tank at Barangay Baluno to serve Baluno, Cawit and Tulungatung, and at Bandera, Barangay Dulian to serve Capisan, Dulian, portion of Calarian, Malagutay, San Roque, Sinunuc and Cabatangan.

The project is comprising of the construction of reinforced concrete tanks, the perimeter fence, the construction of guard house, operator's room and installation of other appurtenances. Each three hundred (300) cu.m. concrete tank capacity is estimated to fill by 5-6 hours and estimated to consume (with shutdown Dumalon water source) by 3-4 hours.

With the construction of this facilities, the water services in the service areas mentioned will be improved, the duration of water interruption due to high turbidity brough by heavy rains will be lessen or may be eliminated at all and also the water source/water production will be maximized.

I. BIDDING REQUIREMENTS

1.1. All eligibility documents shall conform to the requirements stipulated in the Republic Act 9184 & its Implementing Rules and Regulation.

1.2. Statement of the bidder's Single Largest Completed Contract (SLCC) similar to the contract to be bid shall refer to CONSTRUCTION OF WATER SUPPLY SYSTEM particularly construction of reinforced concrete tanks.

1.3. For single contractor, PCAB LICENSE shall be in compliance with the DTI PCAB Categorization Table, Board Resolution No. 201 Series of 2017. For this project, the PCAB License shall be Small B with License Category C & D with Classification either General Engineering (GE-4 Water Supply) or General Building (GB-3 Water Treatment Plant & System)

1.4. Joint Venture bidders' eligibility requirements for infrastructure projects shall be in accordance with the section 23 of the Updated Revised IRR of RA 9184.

1.5. The Bidder may subcontract portions of the Project to the extent allowed by the Procuring Entity as stated in the Philippine Bidding Documents (PBD), but in no case more than fifty percent (50%) of the Project. All subcontracting arrangements should be disclosed at the time of bidding, and subcontractors shall be identified in the bidding documents submitted by the eligible bidder. Subcontractors shall also pass the eligibility check for the portions of the contract that they will undertake. However, the Contractor may also identify its subcontractor during the contract implementation stage. Subcontractors identified during the bidding may be changed during the implementation of this Contract. Subcontractors must submit the documentary requirements under Section 23.1 of the 2016 revised IRR of RA No. 9184 and comply with the eligibility requirements. Subcontracting of any portion of the Project does not relieve the Contractor of any liability or obligation under the Contract. The Contractor will be responsible for the acts, defaults, and negligence of any subcontractor, its agents, servants, or workmen as fully as if these were the Contractor's own acts, defaults, or negligence, or those of its agents, servants, or workmen.

II. GENERAL SPECIFICATIONS

2.1. The pipe laying components of this project shall be implemented in accordance with the latest established standards set by LWUA and as indicated in the plans and bill of quantities. While the backfilling, compaction, asphalt and concreting works shall follow the latest edition Department of Public Works & Highways (DPWH) Standard Specifications for public works & highways following its schedule of Minimum Test Requirements.

In the case of slight inconsistencies between the plans provided and LWUA standards, the discretion shall be based depending on the complexity of the situation and on the decision of ZCWD project in-charge (Technical Services Group)

2.2. Leakages on the ZCWD existing physical asset that occurs in the course of the project's activities, shall be computed with a corresponding amount of the volume of water that continuously went to leak multiply by the water rates to be determined by the ZCWD Water Crisis Act Assessment Committee and shall be deductible against the monies due to the Contractor as well as the manpower, materials and equipment that will be used in the leak repair shall also be shouldered by the Contractor, this is in accordance with the Section 8 in relation to Section 11 of RA 8041 otherwise known as the Water Crisis Act. The volume of water wasted during the leak shall be computed by means of Torricelli's Theorem as follows:

$Q = C_d AV$ where $V = \sqrt{2gh}$, (Velocity of water)

Q = flow of leakage
g = 9.81m/s^2 (gravity in S.I.)
h = pressure head (pressure within the area)
A = area of opening (leak opening)
Cd = coefficient of discharge (average)

Volume of leak = Q x Duration of Leak before it was completely repaired

2.3. Any equipment breakdown or damaged during the implementation of the project shall subject to immediate replacement at the cost of the contractor as this will not toll the running of the period to complete the works called for under this Technical Specifications. Delays will be subjected to liquidated damages provided in Section 68 and Annex E of the Updated Revised IRR of RA 9184.

2.4. The Procuring Entity has the authority to suspend the work wholly or partly by written order for such period as may be deemed necessary due to the following:

2.4.1. Force majeure or any fortuitous event;
2.4.2. Failed on the part of the contractor to:
   a. Correct bad conditions which are unsafe for worker or for the general public;
   b. Carry out valid orders given by the Procuring Entity;

c. Perform any provisions of the contract; or
d. Adjustment of plans to suit field conditions as found necessary during construction.

2.5. The contractor shall furnish As-Built Plan as part of the requirement for issuance of Completion Certificate and Final Billing payment. Submission of the project as built layout is likewise a requirement for project that has stopped implementation due to arbitration or court litigation or the contract for the project has been terminated.

2.6. The contractor's site engineer shall prepare and submit a daily report reflecting the following information with concurrence of this Office Project In-Charge:

- Weather condition
- Activities for the day reflecting all the detail of the actual works performed. (It shall show the plan vs. actual)
- Breakdown of utilized equipment
- Breakdown of manpower
- Materials utilized and delivered on site
- Any other details relevant to the executed activities.

2.7. In cases where the delay reaches 5% of the planned activities, the contractor shall submit a CATCH-UP PLAN the following day reckoned from the date of the delay incurred. The "catch-up plan" shall cover the left-behind activities of the preceding week and the remaining works.

2.8. All pipe materials and appurtenances to be used for this contract shall be inspected by the ZCWD Engineering & Construction Department prior acceptance by the ZCWD project engineer. Manufacturers and Material Testing Certificate from government accredited testing laboratory shall be submitted to this effect. Failure to comply with this provision, the implementing unit-Mainline Expansion & Rehabilitation Division (MERD) shall have the right to order "REMOVE AND REPLACE" the said materials at the expense of the contractor while the period to complete the project shall continue to run and without time extension. For restoration materials to be tested in Zamboanga City: It must be witnessed by the ZCWD Engineer together with the Contractor or the Contractor's representative during sampling and actual testing.

2.9. The winning bidder/contractor shall provide Materials Engineer, who shall be present during the inspection of pipe materials and appurtenances and testing of construction materials.

2.10. The contractor cannot proceed with the next work item unless they can present that the materials indeed passed the requirements/specifications, in which case, the project engineer has the right to demand from the contractor, otherwise, the project engineer may order the stoppage of the work portion where the construction materials did not pass the specifications while the period to complete the project shall continue to run.

2.11. Material Testing for Structural Concrete, Reinforcements and Structural Steel, Pavement Restoration items is required as per testing standard of DPWH (Department of Public Works & Highways).

2.12. All Items of Works for this project shall include all the necessary equipment, manpower and materials to implement and to complete it; and this shall be considered and anticipated by the Contractor in their financial bid offer. Hence, any additional equipment, manpower and/or materials which have been used in the completion of any Item of Work shall be at no extra cost to ZCWD. Also, items/materials / equipment / tools in the bid that was not utilized in the project shall be subject for deduction.

2.13. The contractor shall also prepare a Contractor's Environmental Management Plan (CEMP) that shall detail the specifications for dust control, erosion and sediment control, avoidance of casual standing water, management of solid wastes, workers' camp sanitation, pollution from oil, grease, fuel spills, and other materials due to the operation of construction machineries, safety and traffic management, avoidance of inconveniences to the public, air and noise pollution control. It shall also include guidance on the proper design of the construction zone, careful management of stockpiles, vegetation, topsoil, and vehicles and machinery. The contractor shall also designate its Construction Pollution Control Officer who shall monitor compliance with the conditions of the project's Environmental Compliance Certificate (ECC) during the construction phase and submit a Self-Monitoring Report of its compliance to the CEMP to ZCWD every month.

2.14. Water service interruption schedule for interconnection works shall be coordinated and approved by the ZCWD management. Interruption notice shall strictly follow the LWUA Memorandum Circular No. 005-18, a Circular requiring the Local Water Districts to announce the scheduled water service interruptions at least three (3) days before the scheduled interruption through any means as stated in the said Circular. Hence, the Contractor shall be prepared with the necessary manpower, equipment and materials prior the request for water service interruption and shall consider giving ample time for the interruption request to be assessed, evaluated and approved by ZCWD prior the minimum three (3) days posting of notice.

2.15. The Bill of Quantities (BOQ) prevails in all issues relating to pay items of work. The contractor shall supply the needed materials, equipment & manpower to complete the quantity stated in the BOQ with specifications as stated herein. For deficiency in the contractor's detailed estimate, the contractor shall bear the expenses for the deficiency made in the detailed estimates (materials, manpower or equipment) to complete the quantity stated in the BOQ.

