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I. INTRODUCTION

Gapan City Water District (GCWD) and PrimeWater Gapan City (PWGC) Joint Venture recognize the importance of a system in addressing any eventuality that may arise and cause harm to the health of the people of Gapan City thus have adopted and formulated a Water Safety Plan (WSP) and have made it one of its key priorities. In adherence to Local Water Utilities Administration's (LWUA) standards, GCWD and PWGC, in support of the Technical Department, Motu Proprio the assessment and development of a Water Safety Plan (WSP) for its entire system. This WSP covers the water sources, conveyance system, water treatment, pumps and reservoir, and the distribution network up to its customers. The sole purpose of the WSP is to ensure the integrity of the whole system so that potable water always reaches the concessionaires.

Such objective is achieved by:

- Ensuring that there is no contamination of the source of the water supply and installation of programs to instantaneously resolve such incidences;
- Ensuring that the quality of water, all points is monitored regularly and meets the standards set forth in the Philippine National Standards for Drinking Water (PNSDW); and
- Ensuring that there is no re-contamination of treated water during distribution until the water reaches its concessionaires.

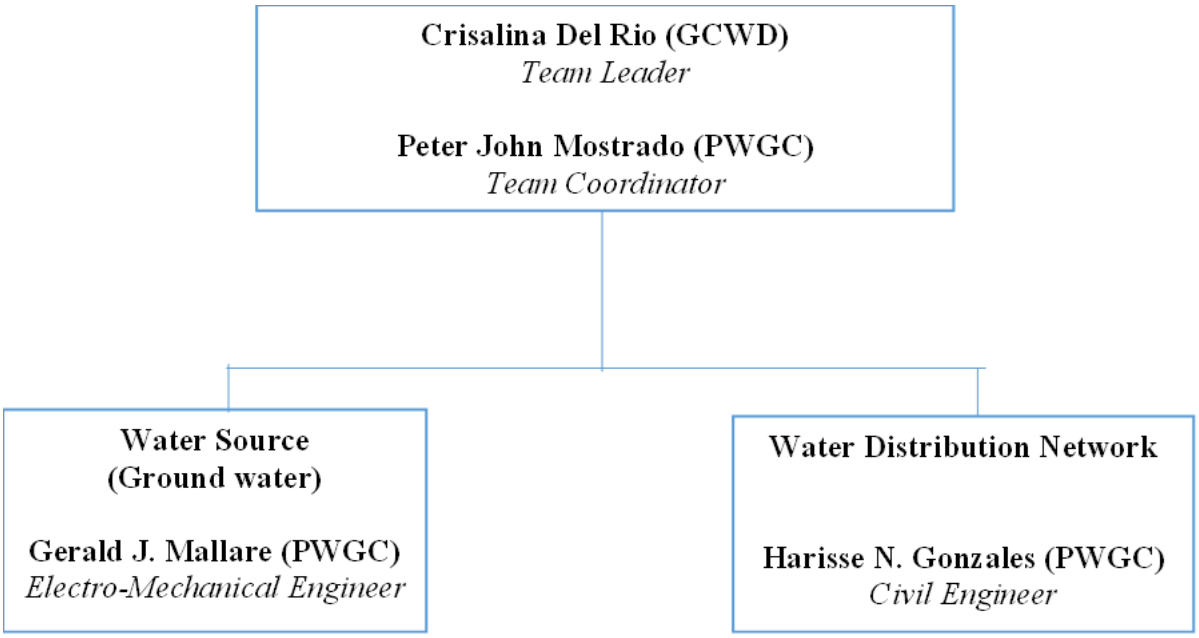
The Water Safety Plan is described as a systematic plan crafted to:

- Guarantee that the potability of water is maintained at all times at every stage of all its operation;
- Identify the persons responsible to undertake the above tasks;
- Forecast any eventuality that may affect the quality of water;
- Formulate programs that prevent the occurrence of such events and improve the system;
- Prepare plans to manage the impacts of these events;
- Implement control and monitoring program to assess effectiveness of the plan;
- Data gathering by means of recording (documentation);
- Regular review and audit of the WSP;
- Make the proper revisions following any event that may warrant such change.

The creation of the WSP by GCWD and PWGC resonates to a number of benefits. The major benefits of developing and implementing a water safety plan include the systematic and detailed assessment of its processes and prioritization of hazards in all its operations and facilities, the establishment of operational barriers to control hazardous events and the availability of contingency and mitigating measures to cushion the impacts of these events. The WSP also provides an organized and structured system to minimize the chances of failure of its services caused by oversight, lapses on management or operational decisions and identifies parties responsible for such. This process ensures the consistency of the quality of water supplied to concessionaires and provides contingency plans to respond to system failures and unforeseeable hazardous events and accidents, which may result in the impairment of its operations. On the overall, the advantages can be summarized as:

- Compliance with water quality targets
- Application of best practices to secure water safety
- Consistency in water quality and safety
- Plans are in place to prevent crisis scenario from water quality impairment
- Potential savings from avoidance of incidents and accidents
- Improvement in asset management
- Ensure the satisfaction of customers

II. GCWD & PWGC WATER SAFETY PLAN TEAM



GCWD & PWGC WATER SAFETY PLAN TEAM				
Name	**Organization / Department**	**Job Title**	**Responsibility**	**Task Descriptions**
Crisalina Del Rio	Gapan City Water District	General Manager	WSP Team Leader	Monitors the: • Production, quality control/ monitoring, storage, and distribution of safe and potable water to consumers • Operation, safeguarding and maintenance of production, treatment, and storage facilities of Gapan City Water District/PrimeWater Gapan City
Peter John Mostrado	PrimeWater Gapan City	Branch Manager	WSP Team Coordinator	Supervises the: • Operation, safeguarding and maintenance of production, treatment, and storage facilities of Gapan City Water District/PrimeWater Gapan City • Operation, safeguarding and maintenance of production, treatment, and storage facilities of Gapan City Water District/PrimeWater Gapan City • Initiates the evaluation of existing systems and research on new treatment methods or chemicals available and submits recommendations

Gerald Mallare	PrimeWater Gapan City / Technical Operations	Technical Head	Water Source	Supervises the: • Operation, safeguarding and maintenance of equipment, appurtenances, structures and grounds on all deep-well pumping stations and reservoir • Maintenance of adequate supply of safe and potable water at the distribution system • Assist in the implementation of other water quality management programs • Initiation of evaluation of existing systems and submits recommendations • Electro-mechanical components/preventive maintenance regarding the operation of all pump stations to ensure the 24/7 availability of potable water supply In-charge of: • Planning, implementation and monitoring of all preventive, predictive and corrective maintenance activities on all equipment, appurtenances, structures and grounds • Submission of report and communications to superiors regarding the monthly

				accomplishment activities and other concerns of the section
Harisse N. Gonzales	PrimeWater Gapan City / Technical Operations	Technical Engineer	Water Distribution Network	In-charge of: • Leak Repairs in the system • Flushing of blow off/ hydrants; guarantees that there is no intrusion of dirt or any substances that will contaminate the water supply in the system • Planning, recommendation, and implementation of all corrective and preventive maintenance works on transmission and distribution of mainline appurtenances and service connection meters • Coordination with local government officials and other non-government officials in the implementations of maintenance works to ensure understanding and smooth facilitation of the works required • Inspection of newly pipeline project in the system; guarantees that there is no intrusion of dirt or any substances that will contaminate the water supply in the system.

Ian Santiago Nelson Ramirez Constancio Almera	PrimeWater Gapan City / Technical Operations	Water Quality/ Water Resource Team Leader	Water Source	In-charge of: • All Water Testing/Sampling that will ensure the potability of water supply • Monitoring of treatment facilities and reservoir • Delivery of water samples to our accredited laboratories for testing.
Emmanuel Santiago	PrimeWater Gapan City / Business Operations	Commercial Head	Complaints	In-charge of: • Receiving complaints/ concerns from customers regarding water supply operation and other query regarding the operation of Gapan City Water District and PrimeWater Gapan City.
Darell De Sahagun	PrimeWater Gapan City / Business Operations	Customer Relations Officer	Communications and social media	In-charge of: • Posting, disseminating and response thru customer complaints, query, information, and other related concerns regarding the operation of Gapan City Water District and PrimeWater Gapan City thru social media and Text Blast.

