ANGELES CITY
WATER DISTRICT
SINCE 1987

WATER SAFETY PLAN

2017

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ANGELES CITY WATER DISTRICT

WATER SAFETY PLAN

Records or Edited Revisions

Revision Number and Date	**Which revision of the document were revised**
Rev. 0.0 Date 11 Nov. 2016	Issue of first revision - all section new
Rev. 1.0 Date 14 Jul. 2017	All sections revised

I. INTRODUCTION

A satisfactory supply of water must be available to every individual and necessary effort must be done to achieve a drinking water quality as high as practicable. The quality of drinking water may be controlled through a combination of protection of water resources, control of treatment processes and management of the distribution and handling of water. Protection of water sources from contamination is the first line of defense. Failure to provide adequate protection and effective treatment will expose the community to the risk of outbreaks of intestinal and other infectious diseases and other water-related diseases too. The most effective means of consistently ensuring the safety of a drinking-water supply is through the use of a comprehensive risk assessment and risk management approach that encompasses all steps in water supply from catchment to consumer. Such approaches are called water safety plans. Angeles City Water District (ACWD) recognized the need and importance to its core business the formulation of a **Water Safety Plan** (WSP).

The plan aims to ensure safe drinking water through good water supply practice, by (1) preventing contamination of source water, (2) treating water to reduce or remove contamination in order that water safety targets are met, and (3) preventing re-contamination during storage, distribution and handling of water.

The adoption of water safety plan and the associated commitment to the approach have a number of benefits. One of the major benefits of developing and implementing a water safety plan include the systematic and detailed assessment of prioritization of hazards and the operational monitoring of barriers or control measures. It also provides for an organized and structured system to minimize the chance of failure through an oversight or lapse of management. This process increases the consistency in ensuring that safe water is supplied and provides contingency plans to respond to system failures or unforeseeable hazardous events.

1.1 THE WATER SAFETY PLAN TEAM

Pursuant to Board Resolution no. 21 s. 2017 with office order no. 3 s. 2017, ACWD organized a multi-disciplinary Water Safety Plan Team representing from different departments with a collective responsibility for understanding the water supply system and identifying hazards that can affect water quality and safety throughout the water supply chain. The team will be responsible for developing, implementing and maintaining the WSP as a core part of their day-to-day roles as they understand water abstraction, treatment and distribution and hazards that can affect safely through the supply system from the catchment to the point of consumption. The WSP Team has the authority to enable implementation of the recommendations stemming from the WSP. It is headed by a team leader who is responsible in driving the project and ensuring focus. In the team includes the operational staff, who will contribute to the success of the plan through facilitation ownership and implementation. The team members collectively possess the skills required to identify hazards as well as to understand how the associated risks may be controlled.