III. PREPARATION OF BILL OF QUANTITIES & DETAILED ESTIMATES & PROJECT IMPLEMENTATION

3.1. FEES AND PERMITS

Fees and Permits shall include obtaining all permits and the Environmental Compliance Certificate (ECC).

3.1.1. The ZCWD shall process the application for **Special Use Agreement in Protected Areas (SAPA)**. The Fees to be paid shall be part of the OCM of this project and shall be chargeable to the contractor during the progress billing. The Engineering & Construction Department of the ZCWD shall gather the necessary data/requirements for the application of SAPA.

3.1.2. Also, other necessary permits – like Building Permit, clearances and performance bond with the DPWH, City Office, DENR, Office of the Building Official, and national government clearances and other documents necessary for the implementation of the project including incidental expenses shall be borne and processed by the contractor in coordination with the implementing unit of ZCWD except for the ECC which shall be processed by the ZCWD and to be paid by the contractor. The expenses for the permits and ECC shall be included & chargeable to in the OCM, hence shall not be a separate pay item.

3.1.3. The affected barangays and stakeholders must all be well-informed and documented through writing as to the definite date of TAKE-OFF.

3.1.4. Obstructions concerning electrical light post, drainage, telecommunication underground wirings, pavement, water and sewer pipeline, etc. shall be coordinated by the contractor with the concerned agencies in coordination with the Technical Services Group of ZCWD.

3.1.5. Further, the contractor shall process the application for permanent electrical connection for the two facilities at Baluno & Bandera, Dulian, under the name of the Zamboanga City Water District and shall be turned over to the ZCWD upon project completion.

3.2. MOBILIZATION/DEMOBILIZATION

Mobilization/ Demobilization shall include the necessary arrangement to mobilize initial activities on site such as; preparation of the working area at site, establishing of communication facilities, on-site office administration office, on-site storage facilities, implementing security requirements and health protocols in the project site as required for the proper performance and completion of the work. Upon demobilization, all restored area must be cleared from debris, tools, equipment, barricades, excavated materials and all other supplies that were used during project implementation. Dismantling all temporary storage facilities, scaffoldings, and all other

temporary office facilities for further arrangement and turnover. The Contractor shall haul or move the equipment, tools and demolished materials from the laboratory (project site) to the destination which is to be determined by the ZCWD Engineer to clear the site and shall return only the necessary items to its origin upon project completion.

3.3. TEMPORARY FACILITIES

Temporary facilities include the construction of site facilities and other necessary components to complete the job at Baluno & Bandera, Dulian. The detail for temporary facilities is reflected in the detailed engineering plan. However, the contractor may construct a larger temporary facilities than what is reflected in the plan should deemed necessary without additional cost to the ZCWD.

3.4. CONSTRUCTION SAFETY AND HEALTH

The contractor shall process and seek the approval from the Department of Labor and Employment (DOLE) for the **Construction Safety and Health Program** for this project. This item shall include the provision of the **Safety Officers**, the provision of warning devices, safety and warning signage, barricades, first aid kit and personal protective equipment (PPE) for the workers.

3.4.1. Regardless of project suspension and any impediments, the contractor shall maintain the safety measures and cleanliness at any of the working areas of the project.

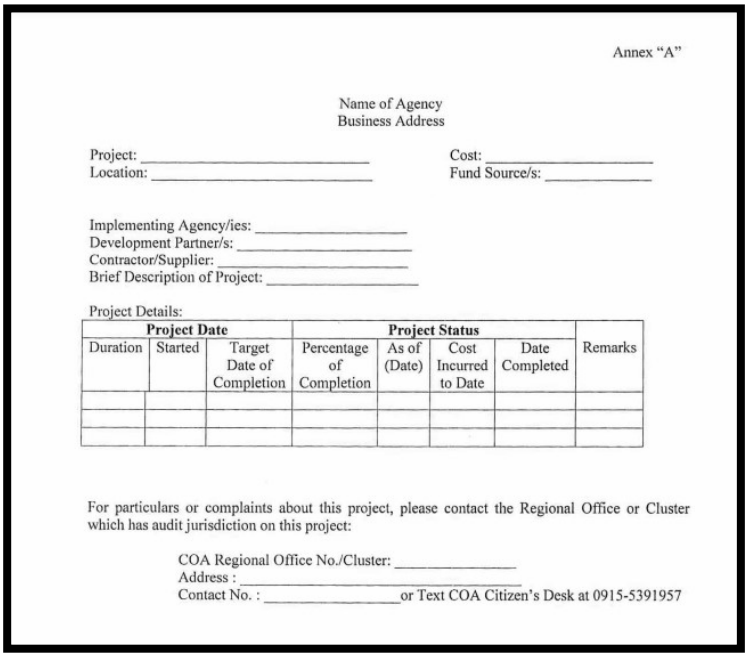
3.4.2. The contractor shall implement the DOLE approved Construction Safety and Health Program in compliance with DOLE D.O. No. 13, Series of 1998.

3.5. CONSTRUCTION OF PROJECT BILLBOARD/SIGNAGES

This item of work includes the construction of at least two (2) sets project signages & billboards by the contractor at Baluno and Bandera Dulian, placed on-site in accordance with the guidelines as specified in COA Circular No. 2013-044 dated Jan. 30, 2013. The frame for bill boards may be made from coco lumber or any lumber as long as the same shall stand for the entire duration of project implementation.

For infrastructure projects, a tarpaulin project signboard must be suitably framed for outdoor display at the project location, and shall be posted as soon as the award has been made. The design and format of the project signboard tarpaulin, as shown in Annex "A" of the said COA Circular shall have the following specifications:

(See next page for specifications)



Annex "A"

Name of Agency
Business Address

Project: _____ Cost: _____
Location: _____ Fund Source/s: _____

Implementing Agency/ies: _____
Development Partner/s: _____
Contractor/Supplier: _____
Brief Description of Project: _____

Project Details:

Project Date			Project Status				Remarks
Duration	Started	Target Date of Completion	Percentage of Completion	As of (Date)	Cost Incurred to Date	Date Completed	

For particulars or complaints about this project, please contact the Regional Office or Cluster which has audit jurisdiction on this project:

COA Regional Office No./Cluster: _____
Address : _____
Contact No. : _____or Text COA Citizen's Desk at 0915-5391957

Tarpaulin, white, 8ft x 8ft;
Resolution: 70dpi
Font: Helvetica;
Font Size: Main Information – 3"
Sub-Information- 1"
Font Color: Black

3.6. FINAL STAKING/LAYOUTING/ LINE & GRADE

This item includes the staking, lay-outing the line and grade of pipeline components of the project. The pipeline & facilities layout shall be in accordance with the detailed engineering plan and based on the actual site conditions. The boundary for the project site/fence as reflected in the detailed engineering plan shall be surveyed and identified by the Technical Services Group as prior the construction.

3.7. PIPELINE EXCAVATION

This shall include the removal of materials of whatever nature encountered including all obstructions of any nature that would interfere with the proper execution and completion of the pipe laying. The removal of the said materials shall conform to the lines and grades shown in the plan.

3.7.1. No excavation shall be allowed when the pipes, fittings and appurtenances intended for the segment is not yet delivered.

3.7.2. Trench shall be backfilled at the end of day's activity. There shall be no open excavation left before leaving the site otherwise open trenches shall be covered with steel plate. The excavated areas shall be passable every end of the day.

3.8. PIPELINES & APPURTENANCES, AND FITTING OF BENDS

This shall include installation of the pipes and fittings into the lined and graded trench with the application of backfilling through the utilization of the native materials up to the pavement level intended for hydrotesting activities. In addition, the cost of installation of thrust blocks, included in this item as reflected in the detailed

engineering plans. PVC Pipes (PNS 65 Series 8/Class 150 Standards) and its fittings are all specified with push-on joints. G.I. Pipes shall be PNS26, Heavy Gauge Standard. Interconnection works shall be in accordance with the detailed plan.

3.8.1. Pipes shall be laid on a dry trench. In cases where excavated trench is filled with water, the trench shall be dried up using equipment such as water pump before installing the pipe. Both ends of the pipes shall be covered with metal sheets or equivalent every after installation in the trench to avoid intrusion of the contaminants.

3.8.2. Water pumps and other equipment shall be included in the interconnection works and pipe fitting works item of work, hence, the same shall be subject to deductive variation order in case the actual site conditions will not require the use of such equipment.