Percival Villareal	PrimeWater Gapan City / Admin Operations	HR and Admin Officer	Validation	In-charge of: • Documentation of all necessary data, meetings and assist in monitoring, reviewing, and updating the WSP • Execution of events and marketing activities related to WSP
Reynold Alexis Carmen	PrimeWater Gapan City / Admin Operations	Purchaser and Liaison Officer	Budgeting/ Procurement	In-charge of: • Preparation of operations budget and emergency fund • Procurement of all necessary items, consumables and equipment needed in the operations

Stakeholder	Relationship to Water District	Point Person to Contact	Concern with Drinking Water Supply	Interaction Mechanism	Records of Interaction
Algela	Supplier of Media Liquid Chlorine	Percival Villareal (PWGC)	Disinfection at source	Replenishment of liquid chlorine supply	Delivery receipts
MMVA 346 Construction FNR Builders	Contractor for plumbing services, repair, and maintenance	Engr. Gerald Mallare (PWGC)	Installation of new service connection, mainline and service line maintenance	Installation, Commissioning, and Regular Inspections	Job Order
City Health Unit	Regulatory Body	Engr. Gerald Mallare (PWGC)	Compliance with PNSDW 2017	Submission of laboratory test results	Bacteriological Tests and PhyCHem Results
Homeowners	Concessionaires	Emmanuel Santiago (PWGC)	Direct user of the water supplied by water district	Informal and scheduled meetings, Costumer complaints	Minutes of meetings, Customers Complaint forms

- *Stakeholders are entities outside the Water District Organization that can directly or indirectly affect the operations and performance of the water district. These Stakeholders are identified and partnered to ensure that health-based targets are met in the production, transmission, and delivery of safe water from catchment to consumers as embodied in this **WSP**.*

III. WATER SUPPLY AND PROCESS DESCRIPTION

Gapan City Water District (GCWD) is a government agency that is mandated by law by virtue of PD 198, to provide water services within the territorial jurisdiction of the Gapan City. Primewater Infrastructure Corporation is a private institution whose main goal is to provide sufficient and potable water through its latest innovation for its joint venture (JV) partners.

Gapan City is a fourth-class component city in the southern tip of the province of the Nueva Ecija clustered with other southern areas – San Antonio, Jaen and San Leonardo, among others. As of December 31, 2021, GCWD and Primewater Gapan City JV has 10,277 active connections.

As of December 31, 2021, GCWD and PrimeWater Gapan City have installed a total of 1634 water service connections.

Table 1. Basic Information on GCWD and PrimeWater Gapan City JV (as of December 2021)

Population Served	49%	
Total Number of Customers		
Residential	9,559	
Commercial	621	
Industrial	97	
Total No. of Concessionaires	10,277	
FACILITIES		
WATER RESOURCES		
Groundwater:		
Freedom Park	24	Liters per second (lps)
San Nicolas New	28	lps
San Nicolas Old	19	lps
San Vicente	22	lps
San Lorenzo	8	lps
San Roque	28	lps
Sta Cruz	18	lps
Pambuan Old	18	lps
Pambuan New	18	lps
Sto Cristo Norte*	30	lps
Reservoirs:		
Sta. Cruz	100	cubic meters (cu.m.)
DISTRIBUTION LINES:		
2”	10,596	Meters
3”	28,236	Meters
4”	25,691	Meters
6”	22,796	Meters
8”	2,040	Meters

Water Availability		
24-hour coverage	79%	11 barangays
Less than 24 hours	21%	3 barangays

**Sto Cristo Norte PS is under construction*

DATA FOR SERVICE COVERAGE AND POPULATION					
LIST OF POPULATION/SERVICE CONNECTIONS PER BARANGAY					
Barangay	**Population**	**Total Service Household Connection**	**Total Served Population**	**% Served Population**	**% Unserved Population**
Bayanihan	5,504	804	2505	45.51%	54.49%
Malimba	3,711	653	3060	82.46%	17.54%
Mangino	12,922	964	3925	30.37%	69.63%
Pambuan	15,370	1738	7405	48.18%	51.82%
San Lorenzo	5,933	2,113	5268	88.78%	11.22%
San Nicolas	13,142	2,090	8810	67.04%	32.96%
San Roque	9,525	911	4260	44.72%	55.28%
San Vicente	9,092	2,270	7320	80.51%	19.49%
Sta. Cruz	3,680	334	1625	44.16%	55.84%
Sto. Cristo Norte	6,162	219	835	13.55%	86.45%
Sto. Cristo Sur	4,483	521	2230	49.74%	50.26%
Sto. Nino	5,019	536	1715	34.17%	65.83%
Maburak	3,514	18	90	2.56%	97.44%
Balante	1,675	16	80	4.78%	95.22%

**Population based on PSA Population Census 2020*

3.A. WATER SOURCES

With the ever-increasing population of Gapan City, the need for water supply has greatly increased as well. GCWD and PrimeWater Gapan City draw 100% of its water supply from groundwater and this has been the only source since 1977. GCWD and PrimeWater Gapan City get 10.17 Million Liters per Day (MLD) of water supply source from the combined 9 facilities and pumped into the main supply lines.

However, based on the population of Gapan City, only 49% of its population is catered by GCWD and PrimeWater Gapan City which translates to the percentage that has access to safe potable water.

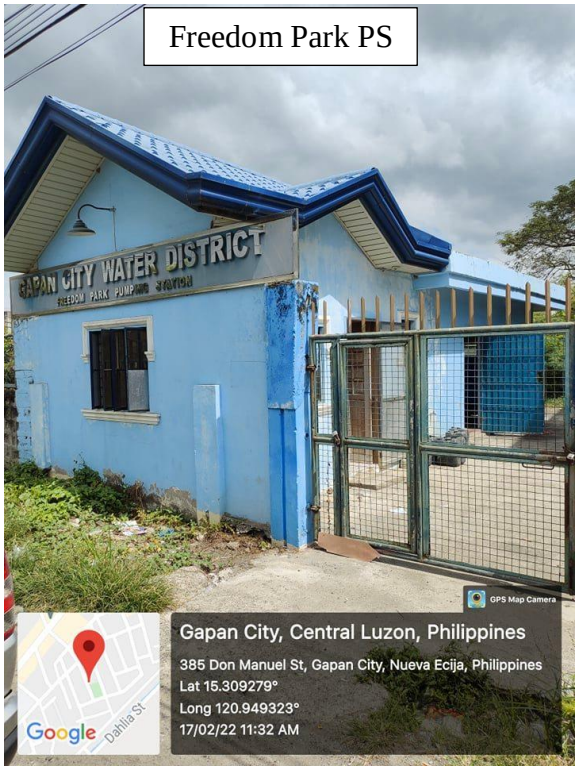
GCWD and PrimeWater Gapan City recognize the increasing current and future water supply requirements and therefore sought to develop additional water sources to help cater to the customers, specifically those areas affected of low water supply.

DETAILS		PUMPING STATIONS				
		1 Freedom Park	2 San Nicholas New	3 San Nicholas Old	4 San Vicente	5 San Lorenzo
Location	Baranggay Latitude Longitude	San Vicente 15.309279° N 120.949323° E	San Nicholas 15.298533° N 120.930835° E	San Nicholas 15.303212° N 120.935564° E	San Vicente 15.311952° N 120.948066° E	San Lorenzo 15.313149° N 120.954158° E
Details	Depth (m) Well casing (dia.) Year drilled	188 250 1977	179 250 2014	--- 250 ---	142 250 2015	184 200 1955
Capacity	LPS	24	18	19	22	8
Pump	Brand Setting (m)	Groundfos ---	Groundfos 78	Groundfos ---	Groundfos 92.5	Groundfos ---
Motor	Brand Setting Control	Franklin Electric 40HP, 3 phase, 60Hz VFD - VACON FLOW 100	Franklin Electric 30HP, 3 phase, 55Hz VFD - ABB	Franklin Electric 40HP, 3 phase, 55Hz VFD - VACON FLOW 100	Franklin Electric 40HP, 3 phase, 55Hz VFD - VACON FLOW 100	Franklin Electric 15HP, 3 phase, 60Hz RVAT
Genset	Motor Brand Capacity (kVA)	Perkins 134	Cummins 50	N/a N/a	Cummins 67.7	Cummins 49.75