3.8.3. During the pipelaying activity, Item 104 (a selected materials derived from the native materials) shall be backfilled as pipe envelope on the newly laid pipeline as well as the Item 200 Sub-base Course and Item 201 Base Course shall also be backfilled right after the pipe envelope and to be compacted pursuant to the DPWH standard Item 200 and Item 201. Nonetheless, the Contractor may opt to backfill the newly laid pipeline with native materials temporarily instead of Item 200 & Item 201, however, the Contractor shall not be entitled to re excavation as additional pay item as the result of the removal of native materials to install the item 200 & item 201.

3.9. HYDRO-TESTING, DISINFECTION AND FLUSHING WORKS

The includes the manpower, equipment and materials (including water) to complete this item. This item of work shall include the filling of required volume of water to attain the full carrying capacity of the pipe, application of the required testing pressure, and disinfection in works by application of the required concentration of chlorine solution up to the flushing activity. The ZCWD representative shall be present during the conduct of the this activity. The contractor may purchase the water from ZCWD for hydrotesting, disinfection & flushing works following the ZCWD approved water rates.

3.9.1. WATER PIPELINE HYDROTESTING, DISINFECTION AND FLUSHING

3.8.1.1 All pipelines shall be thoroughly flushed out with water prior to pressure and leakage tests. The pipeline shall be tested in sections after the trench is temporarily backfilled, but with joints exposed for examination except in heavily traveled roadways and prior to permanent resurfacing.

3.8.1.2 The pipeline shall not be filled with water until the following minimum curing periods have lapsed.

Concrete Thrust Blocks

a. Standard Cement 7 days
b. High Early Strength Cement 36 Hours

3.8.1.3 The pipeline shall be prepared for testing by closing valves when available, or placing temporary bulkheads or end cap in the pipe and filling the line slowly with water. During the filling of pipe and before the application of the specified test pressure, all air shall be expelled from the pipeline. To accomplish this, taps shall be made, if necessary, at points of highest elevation and after completion of the test the taps shall be tightly plugged unless otherwise specified. After the line or section thereof has been completely filled, it shall be allowed to stand under a slight pressure for a minimum of forty-eight (48 hours) to allow the escape of air from any air pockets and to allow the pipe to absorb as much water as possible.

3.8.1.4 During the testing period, all exposed pipes, fittings, valves, hydrants, joints and couplings shall be examined for leaks. If found to be cracked or defective, it shall be removed and replaced with sound material at their own expense. The pipeline shall then be refilled and all bulkheads, joints and connections shall be examined for leaks. If any are found, this shall be stopped.

3.8.1.5 The test shall consist of holding the test pressure on each section of the line for a period of two (2) hours. The test pressure at lowest point shall be 150psi the water necessary to maintain the pressure shall be measured through a water meter. The leakage shall be considered the amount of water entering the pipeline during the two-hour period test.

3.8.1.6 The allowable leakage for uPVC Pipes and ductile iron pipe shall not exceed 1.85 Liter/millimeter of the diameter of pipe per kilometer per day. Should any test of a section of pipeline disclose joint leakage greater than that permitted, the defective pipe, fitting, joint, coupling or other appurtenance shall be located and repaired. The test shall then be repeated until the leakage is within the permitted allowance.

3.8.1.7 All new water mains or extensions to existing systems or valve section of such extension or any replacement in the existing water system shall be disinfected with chlorine in accordance with AWWA Standard C601 "Standard for Disinfecting Water Mains".

3.8.1.8 The amount and concentration of chlorine solution applied shall be such as to provide a dosage of not less than fifty (50) mg per litter and shall be introduced into lines as directed by the ZCWD Site Engineer. After a contact period of twenty-four (24) hours, the chlorine residual at the end of pipelines shall not be less than twenty-five (25) mg per liter. The system shall then be **FLUSHED** with clean (potable) potable water until the residual chlorine is not greater than 0.75 mg per liter but not less than

0.20 mg per liter. All valves and appurtenances in the pipelines being disinfected shall be operated several times during the chlorine periods.

3.8.1.9 The preferred point of application of the chlorine agent is at the beginning of the pipeline, extension or any valved section and through a corporation stop inserted on the top of the laid pipe.

3.8.1.10 Should the initial treatment/ disinfection fail to result in the conditions stipulated above, the chlorination procedure shall be repeated until satisfactory results are obtained.

3.8.2 THE METHODOLOGY FOR HYDROTESTING AND DISINFECTION OF CONCRETE TANK AS PER LWUA STANDARD:

a. General

The operation of testing (leak testing) and disinfecting the reservoir shall be combined. Any leaks found after the reservoir filled shall be repaired and the disinfection procedures repeated to the satisfaction of ZCWD.

b. Cleaning

Prior to disinfecting, the reservoir shall be thoroughly cleaned by hosing down with a high pressure and nozzle of sufficient size to deliver a minimum flow of 3.15L/s (50gpm).

c. Disinfecting

A strong chlorine solution (200 mg per liter) shall be sprayed on all interior surface of the reservoir. Following this, the reservoir shall be partially filled with water to a minimum depth of approximately 30cm (1 ft.). During the filling operation, a chlorine water mixture shall be injected by means of solution-feed chlorinating device. The dosage applied to the water shall be sufficient to give a chlorine residual of at least 50mg per liter upon completion of the partial filling operation. Precaution shall be taken to prevent the strong chlorine solution from flowing back into the line supplying the water. After the partial filling has been completed, sufficient water shall be drained from the lower ends of the appurtenant piping to insure filling the lines with the heavily chlorinated water.

d. Retention Period

Chlorinated water shall be retained in the reservoir and in the appurtenant piping long enough to destroy all non-spore-forming bacteria and, in any event, for at least twenty-four (24) hours. After the chlorine-treated water has been retained for the required time, the chlorine residual in the reservoir and in the lines shall be at least 25mg per liter. All valves shall be operated while the lines are filled with the heavily chlorinated water.

e. Final Filling of Reservoir/Tank

After the chlorine residual has been in accordance Clause C, the water level in the reservoir shall be raised uniformly to approximately 30 cm (1-ft) below the overflow level by the addition of potable water. Before final filling is commenced, the quantity of heavily chlorinated water remaining in the

reservoir after filling the piping shall be sufficient when the water level is raised to its final elevation to produce a chlorine residual of between 1 mg per liter and 2 mg per liter. After the reservoir has been filled, the strength of the chlorinated water in the reservoir shall be determined. If the chlorine residual is less than 1 mg per liter, an additional dosage shall be applied to the water in the reservoir, if the chlorine residual is greater than 2 mg per liter in the reservoir, the reservoir shall be partially emptied and additional potable water added. In no case shall water be released through the drain line prior to the expiration of the required retention period.

f. Leakage Allowance of Concrete Reservoir

After the reservoir has been filled continuously for a period of (30) days, if leakage is such that the water surface drops more than 5.1cm (2 in.) in a 30-day period, the Contractor shall empty the reservoir to permit close examination for evidence of any cracking or other conditions that might be responsible for the leakage. Any cracks shall be "vee'd" and sealed with rubber sealant. Any evidence of leakage through joints shall be repaired to the satisfaction of the ZCWD. Following this operation, the Contractor shall again sterilize the reservoir in accordance with this section, exclusive of the spraying operation.

3.9 VALVES/FITTINGS/INTER-CONNECTION WORKS

This item of work includes the manpower, equipment & necessary materials needed to do the interconnection works as reflected in the detailed engineering plan. The interconnection works shall include the decommissioning works of the existing old pipeline in situ which has been replaced. The decommissioning works involves the permanent shutdown of the existing old pipeline by means of isolating it from the existing system.

3.9.1 All cut–ins and connections shall be done with proper tools and equipment. Whenever tapping or cutting of pipe is required, it shall be done with a tapping or cutting machine designed for the specific purpose. Before proceeding to making the cut-in or connections, all tools, equipment and materials necessary shall be ready on hand and cut-ins or/and connections done with the least inconvenience with the consumers.

3.9.2 All materials needed for this item shall be inspected and evaluated by the Engineering & Construction Department, and laid-out by the contractor before this activity will be undertaken. This is to give time for replacement and arrangement of materials before deploying on site.

3.9.3 Only manpower with experience relative e to this activity will be deployed on site. The names with their corresponding experiences that will perform this activity shall be submitted a week prior the scheduled date of interconnection for proper evaluation.

3.9.4 Should there be a discrepancy between the existing pipe, fitting sizes as reflected in the plan against the actual size, the size for the interconnection shall be done in accordance with the actual size and be subject to variation order.

3.9.5 The contractor shall see to it that the fittings & valves to be used in the interconnection works will be compatible in terms of connection, hence, requiring additional fittings in the interconnection works due to non-compatible connections may be allowed and approved by ZCWD however the additional cost shall be borne by the Contractor.