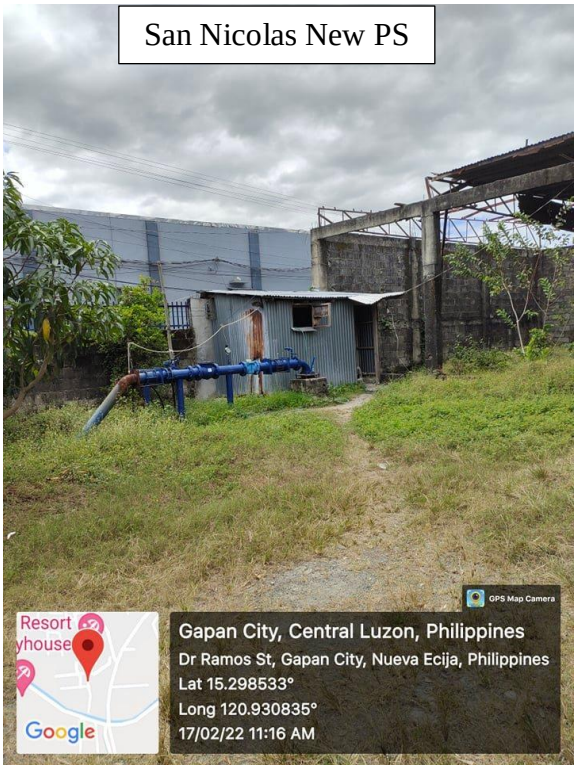
DETAILS		PUMPING STATIONS				
		6 San Roque	7 Sta Cruz	8 Pambuan Old	9 Pambuan New	10 Sto Cristo Norte
Location	Baranggay Latitude Longitude	Baluarte 15.245992° N 120.952403° E	Sta Cruz 15.282733° N 120.984113° E	Pambuan 15.333116° N 120.968254° E	Pambuan 15.323843° N 120.962608° E	Sto Cristo Norte 15.277233° N 120.951354° E
Details	Depth (m) Well casing (dia.) Year drilled	180 250 2012	180 250 2017	173 250 2008	201 300 2020	201 300 2021
Capacity	LPS	28	18	18	18	30
Pump	Brand Setting (m)	Groundfos 92	Groundfos 89	Groundfos 102	Groundfos 108	Groundfos 78
Motor	Brand Setting Control	Franklin Electric 40HP, 3 phase, 57Hz VFD - VACON FLOW 100	Franklin Electric 25HP, 3 phase, 60Hz VFD - DELTA CP 2000	Franklin Electric 40Hp, 3 Phase, 60Hz VFD - VACON FLOW 100	Franklin Electric 40Hp, 3 Phase, 60Hz VFD - VACON FLOW 100	Franklin Electric 50Hp, 3 Phase, 60Hz VFD - VACON FLOW 100
Genset	Motor Brand Capacity (kVA)	Cummins 47	Cummins 75	Cummins 67.7	Cummins 67.7	Cummins 150

The existing deep well facilities include 10 deep well pumping stations (PS, 1-PS ongoing construction) and network of pipelines. With the current deep well facilities, the district expects a shortfall of 3.05 MLD on maximum day demand as of December 31, 2021.

Freedom Park PS



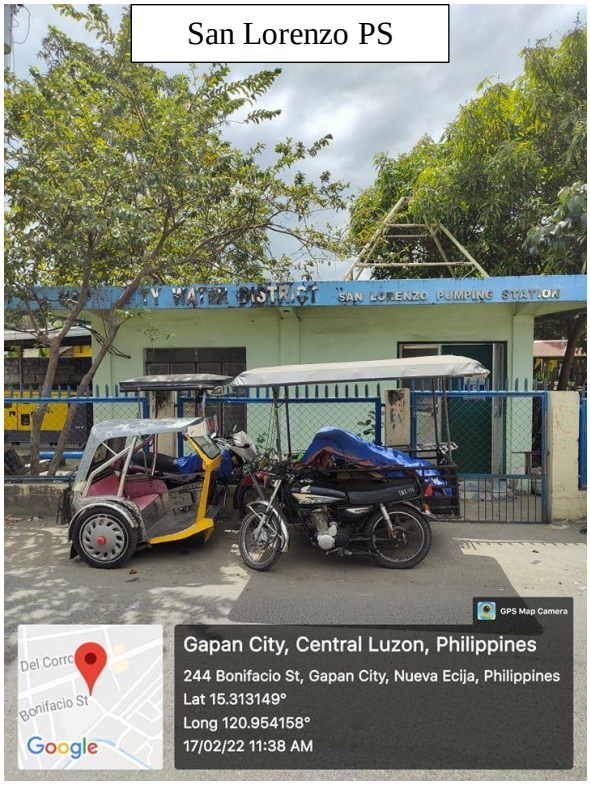
San Nicolas New PS



San Nicolas Old PS

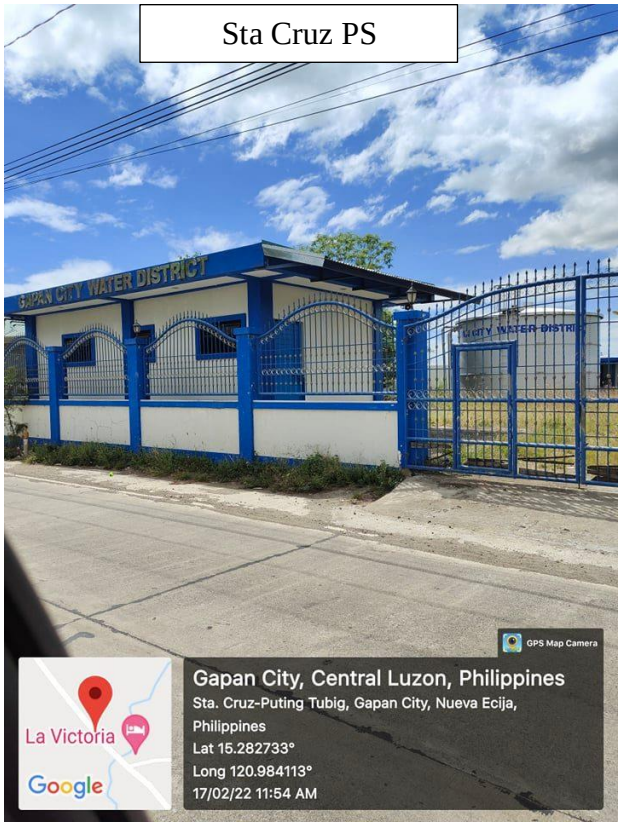
San Vicente PS

San Lorenzo PS



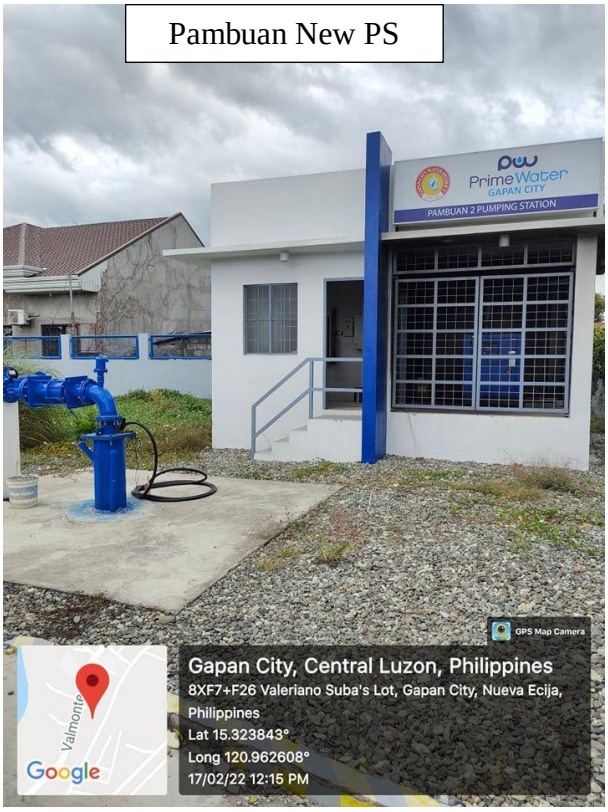
San Roque PS

Sta Cruz PS

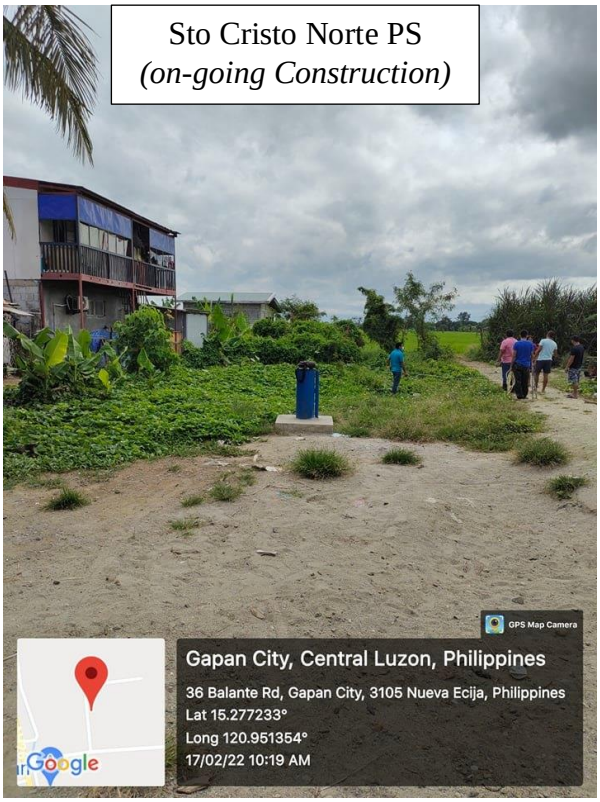


Pambuan Old PS

Pambuan New PS



Sto Cristo Norte PS
(on-going Construction)



In case of groundwater source contamination, shock chlorination will be initiated. Twenty (20) liters of Liquid Sodium Hypochlorite will be thoroughly mixed to 100 liters of clean water. This chlorine mixture will be poured into the sounding tube of the well and will be allowed to stay for 24 hours. After 24 hours, groundwater will be pumped out and to be tested for microbiology analysis.

Typically, a GCWD and PrimeWater Gapan City well is dug with a depth of 180 meters. So as not to compete with the groundwater source of the artesian or shallow wells of locals (e.g. farmers, residence, etc.). This also assures that only the groundwater occurring in the lower but true natural aquifer is abstracted.