3.10 BACKFILLING & COMPACTION WORKS OF NATIVE MATERIALS

This item of work includes the backfilling of Item 104 (derived from the native materials or excavated materials) as pipe envelope pursuant to detailed engineering plan. Manpower and equipment to be used shall be included in this item of work. Materials to be used as pipe envelope shall not be included in the estimates since this will be coming from the native materials/excavated materials on site.

3.11 CLEARING AND GRUBBING

The Contractor shall clear the project site for the construction activities , should there be a need to cut tree(s), the Contractor shall coordinate and acquire the necessary permits from the concerned agencies e.i. DENR.

List of Trees present in the vicinity at Baluno:

Trees (within the proposed perimeter & ground tank):	
Mangosteen	1
Coconut	8
Mango	1
Trees along the proposed Riprap:	
Marang	3
Coconut	1
Mahogany	1

List of Trees present in the vicinity at Bandera, Dulian:

Trees (within the proposed perimeter & ground tank):	
Coconut	9
Mango	1
Guava	4
Durian	1
Larangha	1
Banana	1

3.12 EXCAVATION

This Work includes furnishing all labor, materials, equipment and incidentals necessary to perform all excavation, backfilling, filling, grading, and slope protection as shown on the Drawings.

Except when specifically provided to the contrary, excavation shall include the removal of materials of whatever nature encountered, including all obstructions of any nature that would interfere with the proper execution and completion of the work. The removal of said materials shall conform to the lines and grades shown or ordered. Unless otherwise provided, the entire construction site shall be stripped of all vegetation and debris, and such materials shall be removed from the site prior to performing any excavation or placing any fill. The Contractor shall furnish, place and maintain all supports and shoring that may be required for the sides of the excavations, and all pumping, ditching, or other approved measures for the removal or exclusion of water, including taking care of storm water and waste water reaching the site of the work from any source, so as to prevent damage to the work or adjoining property. Excess materials which have been excavated and stockpiled in selected areas on the site which meet the Specifications shall be used as much as possible for fills.

The Contractor shall furnish, put in place and maintain such sheeting and bracing as may be required to support the sides of excavations, to prevent any movement which could in any way diminish the width of the excavation below that necessary for proper construction, and to protect adjacent structures from undermining or other damage. If, in the opinion of the ZCWD's Engineer, sufficient or proper supports have not been provided, additional supports shall be put in at the expense of the Contractor. The Contractor is responsible for the sufficiency of such supports. Care shall be taken to prevent voids outside of the sheeting, but if voids are formed, they shall be immediately filled with compacted granular fill and rammed.

The Contractor shall at all times during construction, provide and maintain proper equipment and facilities to remove all water entering excavations.

Excavations shall be kept dry so as to obtain a satisfactory undisturbed subgrade foundation until the fills or structures to be built thereon have been completed to such extent that they will not be floated or damaged by allowing water levels to return to natural levels. Dewatering shall at all times be conducted in such a manner as to preserve the undisturbed bearing capacity of the sub-grade soils at proposed bottom of excavation.

Fills shall be placed as shown on the Drawings or as directed by the ZCWD Engineer. Common fill may be used as backfill against the exterior walls of structures or in other areas as designated by the Engineer. Common fill materials shall be placed in layers having maximum thickness of 300mm measured before compaction. Moisture content of the material at the start of compaction shall be at or near optimum. Unsuitable excavated materials shall be removed from the immediate site of work and disposed of by the Contractor on the ZCWD's land or as directed by the ZCWD Engineer

3.13 REINFORCED STEEL BAR GRADE 40/33

This item of works includes the fabrication and installation of all steel bars and steel tie wire, clips, supports, chairs, and spacers required for the reinforcement of concrete as shown on the Drawings. Reinforced steel bar for the reinforced concrete tank shall be grade 40 and the rest may be grade 33.

The reinforcement steel shall be deformed, new billet steel bars conforming to ASTM A615, Grade 60, 40 & 30, substantially free from mill scale, rust dirt, grease or other foreign matter by this Standard Specification. Reinforcement steel shall be accurately fabricated to the dimensions shown on the shop drawings and bar schedules (if any) and in accordance with the details specified in the National Structural Code of the Philippines. The installation of all reinforcing bars shall be secured against displacement with annealed iron wire ties of minimum GA#16 GI Wire (i.e. 1.39mm diameter) or suitable clips at the intersections. All reinforcing bars in slabs shall be supported on concrete cubes or chairs of the correct height, containing soft steel wires embedded therein for fastening to the reinforcement steel. Such spacers or chairs shall have a minimum compressive strength of 24 MPa.

3.14 STRUCTURAL CONCRETE CLASS A

This Item shall consist of furnishing, bending, placing and finishing concrete in all structures except pavements in accordance with this Specification and conforming to the lines, grades, and dimensions shown on the Plans. Concrete shall consist of a mixture of Portland Cement, fine aggregate, coarse aggregate, admixture when specified, and water mixed in the proportions specified or approved by the Engineer. This item of works includes furnishing all labor, materials, equipment and incidentals necessary for the construction of all structural concrete work pursuant to the detailed engineering plan. All **formworks & scaffolding works** to form the structural concrete are already included in this item – (405) Structural Concrete Class A.

The Contractor shall be responsible for the performance of all tests and inspection required by to check & verify the specification of concrete. However, the ZCWD reserves the right to perform any or all prescribed tests and inspection where such is deemed necessary to ensure that delivered materials conform to the specifications, and shall be paid for by the Contractor. The Contractor shall furnish the ZCWD certified copies of records showing that each material has been pre-tested, and complied with all applicable requirements of this Standard. The Contractor shall, at his own expense, replace all rejected materials for failure to comply with this Specification.

3.14.1 Materials

Cement: Cement shall be Portland Cement conforming to ASTM C150, Type I. However, the Contractor shall use Cement Type II if the soil at the project site contains moderate amount of sulfate. The Specification of the Cement shall comply with the ASTM C150 and the DPWH Standards.

3.14.2 Aggregates

Fine aggregate & coarse aggregate shall be washed inert natural sand conforming to ASTM C33, and shall range in size pursuant to DPWH standard.

3.14.3 Water

Water used in mixing, curing or other designated application shall be reasonably clean and free of oil, salt, acid, alkali, grass or other substances injurious to the finished product.

3.14.4 Admixture

Admixtures conforming to ASTM C494 may be used upon approval of the Engineer in writing, to control the time setting, to effect water reduction and to increase workability. Proportioning and mixing shall be as recommended by the manufacturer. The contractor shall use waterproofing admixture in the construction of the concrete ground tanks.

3.14.5 Quality of Concrete

Before placing any concrete, the Contractor shall discuss with the Engineer the source of materials and concrete he proposes to use. Samples of aggregate and cement shall be furnished to the Engineer for testing. The Contractor shall submit to the Engineer, his proposed design mix for evaluation. No excessively wet concrete will be permitted. Concrete delivered to the site or prepared on site having a slump more than that requirement will be rejected.

3.14.6 Forms

Forms shall be made of either steel or new lumber approved by the Engineer and shall be free from roughness and imperfections, substantially watertight, adequately braced and tied to prevent movement and displacement when concrete is placed and vibrated. No wooden spreaders will be allowed in the concrete. Forms shall be thoroughly cleaned before using and shall be treated with approved non-staining oil or other approved material and allowed to dry before placement of the reinforcing steel.

3.14.7 Execution

Ready-mixed or transit-mixed concrete shall conform to ASTM C94. The concrete supplier shall furnish to the Engineer for his approval, the dry proportions to be used, with evidence that these will produce concrete of the quality specified. Ready-mixed or transit-mixed concrete shall be transported to the site in watertight agitator or mixer trucks. Discharge at the site shall be within one (1) hour after the cement was first introduced into the mix.

All debris, dirt and water shall be removed from the forms. Forms, reinforcement steel, pipes, conduits, sleeves, anchors and other embedded items shall be inspected and approved by the Engineer before placing any concrete. The Contractor shall advise the Engineer of his readiness to proceed at least 12 hours before each placement of concrete.

Concrete shall not be placed in water or stay submerged within 24 hours after placing, except for curing nor shall running water be permitted to flow over concrete surfaces within four days after the placing of concrete.

Where waterstop type construction joints are provided, the concrete shall be properly worked by rodding and vibrating around the waterstops to produce watertight joints, before any concrete is poured on the upper surfaces, particularly in the case of horizontal waterstops in slabs.

Waterstops shall be accurately positioned and securely held in place, and shall be protected at all times to prevent damage or displacement. Any damage to, or displacement of waterstops shall be corrected by the Contractor to the satisfaction of the Engineer

During and immediately after placing the concrete, compaction shall be carried out by experienced operators using high-speed internal mechanical vibrators. Care shall be taken to ensure that vibration is continued long enough to produce optimum consolidation without segregation of the aggregates or migration of air.

All concrete work shall be properly cured. Details of the Contractor's curing procedures and curing compounds intended to be used shall be subject to the approval of the Engineer. Formed surfaces shall be thoroughly soaked with water at least twice each day until the forms are removed. Curing shall continue as specified above.

The Contractor shall not remove any forms for at least 48 hours or until the concrete has attained a strength of at least 30 per cent of the ultimate 28-day strength. This is equivalent to approximately 50-day-degrees of moist curing. Day degree represents the total number of days times the average daily air temperature in °C at the surface of the concrete, e.g. 2 days at an average temperature of 25°C equals 50 day-degrees.

Forms for beams and slabs shall not be stripped for at least 150-day degrees and supports shall not be removed until the concrete has attained at least 60% of the specified 28-day strength and is capable of safely supporting its own weight. Construction live loads shall not be placed upon it until the concrete has attained its specified 28-day strength.

Defective or honeycombed areas, as determined by the Engineer, shall be chipped down to at least 25mm deep into sound concrete by means of chisels or chipping hammers. If honeycombs exist around reinforcement steel a clear space, at least 10mm wide shall be chipped all around the steel.

Installation of reinforcing steel, pipes, sleeves, anchors and other embedded items, batching, mixing, transportation, placing, curing and finishing of concrete shall at all times be subject to the inspection of the Engineer. No concrete shall be placed without the prior approval of the Engineer.

Concrete cylinder specimens shall be taken at random by the Contractor in the presence of the ZCWD Engineer in accordance with DPWH Standards. If the strength of any core samples is less than the minimum requirements the Contractor shall strengthen or replace the portions of the structure concerned at no additional cost and to the satisfaction of the ZCWD Engineer.

3.15 INSTALLATION OF RUBBER TYPE WATER STOPPER FOR EVERY REINFORCED CONCRETE JOINTS

This Item shall consist of furnishing and installing waterstops to prevent water seepage at the expansion and construction joints of concrete structures, in conformity to the details shown on the Plans and in accordance with this Specification.

Rubber waterstops shall be furnished molded or extruded rubber with a uniform cross-section that is free from porosity or other defects. If approved, an equivalent standard shape shall be furnished.

3.15.1 Types of Water Stop that may be used in the project:

It shall be fabricated from a compound of natural rubber, synthetic rubber, or a blend of the two, together with other compatible materials. Reclaimed material shall not be used. A certification from the manufacturer showing the composition of the material shall be furnished.

Plastic waterstop shall be fabricated from a homogeneous, elastomeric plastiic compound of basic polyvinyl chloride (PVC). The compound shall contain any additional resins, plasticizers, stabilizers, or other materials needed to ensure that when the material. Is compounded it will meet the performance requirements of this Specification. Reclaimed polyvinyl chloride shall not be used. It shall be formed to a uniform cross-section that is free from porosity or other defects. If approved, an equivalent standard shape shall be furnished.

Material for waterstops shall be evaluated by visual inspection for compliance to the approved contract. Material or packaging shall be clearly marked with unique product identification or specification standard to which it is produced. Material accepted by certification may be sampled and tested at any time and if found not in conformance to the requirement of the contract. the material shall be rejected even if they are already installed in placed.

Waterstops shall be installed at the locations as shown on the approved Plans. where movement at the joints provided for. The waterstops shall be of a type permitting such movement without injury. They shall be spliced, welded, or soldered to form continuous watertight joints.

3.16 WATERPROOFING

Waterproofing shall be applied in accordance with the directions of the manufacturer of the materials and components, and the complete systems shall be fitted in the works by experienced specialist crew. Reinforced Concrete Tanks that

retained water shall be applied with approved water proofing material. Roof slab/deck of the project components shall be externally waterproofed by cementitious water proofing following the manufacturer's application procedures.

Surface Preparation:

- Thoroughly clean the surface of grease residues, degreasing agents, dust, loose components.
- The base should be cleaned of flaking elements.
- All sharp and protruding elements should be removed.
- For concrete tanks in places where the floor intersects with vertical elements (walls, columns), a fillet should be made – a small plinth made of concrete or a special tape in order to remove 90-degree angles, since it is in such places that the waterproof coating can be broken in the first place.

Waterproofing shall be food grade and shall be any of the following:

1. Cement-based waterproofing slurry or cementitious water proofing
2. Polyester reinforced Bituminous membrane
3. Elastomeric Polyurethane Membrane

The contractor shall submit the proposed type of waterproofing to ZCWD for approval prior application. The application shall be in accordance with the waterproofing manufacturer's recommendation.

3.17 MASONRY WORKS

The items of works under the Masonry includes furnishing all labor, materials, equipment and incidentals required to construct all concrete masonry unit walls including the following:

- Laying of concrete Hollow Block (CHB) walls.
- Masonry reinforcing bars for concrete blocks.
- Grouting
- Connecting wall anchors, ties, bolts and related embedded items.
- Installation of frames for doors, windows, louvers, steel lintels, and recessed fixtures.
- Plastering of mortar

The Contractor is responsible for the performance of all tests and inspection of the materials to be used in the masonry works pursuant to the DPWH standards. All perishable materials for the Work of this Section shall be delivered, stored and handled to preclude damage of any nature.

3.18 CARPENTRY WORKS

The work under this item shall consist of furnishing all required materials, fabricated woodwork, tools, equipment and labor and performing all operations necessary of the satisfactory completion of all carpentry and joinery works in strict accord with applicable drawings, details and these Specifications. The form works & scaffolding works are already included in the Item 405 Structural Concrete Class A.

Lumber of the different species herein specified for the various parts of the structure shall be well seasoned sawn straight, sundried or kiln dried and free from defects such as loose unsound knots, pitch pockets, sapwood, cracks and other imperfections impairing its strength, durability and appearance.

Ply board shall be good grade and made of laminated wood strips of uniform width and thickness bounded together with water resistant resin glue. The laminated core shall be finished both faces with select grade tan guile or red lauan veneers not less than to 2 mm thick similarly bonded to the core. The ply board of not less than 19 mm thick shall be free from defects such a split in veneer, buckling or warping.

Plywood shall conform to the requirements of the Philippine Trade Standards 631-02. Thickness of a single layer laminae shall not be less than 2 mm. The laminae shall be superimposed in layers with grains crossing at right angles in successive layers to produce stiffness. The face veneers shall be rotary cut from select grade timber.

Glue shall be from water resistant resins which, upon hardening, shall not dissolve nor lose its bond or holding power even when soaked with water for extended period. Glue in powder form be in sealed container and shall be without evidence of lumping or deterioration in quality. Nails, screw, bolts and straps shall be provided and used where suitable for fixing carpentry and joinery works. All fasteners shall be brand new and of adequate size to ensure rigidity of connections.

All materials to be incorporated in the carpentry and joinery works shall be of the quality specified in this Technical Specifications. Before incorporation in work, all materials shall have been inspected/accepted by the Engineer or his authorized representative.

Finished carpentry covers works on cabinets and fabricated wooden doors. Exposed edges of plywood or plywood for cabinets shall be provided with select grade hardwood strips, rabbeted as necessary, glued in place and secured with finishing nails. To prevent splitting, hardwood for trims shall be drilled before fastening with nails or screws.

Fabricated woodwork shall be done preferably at the shop. It shall be done true to details and profiles indicated on the Plans.

3.19 TILE WORKS

This item shall consist of furnishing all tiles and cementitious materials, tools, and equipment including labor required in undertaking the proper installation of walls and floor tiles as shown on the Plans and in accordance with this specification.

3.19.1 Materials Requirement

A. Ceramic tiles and Trims

Ceramic tiles and trims shall be made of clay, or a mixture of clay and other materials which is called the body of the tile. Tile bodies are classified by ASTM C 242 as to their degree of water absorption. Ceramic tiles and trims

are manufactured either by dust-pressed process in which the clays are ground to dust mixed with a minimum of water shape in steel dies and then fired or by plastic process in which the clays are made plastic by mixing with water, shape by extrusion or in molds and then fired.

B. Glazed Tiles and Trims
Glazed tiles and trims shall have an impervious face of ceramic materials fused onto the body of the tiles and trims. The glazed surface may be clear white or colored depending on the color scheme approved by the Engineer. Standard glazes may be bright (glossy) semimatte (less glossy) matte (dull) or crystalline (mottled and texture: good resistance to abrasion). Glazed tiles are used principally for walls; crystalline glazed tiles may be used for floors provided however that these are used as light duty floors.

C. Unglazed Tiles
Unglazed tiles shall be hard dense tile of homogeneous composition. Its clor and characteristics are determined by the materials used in the body, the method of manufacture and the thermal treatment. It is used primarily for floors and walks.

D. Trims
Trims are manufactured to match wall tile color, texture and to coordinate with it in dimension. These are shaped in various ceramic trims units such as caps, bases, coves, bullnoses, corners, angles, etc. That are necessary for edging or making a transition between intersecting planes.