3.B. WATER TREATMENT / DISINFECTION

In terms of water treatment, GCWD and PWGC groundwater sources are limited to chlorination in each pumping station by the use of a chlorinator equipment. Liquid chlorine (sodium hypochlorite) is injected directly into the transmission pipeline during pumping operation using chemical dosing pump. Chlorine dosage is set / adjusted in relation to water production rate and free chlorine residual requirement.

Dosage is regulated to maintain the 0.3 to 1.5 ppm of chlorine residual required by the PNSDW 2017. The water sample taken from any point in the distribution line should have a minimum of 0.30 ppm residual chlorine. Adjustments on the chemical feed should be done if the residual chlorine falls out of the required 0.3 to 1.5 ppm standard.

Policy: *To pass the Philippine National Standards for Drinking Water (PNSDW) 2017*

I. Purpose

Chlorination involves adding a measured amount of chlorine to water to produce a residual sufficient to kill bacteria, viruses, and cysts. The killing effect of chlorine depends on the pH of the water, temperature, chlorine level and contact time (i.e., the time the chlorine is in the water before consumption).

Typically, chlorine is added to public drinking water as the final stage of treatment, often following an upstream filtration step which removes sediment that can tie up chlorine and shield organisms from its effect. Chlorine has been used for over a century as a primary water disinfectant and is largely responsible for elimination of water-borne diseases.

II. Scope

The scope of disinfection of Chlorine in water is from Pump stations and their servicing areas (faucet).

III. Responsibilities

Pump Operators – daily preparation of Chlorination, testing, monitoring of chlorine residual, and physical characteristics of water.

Pump Operators Team Leader – monitoring of pump operators during pump station operation

Water Resources Head/Electro-mechanical Engineer – Assessment of water quality results

IV. Definition of Terms

Chlorination – the process of adding the element chlorine to water disinfection to make it fit for human consumption as drinking water.

Contact time – the length of time water supply is held in direct contact with a treating agent, e.g., chlorine solution.

Disinfection – water treatment processes designed to destroy disease-causing microorganisms. The efficacy of disinfection is often assessed by measuring the coliform group of indicator organisms.

Residual chlorine – is the amount of chlorine that remains in the water after a certain period or contact time.

V. Procedures

1. Prepare the necessary materials to be used in the chlorination.
2. Observe safety protocol by using appropriate PPE before chlorination.
3. Prepare 24 liters (1 Carboy) of liquid Chlorine (Sodium Hypochlorite)
4. Prepare 24 liters of raw water in a chemical container for mixing.
5. Adjust the metering pump dosing rate based on the production flow rate if necessary.
6. Collect product water sample from faucet and check the residual chlorine to ensure that it is within the target of 0.3 mg/L – 1.5 mg/L.
7. The solution is estimated to be good for only 3 days, thus repeat the Chlorine preparation procedure.

To ensure that the PNSDW residual chlorine requirement for the product water is met, GCWD and PWGC established the following sampling points for daily monitoring:

Pump Station	Sampling Location
Pambuan Old / Pambuan New	Amelia Masiclat
San Lorenzo	Eden Mangulabnan
San Nicolas Old	Deselie Joy YU
San Nicolas New	Rachelle Romano
San Roque	Eden Mallare
San Vicente	Myrna Tecson
Freedom Park	Neil Barlis
Sta. Cruz	Cecelia Constantino

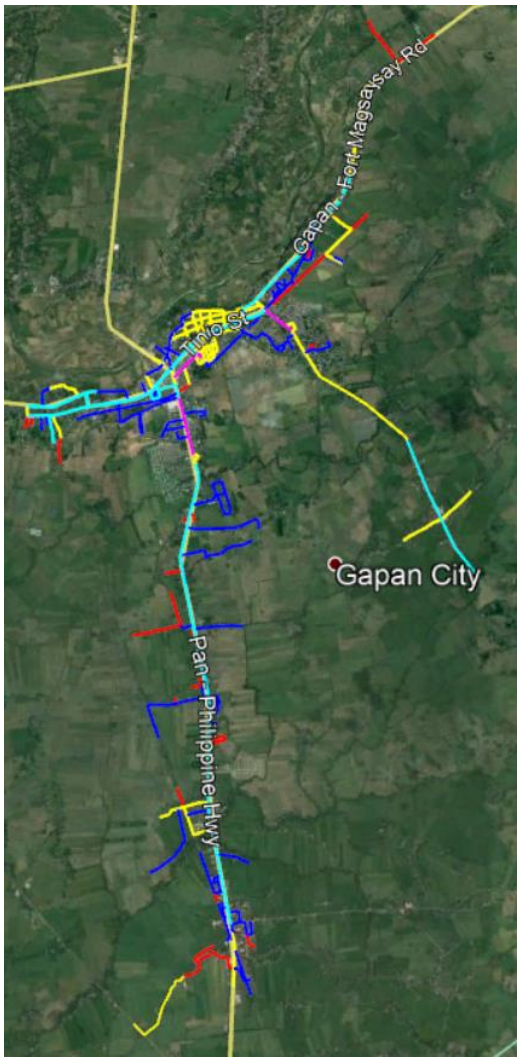
GCWD AND PRIMEWATER GAPAN CITY TARGET WATER QUALITY

(Based on the mandatory parameters required by PNSDW 2017 ed)

PARAMETERS	STANDARD VALUES
I. MICROBIOLOGICAL	
1. Total Coliform	MTFT: <1.1 MPN/100 mL EST: Absent or <1.1 MPN/100mL MFT: <1 total coliform colonies/100 mL
2. Thermotolerant Coliform *E.coli*	MTFT: <1.1 MPN/100 mL EST: Absent or <1.1 MPN/100mL MFT: <1 thermotolerant coliform colonies/100 mL
3. Heterotrophic Plate Count (HPC)	<500'CFU/mL
II. PHYSICAL	
Color	
- Apparent	10 color units
- True	5 color units
Turbidity	< 5 NTU
III. CHEMICAL	
Arsenic	0.01 mg/L
Cadmium	0.003 mg/L
Lead	0.01 mg/L
Nitrate	< 50 mg/L
Benzene	0.01 mg/L
Iron	1.0 mg/L
Ph	6.5 – 8.5
Manganese	0.4 mg/L
Chloride	250 mg/L
Sulfate	250 mg/L
Total Dissolved Solids	600 mg/L

IV. RESIDUAL DISINFECTANT	
Chlorine Residual (as free chlorine)	0.3 ppm to 1.5 ppm

D. DISTRIBUTION



The GCWD and PrimeWater Gapan City water distribution involves an interconnected distribution system with water supply originating from the existing pump stations.

Combined output of the 9 pumping stations flows into the distribution system and is distributed to the twelve (14) barangays of Gapan City. The water flows through GCWD and PWGC pipe network facilities, extending to approximately 89,359 meters.

To check the integrity of pipelines, gauging points are placed in different areas in the distribution system. From the pumping stations, water is distributed to its concessionaires with an estimated population of ninety nine thousand seven hundred thirty two (99,732) through a network of pipelines: primary, secondary, and tertiary mains. The pipelines consist mostly of PVC pipes and steel pipes ranging from 50mm to 200mm.

As of December 2021, were 6 barangays that are experiencing less than or equal to 7 psi water pressure which is attributed to inadequacy of the water supply.

Water supply covers twelve (14) different barangays the San Lorenzo, San Vicente, Mangino, Pambuan, Bayanihan, Sto Nino, San Nicolas, Sto Cristo Sur, Sto Cristo Norte, Malimba, Sta Cruz, Baluarte, Maburak and Balante. The district has nine (9) sources of water supply. These deepwells are located at barangay San Lorenzo,

Pambuan (2), San Vicente (2), San Nicolas (2), San Roque, Sta Cruz. The management has developed systems including methods for measuring and tracking customer requests and complaints as well as the consistency in the procedures of the daily operations of the water network and pumping stations that result in a more consistent quality of drinking water delivered to the consuming public.

Water quality and quantity are monitored regularly. Water quality monitoring is conducted on a regular basis at various points within the system. The quality personnel perform regular examinations for bacteriological, biological, physical, and chemical analysis and submits the same to government accredited laboratories.

Compliance with drinking water quality standards is regulated by the Department of Health (DOH), the lead agency tasked to implement the Sanitation Code of the Philippines. In Gapan City, the City Health Office monitors water quality compliance with Philippine National Standards for Drinking Water (PNSDW) and this is headed by the Mayor. The water district provides copies of results to the City Health Officer.

Water quality and quantity complaints or concerns are received by the Commercial Department. These water quality and quantity complaints are investigated separately by the concerned sections.

Water produced by GCWD and PWGC is intended for general domestic use and consumption such as drinking, personal hygiene, foodstuff preparation, washing of clothes, utensils and other human activities that utilize water.

The intended consumers do not include those who are significantly immune-compromised or industries with special water quality needs. It should be noted that the water is not recommended for use for Hospital products, medical procedures and pharmaceuticals requiring special purification process. These groups are advice to provide additional points of use treatments.

The water is not safe also for use with freshwater aquarium fish species, amphibians and other sensitive domesticated animals that maybe intoxicated by the chlorine present in the water.

IV. HAZARD IDENTIFICATION & RISK ASSESSMENT

For each step of the validated process flow diagram, the WSP Team identified what could go wrong in the water supply system in terms of hazards and hazardous events. The hazard and hazardous event identification was conducted through existing records, historical events, local knowledge, and onsite visits that can affect the safety of a water supply and establish what requires controlling the hazards to provide safe drinking-water.

It is important to rank the hazards to establish priorities. The WSP team used a semi-quantitative risk assessment to calculate a priority score for each identified hazard. The objective of the prioritization matrix is to rank hazardous events and to provide a focus on the most significant hazard. The likelihood and severity were derived from the team's technical knowledge and expertise, historical data, and relevant guidelines. A matrix is used to rate the likelihood or frequency and severity or consequence of the hazards when it occurred for calculation of the risk score. The WSP team determined a cut- off point, which is risk score of 5, above which all hazards will be retained for further consideration. There is little value in expending a great deal of effort considering very small risks. The GCWD and PWGC WSP team has chosen to adopt the Semi-Quantitation Risk Matrix (from Deere et. Al. 2001).

Risk Factor Matrix		**Severity/Consequence**				
		Insignificant No Impact/ Not Detectable Rating 1	Minor Compliance Impact Rating 2	Moderate Aesthetic Impact Rating 3	Major Regulatory Impact Rating 4	Catastrophic Public Health Impact Rating 5
Likelihood/Frequency	Almost Certain Once a day Rating 5	5	10	15	20	25
	Likely once a week Rating 4	4	8	12	16	20

	Moderate Once a month Rating 3	3	6	9	12	15
	Unlikely Once a year Rating 2	2	4	6	8	10
	Rare Once every 5 years Rating 1	1	2	3	4	5
Risk Score			<6	6-9	10-15	>15
Risk Rating			Low	Medium	High	Very High

HAZARD TABLE RATING

HAZARDS	CONSEQUENCE	SEVERITY RATING
Microbial	May cause mortality; should have highest severity rating	5
Chemical	With health significance (toxic); Should have very high severity rating but lower than microbial.	4
	With no health significance (non-toxic) but will make water objectionable.	3
Physical	Will make water objectionable and lead to its non-use (e.g. turbidity)	3
	May make water objectionable but may not lead to its non-use.	2

RISK PRIORITIZATION RATING

PRIORITY LEVEL	PRIORITY TYPE	RISK SCORE	ACTION LEVELS
1	High	15 – 25	The risk requires immediate control measures.
2	Moderate	6 -14	The risk requires determination of additional control measure.
3	Low	1 – 5	Risk should be documented and requires revisiting in the future.

V. DETERMINATION AND VALIDATION OF CONTROL MEASURES, REASSESS AND PRIORITIZE THE RISK

WSP team documented the existing and potential control measures for each of the identified hazards from catchment to the point of use. The team validates each control to determine its efficacy at its point in the water supply system through site inspection, manufacturer's specification and based on monitoring data.

Reassessment of risk was conducted considering the effectiveness of each of the controls. The reduction in the risk rating achieved by each control is an indication of its effectiveness. The risks were prioritized in terms of their likely impact to the capacity of the system to deliver safe water. High priority risks (risk rating from medium to very high) may require system modifications or upgrade while lower priority risks (risk rating of low) can often be minimized as part of routine good practice activities.

VI. IMPROVEMENT/UPGRADE PLAN

An improvement or upgrade plans were drawn up for each of the significant risks with ineffective or no existing controls identified in the reassessment of risks recognizing that other less significant risk can also be controlled by these improvement measures. Each of the identified improvement/upgrade has an owner to take responsibility for its implementation and target implementation due date were also identified.

Improvement / upgrade plans can include short, medium or long-term programs. These plans should be monitored to confirm improvements have been made and are effective and that WSP has been updated accordingly.

VII. MONITORING OF THE CONTROL MEASURES (OPERATIONAL MONITORING)

Operational monitoring includes defining and validating the monitoring of the control measures and establishing procedures to demonstrate that the controls continue to work.

All control measures identified as "critical" were assigned as "critical control points" and were monitored against "critical limits or operational limit" criteria. This critical/ operational limit is a criterion that will indicate whether the control measure is effective and is functioning as it was designed to be.

Monitoring plan for the whole water supply system indicating an acceptable critical/operational limit for each control, designated monitoring locations, and established a schedule for frequency of monitoring and assigned responsible parties. Corrective actions to be taken if monitoring reveals a parameter to be outside of the acceptable "limits" were also established.

VIII. VERIFICATION

Verification provides evidence that the overall system design and operation is capable of consistently delivering water of the specified quality to meet the health-based targets. It involves three (3) activities:

1. Compliance monitoring – confirmation of compliance with water quality targets,
2. Internal and external auditing of operational activities – it can have both an assessment and a compliance checking role. The frequency of audit depends on the level of confidence required by the water utility and the regulatory body.
3. Consumer Satisfaction – includes checking that consumers are satisfied with the water supplied.

IX. MANAGEMENT PROCEDURES

Management procedures are clear documentation of operational procedures for actions to be taken when the system is operating under normal conditions, and incident situations. The procedures should be written by experienced staff and should be updated as necessary, particularly considering implementation of the improvement/upgrade plan, review of incidents, emergencies and near misses. It also includes documentation of the system assessment, monitoring and communication plans and supporting programs.

A wide range of records is generated daily as GCWD and PWGC continue to operate providing safe drinking water to its entire service area aside from the actual implementation of the water safety plan. Regular monitoring of every process step and any necessary corrective actions taken for every deviation from operational limits, incident response reports are consistently recorded and kept for future reference. Water Resources Section have developed a document control system that ensures that all documents are up to date, that the current revisions are in use, readily available when required and that the obsolete ones are retrieved and discarded. The documents were kept simple and short as much as possible and the level of detail in the procedures and work instructions is sufficient to provide assurance of operational control when performed by competent and well-trained operators.

Records need to be retained and stored at a defined number of years with disposal schedule and specified storage areas, which are accessible only to authorized personnel. This system of recording and documentation foster process and records ownership and eventual implementation of the procedures and more importantly it provides an auditable system wherein review can be done periodically.

X. SUPPORTING PROGRAM

Supporting programs are division-wide activities that should be in place in support of the delivery of safe quality water. These activities do not directly affect water quality but are meant to ensure that no additional source of potential hazards will come from the operating /surrounding environment, the equipment's used, and the people themselves, employees and visitors alike.

GAPAN CITY WATER DISTRICT & PRIMEWATER GAPAN CITY

Support Programs

Activity	Objective	Program/System	Schedule	Responsible Unit	Participants
Orientation, Training, Seminars and Awareness	To ensure that GCWD and PWGC personnel and the concessionaires understand their role in the effective implementation of the WSP and the effect of their action on water quality.	WSP General Awareness Program for all GCWD and PWGC employees	2nd Quarter of 2023	GCWD, PWGC and PrimeWater Central Office (PWCO)	All GCWD/ PWGC Employees
		Training for the Technical Operations department on chlorine handling, dosing, residual monitoring, water quality, etc.	Calendar Year of 2023	Water Resources Section - PWCO	PWGC Technical Operations department and Customer Relations Officer
		WSP Orientation for every new member of the WSP Team	2nd Quarter of 2023	WSP Team and Water Resources Section - PWCO	All GCWD/ PWGC Employees
		Orientation of New Service Applicants on proper handling of water, use of	Every New Application for Service	Business Operations department	New Service Connection Applicants

		standard materials, effect of cross connections, etc.	Connection		
		Training on selected employees on emergency preparedness and response (disaster risk reduction)	Calendar year of 2023	Administrative Department and CDRRMO	Selected Employees of GCWD and PWGC
		Pressure Management	Calendar year of 2023	Engineering and Maintenance Section - PWCO	Technical Operations department & GCWD
Calibration and preventive maintenance of system appurtenances and equipment	To ensure that all GCWD and PWGC equipment are performing well and accurately measuring critical limit operational parameters.	Calibration program on the following:			
		Process Instruments (Flow Meters, pressure gauges, water level tester, pump and motor efficiency etc.)	Per calibration program and as needed	Technical Head	Selected Employees of GCWD and PWGC
		Chlorine Dosing Equipment	Per calibration program and needed	Technical Head	Selected Employees of GCWD and PWGC

		Water Meters and Valves	Per approved program	Engineering and Maintenance Section	Pump operators and other field personnel
Training on Hygiene and Sanitation	To ensure that all personnel directly in responsible with the supply and delivery of safe water will practice proper hygiene and sanitation to prevent water contamination	Water Quality Monitoring and Safety and Health	Quarterly meetings of responsible sections	PWGC Technical and Business Operations department and Water Resources Section - PWCO	Selected Employees of PWGC
Customer Care	To enhance customer satisfaction	Customer Service Program	Calendar year of 2023	GCWD and PWGC Administrative Department	PWGC Business Operations department
Watershed Protection and Preservation	To ensure the protection of watershed and the sustainability of water supply	Adopt a Tree Program, Watershed Management Program and River clean-up program	2023 strategic initiatives	GCWD and PWGC Administrative Department	CENRO, NGO's and Barangay stakeholders

XI. REVIEW AND AUDIT

Water Safety Plan shall be reviewed periodically and updated regularly to ensure that new risks and significant incidents threatening the safety of water supply to customers are regularly assessed and addressed. The review shall comprise all aspects of the WSP including changes in the water supply system, improvement programs, revised procedures, staff changes and stakeholder contact details.