E. Accessories
Accessories like some soap holders and shall be made wall mounted type with colors to reconcile with the color of the adjacent wall tiles.

F. Cement
Cement shall be portland conforming to the specification requirements defined in this specifications.

G. Sand
Sand shall be well graded fine aggregate clean river sand, free from soluble salts and organic impurities.

3.19.2 Installation

A. Before tile is applied the floor surface shall be tested for levelness or uniformity of slope by flooding it with water. Area where water ponds are filled or leveled, shall be retested before the setting bed is applied.

B. Establish lines or borders and center of the walls at the filled work in both direction to permit the pattern to be laid with a minimum of cut tiles.

C. Clean concrete subfloor then moisten but do not soak. Then sprinkle dry cement over the surface and spread the mortar on the setting bed.

D. Apply and spread mortar mix for setting bed and tamp to assure good bond over the entire area to be laid with tile.

E. Allow the setting bed to set sufficiently to be worked over then spread a bond coat over the surface and lay tile

F. Tiles shall have laid in place for at least 24 hours before grouting of the joints is started. Grouting mortar shall be white Portland cement of blended with pigments to acquire the color appropriate for the ceramic tile

G. Clean ceramic tile surfaces thoroughly as possible upon completion of grouting.

H. Rinse tile thoroughly with clean water before and after using chemical cleaners.

I. Polish surface of tile with soft cloth.

3.20 PAINTING WORKS

The Contractor shall provide all labor, material and equipment and perform all operations necessary for all painting work specified which includes the Perimeter Fence/Gate, Operator's Room, Guard House, Shed, Concrete Tank (exterior) and its color shall be decided by ZCWD.

All work shall be done by thoroughly qualified painters in a neat and workmanlike manner. All work which shows carelessness or lack of skill in execution or is defective due to any other cause will be rejected. Said work shall be redone to satisfaction of ZCWD prior to acceptance of work.

Unless specified otherwise, paint shall be applied by brush or spray. Paint shall be applied only on thoroughly clean and dry surfaces, unless specified otherwise. Paint shall not be applied in extreme heat, cold, damp or humid weather, or in dust- or smoke-laden air. Painters shall smoothen uneven surfaces, use filler/wall putty/ body filler to patch up cracks or holes on walls. Use masking tape to protect areas unnecessary for painting. Clean wall surfaces before application of paint primer. For new masonry wall apply concrete neutralizer.

Primer paint shall be Acrylic Solvent Based Primer for plasterboard, fiber cement board, concrete wall and new concrete surfaces, reduce it with Acrylic Solvent Based Reducer, if necessary, reduce it with ¼ liter per 4 liters of paint. Use plastic sheets or old newspaper to protect floors and furniture from paint splashes. Stir well before each use.

For finishes, Acrylic Solvent Based Top Coat with desired amount of Solvent Based Thermoplastic Acrylic Resin shall be applied to wall initially applied with primer coating. Acrylic Solvent Based Reducer serves as reducing agent to acrylic paint. Apply 2-3 coats of Acrylic Solvent Based Top Coat for good finish.

All metal surface shall be painted with metal primer (e.i. epoxy primer, zinc chromate) and finished with quick dry enamel or Acrylic Solvent Based.

3.21 PLUMBING WORKS/ WATER SUPPLY & DISTRIBUTION SYSTEM

Plumbing specifications and installation shall conform to the Revised Plumbing Code of the Philippines and Sanitation Code and the Local Water Utilities Administration (LWUA) Standards and all installation shall be in accordance with the detailed engineering plan.

3.21.1 Submittals

The Contractor shall submit to the ZCWD Engineer for approval of the following Manufacturer's Catalog Data/Brochure/ Shop drawing before supply & installation:

a. Water distribution main such as PVC Pipe (PNS 65 Series 8 or ISO 16422 PN 16 Standard), GI Pipe (PNS 26 Heavy Gauge) & its fittings, and service line pipe, fittings, joints, valves, and couplings.

b. Materials for interconnection such as Cast Iron/ Ductile Iron Fittings, Gate Valves, Sleeve Type Coupling for the appropriate diameter it will be used.

c. Mechanical Flowmeter:

d. Check Valve, Air Release Valves,

The Contractor shall furnish to the PZCWD Engineer a copy of operating instructions for each of the equipment and materials mentioned above outlining the step-by-step procedures required for system start-up, operation and shut down. The instructions shall include the manufacturer's name, model number, service manual, parts list, and brief description of all equipment and their basic operating features.

3.21.2 Specifications of plumbing fixtures:

All materials specified herein shall be supported with manufacturer's materials testing certificate for quality control purposes and this shall be approved by the ZCWD prior any utilization in any items of work. All materials for asphalt & concrete pavement restoration including Items 200 & 201 shall be tested pursuant to DPWH standards prior restoration works.

ZCWD shall provide a widely known and accepted Specification commonly used in the water industry should some of the materials' specifications has not been specified in this section. Also, during the project implementation, should there be an inconsistency between the specifications herein and in the provided detailed engineering plan, the ZCWD shall determine which specification shall be adopted and implemented.

3.21.2.1 POLYVINYL CHLORIDE (PVC) PIPES SPECIFICATIONS

3.21.2.1.1 UNPLASTECIZED POLYVINYL CHLORIDE (uPVC) PIPES

uPVC pipes & fittings shall conform to either of the standards adopted by the contractor such as PNS 65, ASTM D1784 or ISO 4439. The uPVC pipes shall be Bell & Spigot with Rubber Ring or fixed seal or its equivalent and shall contain the following customized markings:

- Manufacturing year
- Serial no.
- Nominal diameter
- Standard
- Pressure Rating

The nominal pressure rating of uPVC pipes shall be **Series 8 (Class 150)**

3.21.2.1.2 ORIENTED POLYVINYL CHLORIDE (PVC-O)

PVC-O pipes shall conform to ISO 16422 PN 16 Standard. The PVC-O pipes shall be Bell & Spigot with Rubber Ring or fixed seal or its equivalent and shall contain the following customized markings:

- Manufacturing year
- Serial no.
- Nominal diameter
- Standard
- Pressure Rating

The nominal pressure rating of uPVC pipes shall be **PN 16 (16bars or 232psi)**

3.21.2.2 EDIBLE LUBRICANTS

Lubricants to be used in pipe fitting are specified to be of food-grade base only. It shall conform to the water potability standards of *Philippine National Standards of Drinking Water (PNSWD) 2017* for safety purposes and to further avoid damaging the rubber seal for that matter.

3.21.2.3 ALUMINUM DETECTABLE WARNING TAPE

Total Width - 3 inches
Thickness - ≤ 5 Mil
Material - Aluminum *(Made Detectable for its maximum life span)*
Customized Label - **CAUTION BURIED PIPELINE BELOW** (*Black print)*

3.21.2.4 VALVES AND FITTINGS

a. Commercial Fire Hydrant –this fire hydrant shall have 63mmØ diameter hose connector and 1-100mm hose pumper outlet and a dry type transfer of tapping. All other accessories to the complete

assembly of the fire hydrant are indicated and specified in the provided detailed plan.

b. 75mmØ Fire Hydrant – the fire hydrant shall be made up of 75mmØ brass head and Galvanized Iron vertical pipe and 63mm Ø hose connector. All other accessories to the complete assembly of the fire hydrant are indicated and specified in the provided detailed plan.

c. Gate Valves – Gate valve body shall be made up of Ductile Iron (D.I.) body in accordance with a pressure rating of 16 Bar. This section applies to gate 50 mm (2in.) through 300 mm (12in.) in sizes. The valve shall be non-rising stem with a minimum of two ”0” ring seal as (at least one above the stem collar), or rising stem when shown on the drawings. The valves shall have a 50 mm (2in.) square operating nut with a cast arrow showing direction in which the nut is to be turned to open the valve. Valves shall be constructed to permit the replacement of the "O" rings above the stem collar under full working water pressure with the valves in the fully open position. The valves shall be painted in blue.

d. Blow Off Valves –the assembly shall be of iron body gate valve with 16bar pressure rating. Sizes, complete assembly detail and locations are reflected in the provided plans

e. Air Release Valves –shall be a combination air release valve body and made up of iron and a pressure rating of 16 Bar. Sizes, complete assembly detail and locations are reflected in the provided plans. Air release valves sizes from 50mm and above in diameter shall have flange connections while 25mm may have threaded connections, except where otherwise shown on the drawings, and shallow be designed for a water working pressure of 1.0 MPa (150 psi). The valve shall be designed to automatically permit the escape of accumulated air under pressure while the pipe is in operation and capable to admit air during draining of pipes.

f. Flexible Coupling –Sleeve type coupling body shall be made up of cast iron body and a pressure rating of 16 Bar. These couplings must be capable of jointing both DI, uPVC pipes and existing pipeline as per interconnection details. The minimum center sleeve length of flexible coupling shall not be less than seven (7”) inches for sizes 50mm to 300mm and not less than (12”) for sizes 350mm and above.

Other Fittings – Adaptors, flanges, tees, cross tees, and other bends indicated in the plans are specified to have a cast iron body in accordance with the ASTM-A53 global standards and a pressure rating of 16 bars.

3.21.2.5 WATER METER/FLOW METER

The size for water meter is indicated in the Detailed Engineering Plan and the manner of its installation. Below are the minimum specifications of the water meter/flow meter to be used in this project:

- For Cold Potable Water Application;
- With pressure rating of PN 16;
- With the following accuracy:
  $Q_{transitional}$ flow +– 2%
  $Q_{minimum}$ flow +-5%
- Minimum installation requirements of unrestricted straight pipe of 5D before the meter & 3D after the meter or better;
- Unit in Cubic Meter
- IP 68 Meter Body
- Flange Connection (Note: the Contractor shall consider the flange connection standard before the purchase of water meter & other fittings);

3.21.2.6 TANK LEVEL SENSOR

The contractor shall supply & install a tank level sensor at Baluno & Bandera Tanks and it monitor/screen shall be at the Operator's Room.

- IP68 Protection;
- DC or AC powered;
- For cold potable water application;
- The unit height of water shall be in metric system
- Monitoring/Screen shall be installed in Operator's Room;
- With complete accessories such as Sensor Hub;

3.21.2.7 CHECK VALVE

The check valve shall be installed in accordance with the detailed engineering plan and it shall have the following specifications:

- Check Valve shall be in accordance with AWWA C508 Standard
- Capable in preventing backflow
- Pressure rating of 16bars,
- Swing Type Check Valve with Ductile Iron body;
- For cold potable water application
- Flange Connections;

3.21.2.8 PRESSURE REDUCING VALVE

The Pressure Reducing Valve (PRV) shall be installed in accordance with the detailed engineering plan and it shall have the following specifications:

- It shall be hydraulically operated, diaphragm actuated control valve that reduces higher upstream pressure to lower constant downstream pressure;
- Body, Spring, Tubbing & Fittings shall be Stainless Steel 316 or Bronze/Brass;
- The Pilot Adjustment shall be 0.8 to 6.5bar (or nearer)
- Pressure rating of the body shall be atleast 16bars,
- For cold potable water application
- Flange Connections;

3.21.2.9 Basket Strainer

The basket strainer shall be installed in accordance with the detailed engineering plan and it shall have the following specifications:

- Capable in retaining particles that could damage the other instrumentation/fittings/flow meter;
- Pressure rating of 16bars,
- With stainless mesh screen of more or less 6mm diameter
- The body shall be Ductile Iron body;
- For cold potable water application
- Flange Connections;

3.22 CONCRETE PAVEMENT (ITEM 311 - PCCP)

This Item shall consist of pavement of Portland Cement Concrete, with or without reinforcement, constructed on the prepared base in accordance with this Specification and in conformity with lines, grades, thickness and typical cross section shown on the Plans.

The concrete pavement at the driveway shall be in compliance with the Item 311 of the DPWH Standard.

3.23 ELECTRICAL WORKS

The work to be done shall consist of fabricating, furnishing, delivering, and installing, electrical materials/fixtures completed in accordance with all the details of the electrical work as shown on the drawings including material, labor, tools and equipment and all incidental works as found necessary.

All works shall be done in accordance with the latest requirements of the publications and agencies having jurisdiction, as well as the requirements of the approved standards.

National Fire Protection Association	-	NFPA
National Electrical Manufacturer Association	-	NEMA

Underwriter Laboratories, Inc.	-	UL
Philippine Electrical Code	-	PEC
Philippine National Standard	-	PNS
Federation Specification: Circuit Breaker, Molded Case, Brach Circuit and Services		
American National Standard Institute	-	ANSI
American Society for Testing and Materials	-	ASTM

The Contractor shall employ a licensed Registered Electrical Engineer or Master Electrician to perform or to supervise and to conduct the continuous inspection of all electrical work.

The Contractor shall first obtain approval from the ZCWD before procurement, fabrication or delivery of electrical materials to the site. Partials submittals will not be acceptable and will be returned without review. Submittals shall include the Manufacturer's Name, Trade Name, Place of manufacturer, Catalog Model or Number, Nameplate data, Size, Layout Dimensions, Capacity, Project Specification and Paragraph reference, Technical Society Publication References and other information necessary to establish contract compliance of each item to be furnished.

All permits and electrical fees required for this work shall be obtained at the expense of the Contractor. The Contractor shall furnish the Engineer-in-Charge, the final certificates of Inspections and approval from the proper government authorities after the completion of work. The Contractor shall prepare all as-built plans and all other paper works as required by the ZCWD.

The Contractor shall furnish and install electrical materials as shown in the drawings. A licensed Electrical Engineer or Master Electrician is required to implement the installation of the electrical system.

Electrical installation shall conform to the requirements of the latest edition of the Philippine Electrical Code (PEC) and the other approved standards.

The Contractor shall install all electrical works with the supervision of the qualified Registered Electrical Engineer (REE) or Master Electrician. All electrical installation applications regardless of capacity and voltage whether new, addition or revision shall be accompanied by electrical plans signed and sealed by a duly licensed Professional Electrical Engineer (PEE).

All Materials to be use shall be brand new, in good conditions, free from any defects, damage and corrosion.

All Materials shall conform and certified or listed to a reputable 3rd party certifying body, such as UL, IEEE, NEMA, IPCEA and ASTM, on where such standard has been established for particular types of materials.

During the Construction period, the contractor shall provide their own power supply (genset or construction/temporary power connection with the ZAMCELCO). Upon project completion the contractor shall process the application of permanent power connection under the name of Zamboanga City Water District.

3.23.1. SAFETY GUARANTEES

Ensure that safety, security and housekeeping guidelines are issued and implemented by the Contractor.

Regularly conducts walk-through inspection on the jobsites and immediately calls attention to unsafe practices and work conditions.

Every personnel working in the project shall be equipped with protective gear and gadgets for safety precautions.

The Contractor shall guarantee that the entire electrical systems are free from all kinds of defect (workmanship and materials) with a minimum covered period of two (2) years from the final date of acceptance of the ZCWD. Except for those guarantees or warranties for longer terms are provided or specified herein, the longer term shall apply.

3.23.2. WIRES, CABLES AND BUSBARS

All wires and cables shall comply with the requirements of applicable standards and 3rd party certifying body such as UL, ASTM, and IPCEA.

All wires shall be copper with 99.9% conductivity, soft-drawn and annealed.

Minimum size for Lighting and power system shall be 2.0 mm dia. (solid) THHN/THWN.

For Fire pump and Jockey pump conductor wires shall be rated as Fire Rated/Fire Resistance Wires, Low-smoke, halogen-free cables (LSHF). Sizing for Busbars shall be 1000Amps per square inch.

All wires shall be color coded as follows:

Line A – Black
Line B – Red
Line C – Yellow
Fire Rated Cable – Orange
Ground – Green
Control wire #01 – Brown
Control wire #02 – Blue

3.23.3. CONDUIT, FITTINGS, HANGER AND SUPPORTS

The use of Metallic and Non-Metallic conduit depends on the area where it will be installed, as indicated on plans.

No Conduit smaller than 15mm.dia. Electrical trade size shall be used and conduit shall not be bent more than 3 times with the radius of 90degree.

The interior and exterior of metallic conduits shall be standard weight, mid steel, hot-dip galvanized and interior coating.

Non-metallic conduit shall be high impact schedule 40 series. Conduit shall be provided with guy-wires for wire pulling.

Conduit shall be properly sealed to avoid entry of foreign object, dust, moisture, water etc.

Conductors shall be spliced and dead ended as shown in the construction drawings. There shall be not more than one splice per conductor in any span and splicing sleeves shall not be located near conductor support. No splices shall be located in Grade B crossing spans and preferably not in the adjacent spans. A high-grade Hydraulic Crimping tool must be used in the termination of conductors.

3.23.4. OUTLETS, BOXES, PULL BOX AND FITTINGS

Outlet boxes shall be galvanized deep-type pressed-steel of standard gauge #16, unless otherwise indicated.

All outlets, boxes and pull box shall be provided with suitable fittings.

Boxes without wiring device shall be provided with suitable metal cover plate as manufactured standard.

Pull boxes shall be powder coated, hinge type and minimum of gauge #16 depending on the size. Contractor shall submit shop drawing and secure approval from the Engineer and the Architect of pull boxes size and location before fabrication and installation.

All power outlets must be grounding wired ready like a universal outlet with ground and the likes.