In addition to review of the WSP, periodic audit shall be done to ensure that system management is being carried out as described in the WSP; operational monitoring parameters are kept within operational limits and that compliance is being maintained; verification programs are operated by the water supplier; and supporting programs and strategies for improvement are applied.

XII. REVISE WSP FOLLOWING AN INCIDENT

To ensure that a WSP covers emerging hazards and issues, the WSP Team should review it periodically. The implementation of the WSP framework reduces the number and severity of incidents, emergencies or near misses affecting or potentially affecting the quality and safety of water. However, such incidents/events may still occur. Hence, in addition to the periodic review of the WSP, review of the WSP following every emergency, incident, or unforeseen event irrespective of new hazards were identified is very important to ensure that the same incident/emergency will not recur in the future and to determine whether the response was effective or need to be improved. The result of a post incident review is always likely to identify areas for improvement whether it is a new hazard, or a revised risk for the risk assessment, a revision for an operating procedure, a training issue and the WSP must be revised to reflect the change and incorporate the lessons learned into the WSP documentation and procedures.

Revise the WSP as necessary including updates to supporting programs.

ANNEX A: RISK ASSESSMENT

Process	Hazardous Event	RAW RISK					Control Measure	Effectiveness of Control Measures	RESIDUAL RISK			
		Hazard	Likelihood	Severity	Score	Risk Rating			SEVERITY	LIKELIHOOD	Risk Score	Risk Rating
Well	Intrusion of solid particles thru well casing	P	3	3	9	Medium	Maintain the pump rating capacity as per specifications	Pump rating capacity is maintained however need to conduct pump well test to check water level drawdown or conduct camera logging.	3	1	3	Low
	Presence of septic tank within the 25-meter radius	M	5	5	20	Very High	Cement Grouting around annulus of casing	Existing cement grouting of all pump station wells meet the sanitation code standard (>10 meters). Compliance with PNSDW no presence	5	1	5	Low

								of contamination per monthly Bacteriological Test results.				
	Open Sounding Tube/Intake Box/Cable Wire passage	M	5	3	25	Very High	Sealing of all openings	Seal is in place. No presence of contamination per monthly Bacteriological Test results.		1	5	Low
	Flooding	M	2	5	10	Medium	Sealing of all openings	Bacteriological Test shows negative results. Physical and Chemical analysis is within the PNSDW required limit	5	1	5	Low
		P	2	3	6	Low						
		C	2	4	8	Low						

Process	Hazardous Event	RAW RISK					Control Measure	Effectiveness of Control Measures	RESIDUAL RISK			
		Hazard	Likelihoo	Severity	Score	Risk Rating			SEVERITY	LIKELIHOOD	Risk Score	Risk Rating
Well	During Pump Repair	M	3	5	15	High	Flushing after re-installation of Pump	Ensure that the water is clear before feeding	5	1	5	Low
	Turbid water caused by Power Fluctuation	P	4	2	8	Low	Automatic Start of pump equipment for Production Well	Turbidity test results are within the PNSDW	2	1	2	Low
	Earthquake	P C M	1	5	5	Low	Natural Disaster/ Ocular Inspection	Urgent Repair and Maintenance for damage equipment, transmission lines and	5	1	5	Low

								Facilities/Water test results is within the PNSDW required limit.				

Process	Hazardous Event	RAW RISK					Control Measure	Effectiveness of Control Measures	RESIDUAL RISK			
		Hazard	Likelihoo	Severity	Score	Risk Rating			SEVERITY	LIKELIHOOD	Risk Score	Risk Rating
Treatment	Non-Availability of Liquid Chlorine	M	3	5	15	High	Use of Chlorine Granules as alternative for disinfections/ Inventory for stock of Liquid Chlorine	No presence of contamination per monthly Bacteriological testing	5	1	5	Low

	Defective Chlorine dosing devices	M	3	5	15	High	Periodic inspection and corrective action Availability of spare units	Occasional downtime due to unavailability of some parts/Test for residual chlorine	5	2	10	Medium
	Under dosing of Chlorine	M	3	5	15	High	Maintain appropriate dosage	Proper orientation for operators	5	2	10	Medium
	Low Quality of disinfectant	M	5	5	25	Very High	Monitoring of Residual testing must be PNSDW limit	Technical Head strictly monitoring	5	5	25	Very High

Process	Hazardous Event	RAW RISK					Control Measure	Effectiveness of Control Measures	RESIDUAL RISK			
		Hazard	Likelihood	Severity	Score	Risk Rating			SEVERITY	LIKELIHOOD	Risk Score	Risk Rating
Reservoirs	Intrusion of contaminants in reservoir due to unsecured/ improper vent cover	PCM	2	5	10	High	Secure or fix the vent cover	Regular inspection of reservoir vent cover and urgent repair if necessary	5	1	5	Low
	Facility damage caused by natural calamity like earthquake/ typhoon, etc.	PCM	2	5	10	High	Immediately repair is required	In place	5	1	5	Low
	Poor construction of workmanship of facilities	PCM	2	5	10	High	Standard procedure is required	Proper supervising and monitoring during construction required.	5	1	5	Low

	Unprotected service reservoir access (Open vicinity allowing entry of animals which are known as carriers of harmful microorganism to contaminate water with their feces and urine.)	P C M	3	5	15	High	Construction of perimeter fence	Proper supervising and monitoring during construction required place	5	1	5	Low
Process	**Hazardous Event**	**RAW RISK**					**Control Measure**	**Effectiveness of Control Measures**	**RESIDUAL RISK**			
		Hazard	**Likelihoo**	**Severity**	**Score**	**Risk Rating**			**SEVERITY**	**LIKELIHOOD**	**Risk Score**	**Risk Rating**
Distribution Storage	Improper storage and handling of materials (pipes with no end caps	M	5	5	25	Very High	Proper Handling is required	Regular inventory and inspection for proper handling of materials must be complied.	4	2	8	Medium

	stored in open stockyard allowing the entry of small animals like rodents etc. which carries harmful microorganism)											
Distribution Lines	Intrusion of contaminants due to water line, fittings and valves breakage/burst due to low pressure and no water	P C M	5	5	25	Very High	Conduct re-active leak detection and repair/Pipeline and appurtenances rehabilitation program	Reduction of frequency of leak reported and repair; No presence of contamination per monthly bacteriological test results	5	2	10	Medium

	Contamination of water supply due to use of sub standards materials	P C M	1	5	5	Low	Water Resources Head Monitoring	Proper monitoring and Inventory of standard materials.	5	1	5	Low

Process	Hazardous Event	RAW RISK					Control Measure	Effectiveness of Control Measures	RESIDUAL RISK			
		Hazard	Likelihood	Severity	Score	Risk Rating			SEVERITY	LIKELIHOOD	Risk Score	Risk Rating
Distribution Lines	During Interconnections	P C M	5	5	25	Very high	Proper dewatering/ sealing and conduct flushing and disinfection	In place	5	2	10	Medium

	Mainlines and Service Lines are near canals and disposal of domestic wastewater from nearby households	P C M	5	5	5	High	Proper place for mainline and service connections	Relocate lines that are near or on this site. Bacteriological test results pass.	5	2	10	Mediu m
Concessionaire	Intrusion of contaminants due to Cross Connection and use of substandard materials after the meter	P C M	3	5	15	High	Educate Consumers for new connection application	Required customer to use standard materials for their own safety and convenience	5	1	5	Low
	Illegal tapping	P C M	5	5	25	Very High	Policy on Illegal connection	Cannot be determined due to no baseline data/Lessen during pipelines	5	2	10	Mediu m

								rehabilitation and transfer of service connections				

ANNEX B: CONTROL MEASURES

Process	Hazardous Event	RAW RISK					Control Measure	Effectiveness of Control Measures	SEVERITY	RESIDUAL RISK			
		Hazard	Likelihood	Severity	Score	Risk Rating				LIKELIHOOD	Risk Score	Risk Rating	Proposed Control Measures
Well	Intrusion of solid particles thru well casing	P	3	5	15	Medium	Maintain the pump rating capacity as per specifications	Pump rating capacity is maintained however need to conduct pump well test to check water level drawdown or conduct camera logging.	3	1	3	Low	Continue water quality monitoring through portable test kit/Scheduled Water quality test for

													accredited Laboratory
	Presence of septic tank within the 25-meter radius	M	5	5	25	Very High	Cement Grouting around annulus of casing	Existing cement grouting of all pump station wells meet the sanitation code standard (>10 meters). Compliance with PNSDW no presence of contamination per monthly Bacteriological Test results.	5	1	5	Low	Continue Water Quality monitoring through portable test kit/Scheduled Water quality test for accredited Laboratories
	Open Sounding Tube/Intake	M	5	5	25	Very High	Sealing of all openings	Seals are in place. No presence of contamination per	5	1	5	Low	Urgent sealing of all openings for well

	Box/Cable Wire passage							monthly Bacteriological Test results.					appurtenances/ Monitoring and Water quality test results

Process	Hazardous Event	RAW RISK					Control Measure	Effectiveness of Control Measures	SEVERITY	RESIDUAL RISK			
		Hazard	Likelihood	Severity	Score	Risk Rating				LIKELIHOOD	Risk Score	Risk Rating	Proposed Control Measures
Well	Flooding	M	2	5	10	Medium	Sealing of all openings	Bacteriological Test shows negative results. Physical and Chemical analysis is within the PNSDW required limit	5	1	5	Low	Rehabilitation of all Pumping Station that are affected by flood.
		P	2	3	6	Low							
		C	2	4	8	Low							
	During Pump Repair	M	3	5	15	High	Flushing after re-	Ensure that the water is clear before feeding	5	1	5	Low	Clean Surroundings

							installation of Pump						during and after pump repairs
	Turbid water caused by Power Fluctuation	P	4	2	8	Low	Automatic Start of pump equipment for Production Well	Turbidity test results is within the PNSDW	2	1	2	Low	Scheduled Flushing
	Earthquake	P C M	1	5	5	Low	Natural Disaster/ Ocular Inspection	Urgent Repair and Maintenance for damage equipment, transmission lines and Facilities/Water test results is within the PNSDW required limit.	5	1	5	Low	Standby personnel for emergencies

Process	Hazardous Event	RAW RISK					Control Measure	Effectiveness of Control Measures	RESIDUAL RISK				
		Hazard	Likelihood	Severity	Score	Risk Rating			SEVERITY	LIKELIHOOD	Risk Score	Risk Rating	Proposed Control Measures
Treatment	Non-Availability of Liquid Chlorine	M	3	5	15	High	Use of Chlorine Granules as alternative for disinfections/Inventory for stock of Liquid Chlorine	No presence of contamination per monthly Bacteriological testing	5	1	5	Low	Usage of Chlorine Granules as alternative in case there is Non-Availability of liquid chlorine. /Strictly regular monitoring of stocks of Liquid Chlorine

	Defective Chlorinating devices	M	3	5	15	High	Periodic inspection and corrective action Availability of spare units	Occasional downtime due to unavailability of some parts/Test for residual chlorine	5	2	10	Mediu m	Back up chlorinating system/ Availability of Spare unit
	Under dosing of Chlorine	M	3	5	15	High	Maintain appropriate dosage	Proper orientation for operators	5	2	10	Mediu m	Set proper dosing for Chlorination System
	Low Quality of disinfectant	M	5	5	25	Very High	Monitoring of Residual testing must be PNSDW limit	Technical Head strictly monitoring	5	5	25	Very High	Compliance with GCWD and PWGC specifications. Require Supplier to submit material

													safety data sheet of certificate of analysis
Process	**Hazardous Event**	**RAW RISK**					**Control Measure**	**Effectiveness of Control Measures**	**RESIDUAL RISK**				
		Hazard	**Likelihood**	**Severity**	**Score**	**Risk Rating**			**SEVERITY**	**LIKELIHOOD**	**Risk Score**	**Risk Rating**	**Proposed Control Measures**
Reservoir	Intrusion of contaminants in reservoir due to unsecured/ improper vent cover	M	2	5	10	High	Secure or fix the vent cover	Regular inspection of reservoir vent cover and urgent repair if necessary	5	1	5	Low	Urgent repair of improper vent cover/Regular monitoring
	Facility damage caused by natural calamity like earthquake/ typhoon, etc.	M	2	5	10	High	Immediately repair is required	In place	5	1	5	Low	Ocular inspection is required after the event/Urgent

													repair if necessary
	Poor construction of workmanship of facilities	P C M	2	5	10	High	Standard procedure is required	Proper supervising and monitoring during construction required.	5	1	5	Low	Fallow the plans for construction
	Unprotected service reservoir access (Open vicinity allowing entry of animals which are known as carriers of harmful microorganism to contaminate water with their	P C M	3	5	15	High	Constructio n of perimeter fence	Proper supervising and monitoring during construction required place	5	1	5	Low	Urgent construction of perimeter fences

	feces and urine.)												

Process	Hazardous Event	RAW RISK					Control Measure	Effectiveness of Control Measures	RESIDUAL RISK				
		Hazard	Likelihood	Severity	Score	Risk Rating			SEVERITY	LIKELIHOOD	Risk Score	Risk Rating	Proposed Control Measures
Distribution Storage	Improper storage and handling of materials (pipes with no end caps stored in open stockyard allowing the entry of small animals like rodents etc.	M	5	5	25	Very High	Proper Handling is required	Regular inventory and inspection for proper handling of materials must be complied.	4	2	8	Medium	Proper Storage must be observed.

	which carries harmful micro-organism)												
Distribution Lines	Intrusion of contaminants due to water line, fittings and valves breakage/burst due to low pressure and no water	P C M	5	5	25	Very High	Conduct re-active leak detection and repair/Pipeline and appurtenances rehabilitation program	Reduction of frequency of leak reported and repair; No presence of contamination per monthly bacteriological test results	5	2	10	Medium	Leak Detection program/urgent leak repair for all leaks located for the program.
	Contamination of water supply due to use of sub standards materials	P C M	1	5	5	Low	Water Resources Head Monitoring	Proper monitoring and Inventory of standard materials.	5	1	5	Low	Observed the Standard delivery of Materials.

	During Interconnections	PCM	5	5	25	Very high	Proper dewatering/ sealing and conduct flushing and disinfection	In place	5	2	10	Medium	Observed cleanliness in workplace/proper dewatering and flushing

Process	Hazardous Event	RAW RISK					Control Measure	Effectiveness of Control Measures	RESIDUAL RISK				
		Hazard	Likelihood	Severity	Score	Risk Rating			SEVERITY	LIKELIHOOD	Risk Score	Risk Rating	Proposed Control Measures
Distribution Lines	Mainlines and Service Lines are nearby canals and disposal of domestic wastewater from nearby households	M	5	5	5	High	Proper place for mainline and service connections	Relocate lines that are near or on this site. Bacteriological test results pass.	5	2	10	Medium	Relocate all Mainline and service lines

Concessionaire	Intrusion of contaminants due to Cross Connection and use of substandard materials after the meter	PCM	3	5	15	High	Educate Consumers for new connection application	Required customer to use standard materials for their own safety and convenience	5	1	5	Low	Orientation for New Applications of service connections.
	Illegal tapping	PCM	5	5	25	Very High	Policy on Illegal connection	Cannot be determined due to no baseline data/Lessen during pipelines rehabilitation and transfer of service connections	5	2	10	Medium	Issue penalty for those who have illegal connections.

ANNEX C: IMPROVEMENT PLANS

Process Step	Action Proposed Control	Hazardous Event	Identified Specific Improvement Plan	Accountabilities	Cost	Funding Source	Due	Status
Well	Blending/Put up Arsenic filters for affected wells	Arsenic Contamination	1 Unit of Arsenic Filter installed and operational/Negative results of Arsenic (passed PNSDW)	Supplier/ Technical Head	N/A	CAPEX	5 years for all affected Pump Stations	On going
	Pump Repair/ Rehabilitation	Microbial intrusion during Pump Repair/ Rehabilitation	Cleanliness in workplace during repair/Feed to line if turbidity below or equal 5 NTU.	Pump Operators	Salary	O&M Expenses	Every after repair	On Going
Treatment	Alternative usage of Chlorine Granules	Non-Availability of Liquid Chlorine	Purchase Chlorine Granules for emergency purpose/Proper	Technical Head/ Pump Operator			Purchasing	On Going

			monitoring /Inventory of Liquid Chlorine					
	Maintain appropriate dosing rate.	Under dosing of Chlorine	Set proper dosing for Chlorination System	Technical Head /Pump Operator				
	Availability of Spare Parts for Chlorinating Unit	Defective Chlorinating Unit	Purchase of spare Unit of Chlorine Dosing Pump	Purchasing	40,000	CAPEX	2019	Procurement

Process Step	Action Proposed Control	Hazardous Event	Identified Specific Improvement Plan	Accountabilities	Cost	Funding Source	Due	Status
Reservoir	Construction of concrete perimeter fence on all reservoirs	Entry of Microbial due to animal defecation through open vents/manholes	Standard construction of concrete perimeter fences for all reservoirs	Outsource				Completed