3.23.5. WIRING DEVICES

All plates (Appearance and color) for receptacle, switched and special outlet shall be approved by ZCWD.

All switched one way, two-way, three-way as indicated in plans shall be rated 15 Amperes, 240Volts. The termination shall be quick connect.

Receptacle outlet shall be grounding type 3 wires, rated at 10 Ampere, 240Volts. Termination shall be quick – connect.

Special outlet shall be grounding type rating as indicated in the plans.

3.23.6. PANELS, BREAKERS AND DISCONNECTING MEANS

Panels shall be fabricated by a reputable fabricator. Only one brand of circuit breaker will be allowed for the entire project. Using multiple or combination of brand will be rejected.

All Panel and cabinet shall be gauge # 16, with dead front construction furnish, light gray enamel in color, powder coated.

Standard Grounding bus bars shall be provided in all panels, minimum size of grounding bus bars should be 50% of the line bus bars.

Standard enclosure and mounting for panels and cabinet as per load schedule. For indoor panel shall be NEMA 1 enclosure and for outdoor it should be NEMA 4X or as indicated on plans. And it shall meet NEMA and UL specifications.

As Indicate in the plans, provide individual disconnect switch and circuit breakers.

Contractor must submit shop drawings of panel boards, in full details including location, cable entry and exit, dimension of panel (Wire Gutter and Breaker Area), brand of breaker, and size of busbars Line, Ground and Neutral if applicable.

The minimum interrupting capacities of its circuit breaker are as per indicated in the plans (Load Schedule). Individual circuit breaker sensitivity shall be always coordinated between its circuit breaker.

Disconnecting means shall be non-fusible, rating as indicated on plans (Load Schedule). Enclosure shall be gauge #16, NEMA 1 for indoor and NEMA 4X for outdoor except otherwise indicated on plans. Its motor shall be provided with disconnecting means rating same as the load schedule, unless otherwise provided by the motor supplier.

Disconnecting means shall be lockable type, push button station that can be locked in the open position unless otherwise specified in plans.

3.23.7. LIGHTING FIXTURE AND ACCESSORIES

All lighting fixture aesthetic (Standard, decorative, special lighting, etc.) shall be approved by ZCWD.

Provide lighting fixture and accessories in accordance with the requirements of the following plans: Electrical, Architectural, Interior Designer and Lighting Consultant.

Contractor shall submit catalog with technical specification in full details, enclosure ratings (IP), finishes and dimensions, metal thickness and gauge, electrical provision (watts, Voltage, frequency, ampere rating) and electrical connections. Submit actual sample for Engineer and Architect review and approval of ZCWD.

Provide ballast that is suitable for the operation of specified lamps, Contractor shall be liable for the coordination of the supplied ballast and lamps and for proper operation of lighting fixture. No extra additional charge to the ZCWD if the lamps and ballast are not properly coordinate and failure to operate.

Ballast shall be listed to the third certifying bodies such as Underwriters Laboratories and Certified Ballast Manufacturers Association. And shall be designed, built and tested in accordance to the standard, rules and regulation of ANSI, NEC and PEC.

Lighting fixture that are clearly equipped with ballast or other similar operation with proper coordination to the lamp types, Programmed start ballast shall be specified.

Ballast shall be high power factor, have a guarantee against defects for a period of two (2) years, except for electronic ballast that have a minimum of three (3) years.

Fixture shall have housing for discharge lamps (fluorescent, H.I.D.) to make electrical components easily accessible and replaceable during maintenance. Fluorescent lamps shall be spring load type.

Provide reflectors and baffles as required, for Architect and Engineer approvals.

For outdoor fixtures which are directly exposed to water or other foreign elements/materials shall be IP rated / effectively gasketed to prevent access of moisture into electrical components or enclosing diffusers, depending on their location and proposed. Contractor is required to submit sample for Architect and Engineer review and approvals.

Provided necessary / required support for the fixture such as plates, plaster frames, hangers etc. for safe supports of fixture in ceiling (close or open), open space, walls, in ground and others which they shall be installed. Materials shall be made with non-ferrous metal, or of steel that has been suitably rustproof.

3.24 GROUTED RIPRAP (CLASS A)

3.24.1. This item of work shall consist of the supply and delivery of manpower, tools/equipment, materials and placing of riprap with cement grout with filter backing, furnished and constructed in accordance with this Specifications and to the lines and grades and dimensions shown on plans.

3.24.2. Stones for riprap shall consist of rock as nearly as rectangular in section as is practical, except that riprap of Class A may consist of round natural stones. The stones shall be sound, tough, durable, dense, resistant to the action of air and water and suitable in all aspects for the purpose intended.

3.24.3. The materials to be used in this item shall be in accordance with the DPWH Bluebook latest edition.

3.24.4. Excavation/Cutting of soil to slope as shown in the plan shall be included & incorporated in Riprap item of work. No additional item or cost shall be added or chargeable to ZCWD due to cutting of soil to meet the slope requirements.

IV. GUIDELINES FOR BILL OF QUANTITIES AND FINANCIAL BID PREPARATION

In the preparation of the detailed estimates or financial bid, the DPWH Department Order No. 197, Series of 2016 shall be followed:

4.1. DIRECT COST

The Estimated **DIRECT COST** shall consist of the following:

4.1.1. **Cost of materials** to be used in doing the work item called for, which shall include, inter alia, the following:

- Cost at source, including processing, crushing, stockpiling, loading, royalties, local taxes, construction and/or maintenance of haul roads, etc.
- Expenses for hauling to project site.
- Handling expenses.
- Storage expenses.
- Allowance for waste and/or losses, not to exceed 5% of materials requirement.

4.1.2. **Cost of Labor** this shall include the following:

- Salaries and wages, as authorized by the Department of Labor and Employment.
- Fringe benefits, such as vacation and sick leaves, benefits under the Workmen's Compensation Act, GSIS and/or SSS contributions, allowances, 13th month pay, bonuses, etc.

4.1.3. **Equipment Expenses**

Rental rates of equipment shall be based on the prevailing "Association of Carriers and Equipment Lessors, (ACEL) Inc." approved for use by the DPWH (Presently it is the 2014 ACEL Rates). Rental rates of equipment not indicated in the ACEL booklet shall be taken from the rental rates prepared by the Bureau of Equipment. For simplicity in computation, the operated rental rates are preferred over the bare rental rates as the former includes operator's wages, fringe benefits, fuel, oil, lubricants and equipment maintenance. The make, model and capacity of the equipment should be indicated in the detailed unit cost analysis.

Mobilization and Demobilization shall be treated as a separate pay item. It shall be computed based on the equipment requirements of the project stipulated in the proposal and contract booklet. Mobilization and demobilization shall not exceed 1% of the Estimated Direct Cost (ECD) of the civil works items.

4.2. INDIRECT COST

The Indirect Cost shall consist of the following:

4.2.1. **Overhead Expenses** which include the following:

- Engineering and Administrative Supervision.
- Transportation allowances.
- Office Expenses, e.g., for office equipment and supplies, power and water consumption, communication and maintenance.
- Premium on Contractor's All Risk Insurance (CARI).
- Financing Cost such as Premium on Bid Security, Premium on Performance Security, Premium on Surety for Advance Payment, Premium on Warranty Bond (one year).
- Fees, Permits and clearances.
- Provision of service vehicle.

4.2.2. **Contingencies** includes the following:

- Expenses for meetings, coordination with other stakeholders, billboards (excluding Project Billboard which is a pay item under the General Requirements), stages during ground breaking & inauguration ceremonies, and other unforeseen events.

4.2.3. **Miscellaneous Expenses** - These include laboratory tests for quality control and plan preparation.

4.2.4. **Contractor's Profit Margin**

The margin of contractor's profit shall be in accordance with the table below. The profit is computed as the profit mark-up multiply by the Estimated Direct Cost.

4.2.5. **Value Added Tax (VAT) Component**

Which shall be the five (5) percent of the summation of Estimated Direct Cost, Overhead, Contingencies & Miscellaneous (OCM) and Contractor's Profit.

4.2.6. **OCM and Profit Mark-Up**

4.2.6.1. The following items shall not be subjected to OCM and Profit mark-up:

- Mobilization and Demobilization

4.2.6.2. The following non-civil works items shall not be subjected to OCM mark-up:

- Field/Laboratory Office & Living Quarters (Rental Basis)
- Furnishing of Furniture, Laboratory Equipment, Survey Equipment and Consumables
- Assistance to the Engineers
- Photographs
- Health and Safety
- Environmental Certificate
- Traffic Management
- Communication Equipment, etc.

4.2.6.3. The detailed estimates for this project shall not exceed with the following mark-ups:

Estimated Direct Cost	OCM	Profit	Value Added Tax (VAT)
Above 5 Million up to P50 Million	12%	8%	5%