		Presence of nearby canals and disposal of domestic waste from nearby households						
	Immediate repair after ocular inspections	Entry of microbial due to damage facility and appurtenances cause by natural calamity like earthquake, typhoon etc.	Immediate repair and rehabilitation for damage facilities and appurtenances after inspections	Outsource		CAPEX		On Going
Distribution	NRW Reduction Programs	Entry of contaminants/Microbial at leaking pipelines, fittings, and valves due to low pressure and no water	NRW Program Statement	Technical Operations		CAPEX		On going

	Pipeline repair	Entry of contaminants/microbial due to pipe burst during natural calamity	Conduct turbidity and residual Chlorine Test; collect sample for Bacteriological Test.	Technical Operations				
	Handling of Materials	Improper handling/stoking of pipes on site	Cover pipes with canvas (trapal) to avoid exposure directly to sunlight and rain. Cover end pipes to prevent the entry of contaminants.	Business Operations				

Process Step	Action Proposed Control	Hazardous Event	Identified Specific Improvement Plan	Accountabilities	Cost	Funding Source	Due	Status
Distribution	Inspection of inter connection and Conduct turbidity and Bacteriological Test	During Interconnection	Conduct Flushing of nearest hydrant, Conduct turbidity and residual chlorine test; collect samples for Bacteriological Testing Verify fittings installed for possible leakage, sand bedding and backfill with new soil materials every after layout.	Technical Operations				
	Relocation of Mainline and service lines.	Mainlines and Service Lines are nearby Canals	During rehabilitation programs of water distribution lines/	Technical Operations				On Going

			relocate all Mainlines and service lines that are nearby Canals and domestic waste disposal of nearby households					
Concessionaire	Inspection of materials/ pipe laying prior to the installation of service connections	Cross connection and Use of substandard materials after the meter	Implement Pre installation for New Service Connections	Business Operations				On Going
	NRW Reduction Program	Illegal Tapping	Implementation of NRW Reduction Program	Technical Operations				On Going

ANNEX D: OPERATIONAL MONITORING AND CORRECTIVE ACTION

Process Step: Control Measures	Critical Limit	What	Where	When	How	Who	Corrective Action
Well: Continue water quality monitoring	Zero (0) 500 CFU	Coliform HPC	Production Wells	Monthly	Bacteriological	DOH accredited laboratory	Proper Dosing of Chlorine Mixture
Well: Implement use of food grade paints of all discharge pipes	Covers in place (Tightly Seal)	Condition of seal	Site (well)	Daily	Ocular Inspections	Pump Operators	Repair/Replace
Well: Pump Repair	Less or equal to 5 NTU	turbidity	source	After repair	Through TDS meter	Technical Operations	Increase flushing time

Process Step: Control Measures	Critical Limit	What	Where	When	How	Who	Corrective Action
Treatment: Compliance with GCWD and PWGC specifications. Require supplier to submit material safety data sheet and certificate of analysis	Liquid Chlorine 7-8% Concentration	Concentration	Chlorine Test Kit	Upon Delivery	Verify results through portable chlorine residual test kit from near point to end point users	Technical Head	Require Supplier to replace delivered product if necessary

Treatment: Proper setting of dosing feed rate	Corresponding feed rate	Chlorine feed rate	Treatment sites	Daily	Gauge Reading	Pump Operators	Adjust dosage to comply to standard feeding
Treatment: Back up Chlorinating System	Continuous dis infection/treatment	Chlorinator	Treatment Sites	Daily	Equipment Check Up	Technical Operations and Administrative department	Purchase spare of chlorine dosing pump

Process Step: Control Measures	**Critical Limit**	**What**	**Where**	**When**	**How**	**Who**	**Corrective Action**
Distribution: Storage handling	No roofing; cover not in place	Pipes	Warehouse area	Daily	Ocular Inspections	Business Operations	Proper cover for pipes

Distributions: NRW Reduction programs (Physical Losses Component)	Major leak repair due to road upgrading and improvements	Leaks repaired	Within affected Areas	On Scheduled	Leak Detection program	Technical Operations	Total Pipe replacement for Major Leak repairs for Roads that are upgrade and improve. Urgent for those leaks that are visualized after the Leak detection event.
Distribution: Pipeline repair	Not more than 5 NTU; not less than 0.3 ppm residual	Turbidity, Residual Chlorine; coliform; HPC	Within affected areas	After every pipe burst repair	Portable TDS and Chlorine Residual test kits.	Technical Operations	Increase flushing time if turbidity is above critical limit and increase the dosage of Chlorine if necessary.
Distribution: Interconnection and conduct turbidity and microbiological test	Not more than 5 NTU; not less than 0.3 ppm Presence of foreign	Turbidity, Chlorine residual; Coliform; HPC	Construction Site	After every pipeline interconnection	Portable TDS and Chlorine residual test kits	Technical Operations	Clear the distribution lines for any possible foreign objects that will contaminate the water supply.

	objects recovered during flushing						

Process Step: Control Measures	Critical Limit	What	Where	When	How	Who	Corrective Action
Reservoirs: Construction of concrete fence on all reservoirs	No runoff within the perimeter area	Domestic Waste	Around the reservoir site	Daily and Monthly	Ocular Inspections	Technical Operations	Repair perimeter fence.
Reservoirs: In place residual chlorine, turbidit, ph and regular bacteriological test	Positive results of total coliform, E Coli and HPC	Bio film growth	Reservoir	Per Scheduled and Monthly	Bacteriological Test	Technical Operations	Reservoir cleaning and disinfection activity

Consumer: New Service Connection Installation and Rehabilitation program for existing connections	No Service Connection submerged in Canal	Service Connections	Drainage line/Canals	Monthly	Ocular Inspections	Business Operations	Report to Maintenance and NRW team for appropriate Action

ANNEX E: VERIFICATION MONITORING PROGRAM

VERIFICATION ACTIVITY	LOCATION	Type of Activity	Frequency of Monitoring	Responsible Unit	Records	PNSDW PARAMETERS
Bacteriological Testing	Source Distribution System Consumers Tap Reservoirs	Water Quality Testing	Monthly/As per Maintenance Order for Water Quality Complaints	Water Resources Section/ DOH Accredited Laboratory	Filling of Hard Copy/Soft Copy Records	Total Coliform, Fecal Coliform and HPC
Physical/Chemical Testing	Source Distribution System Consumers Tap Reservoirs Distribution System Consumers Tap Reservoirs	Water Quality Testing	Twice a Year/Once a Month for Arsenic and Silica as required.	Water Resources Section /CRL and National Reference Laboratories	Filling of Hard Copy/Soft Copy Records	Arsenic, Cadmium, Lead, Nitrate, Benzene, Color, Turbidity, Iron, pH, Manganese, Chloride, Sulfate, TDS, and Residual Chlorine
Iron, Manganese & Hydrogen Sulfide Filtration	Source Distribution System Consumers Tap	Water Quality Testing	Twice a Year/Backwashing and Rinsing is	Technical Operations	Filling of Hard	Iron, Manganese and Hydrogen Sulfide

			twice a week for Filters		Copy/Soft Copy Records	
Arsenator Kit, Bacteriological Test Kit, Chlorine Residual Test Kit, PH & TDS Meter	Supplier's Office	Calibration and Maintenance	Calibration at least once a year or as needed	Technical Operations /Calibration Section (Supplier's Office)	Filling of Hard Copy/Soft Copy Records	
Records Verification						
Pressure	Pump Station	Operations Audit	Daily	Technical Operations	Daily Operational Report/Filling of Hard/Soft Copy Records	
Water Level	Pump Station					
Volumetric Flow	Pump Station					
Residual Chlorine	Pump Station Consumers Tap					Maximum of 1.5 ppm Nearest Point from source and minimum of 0.3 ppm farthest point from source.

VERIFICATION ACTIVITY	LOCATION	Type of Activity	Frequency of Monitoring	Responsible Unit	Records	PNSDW PARAMETERS
Water Treatment (Chlorination)	Pump Station	Water Quality Testing	Daily	Technical Operations	Filling of Hard Copy/Soft Copy Records	Chlorine residual
Customer Satisfaction Survey	Served Barangays Main Office/Sub Office	Random Survey from customer	Daily/Survey Forms	Business Operations	Filling of Hard Copy/Soft Copy Records	
Records Verification						
Pressure **Air Release Valves** **Hydrants** **Maintenance Order**	DISTRIBUTION SYSTEM	Operations Audit	Daily/Monthly	Technical Operations	Daily/Monthly Operational Report/Filling of Hard/Soft Copy Records	

Leak Detection	Pipeline Network	Maintenance and Repair	Leak Detection Activity/As needed	Technical Operations	Filling of Hard Copy/Soft Copy Records	
Regulatory Compliance	Laboratory Test Results of Water Quality	External Audit	Monthly/Twice a Year	City Health Unit	Certification?	
	Main Office Operations Record			LWUA		

****** This Water Safety Plan shall be subjected to Internal and External Audit based on the guidelines set by DOH and LWUA***