Angeles City Water District

WATER SAFETY PLAN STRUCTURE

Figure 1: ACWD Water Safety Plan Team Structure

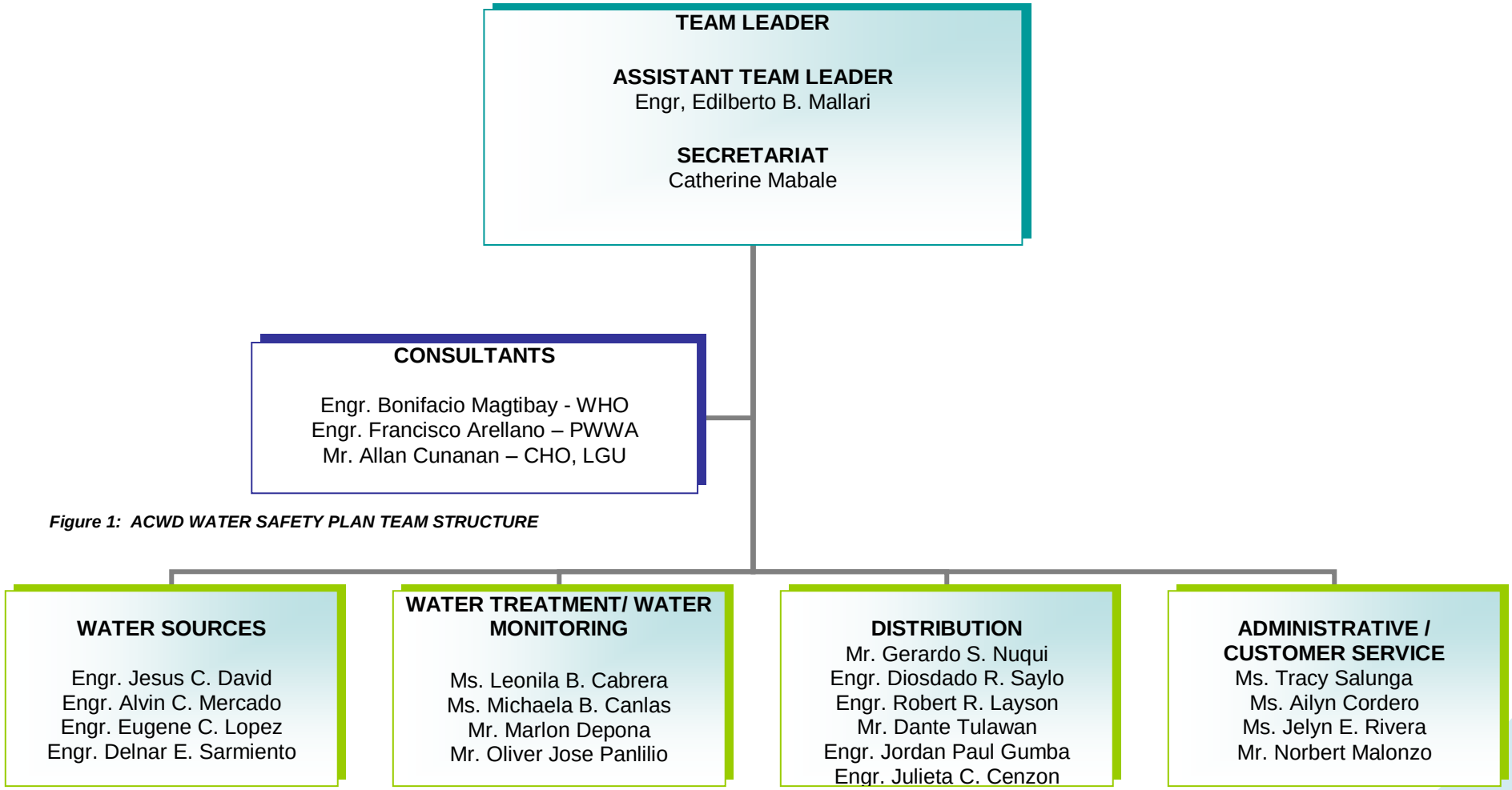


Figure 1: ACWD WATER SAFETY PLAN TEAM STRUCTURE

Table 1: Key Personnel of the Water Safety Plan Team from Groundwater to Distribution

Name	Job Title	Role in the WSP Team	Contact Details	Expertise																		Remarks
				1				2			3		4	5	6	7	8	9				
				a	b	c	d	a	b	c	a	b						a	b	c	d	
		Team Leader																				
Edilberto B. Mallari	Department Manager	Assistant Team Leader	9209222097																			
Jesus C. David	Sr. Water Utilities Mgmt. Officer	Water Sources	9209222045																			
Alvin C. Mercado	Water Maintenance Head	Water Sources	9237389639																			
Delnar E. Sarmiento	Water Utilities Mgmt Officer A	Water Sources	9258166635																			
Eugene C. Lopez	Water Utilities Mgmt Officer B	Water Sources	9333504485																			
Leonila B. Cabrera	Sr. Quality Control Inspector	Water Treatment/Monitoring	9174517715																			
Michaela B. Canlas	Quality Control Inspector	Water Treatment/Monitoring	9434598190																			
Oliver Jose Q. Panlilio	Medical Technologist	Water Treatment/Monitoring	9267592851																			
Marlon Depona	Chemist B	Water Treatment/Monitoring	9287421562																			
Gerardo S. Nuqui	Division Manager	Distribution	9209458649																			
Diosdado R. Saylo	Principal Engineer	Distribution	9258160720																			
Robert Layson	Supervising Engineer A	Distribution	9237389651																			
Jordan Paul Gumba	Engineer B	Distribution	9171500415																			
Dante Tulawan	Water Sewerage/Maintenance Man A	Distribution	9237389652																			
Ailyn Cordero	Division Manager A	Customer Service	9237389615																			
Tracy T. Salunga	Division Manager A	Administrative	9209696580																			
Jelyn E. Rivera	Sr. Corporate Accountant	Finance	9228390421																			
Julieta C. Cenzon	Engineer B	Distribution	9339854508																			
Catherine Mabale	Industrial Relations Management	Secretariat	9553221636																			

Descriptive Meaning of Expertise Rating:

1. Technical expertise on the operation and maintenance of
    a. Source
    b. Storage
    c. Treatment
    d. Distribution
2. Provide operational support for the WSP in terms of
    a. Administrative
    b. Financing
    c. Technical
    3. Capable of communicating the WSP objectives and outcomes
    a. Inside the WD
    b. Outside the WD
    4. Understand Water Quality Targets to be met (Specific knowledge on product water)
5. Understand the impact of proposed quality controls on the environment
6. Knows the regulation
7. Familiar with training and awareness programmes
8. With Authority
9. Other Members
    a. Consultants
    b. Coordinator
    c. Secretariat
    d. Documentation Committee

II. WATER SUPPLY AND PROCESS DESCRIPTION

2.1 Background

Angeles City Water District (ACWD) is a government owned corporation with a vision to excel in providing superior quality and customer-oriented water service to its valued concessionaires at reasonable and affordable rates and at least possible cost.

Now under the stewardship of General Manager Reynaldo C. Liwanag, ACWD was created in September 1987 by virtue of a Sangguniang Panlungsod Resolution No. 66 dated September 1, 1987 during the administration of the late former Mayor Francisco G. Nepomuceno. Subsequently, Certificate of Conformance # 322 was issued by Local Water Utilities Administration (LWUA) on December 1, 1987.

3.1.1 History

The district started the preparation of the feasibility study for the comprehensive improvement and expansion project in 1986 conducted by NJS Consultancy Services from Japan thru the Local Water Utilities Administration (LWUA). The scheduled implementation of the project amounting to P290 Million was in 1991, but due to the Mt. Pinatubo eruption incident in June in that year, the project implementation was delayed requiring resurvey and redesigning of the project.

In 1995, the loan was finally approved by the Overseas Economic Cooperation Fund of Japan and subsequently the loan contract was signed between ACWD and LWUA. By mid-1995, the project was started and by August 9, 1997, it was completed. A total of 173.24175 Km. transmission and distribution lines from 75 mm to 700 mm diameter in sizes were laid. Seven new production feeder wells were drilled to fill the one-million-gallon concreted tank, where 5 – 100 horsepower centrifugal booster pumps will distribute the potable water supply to end users.

To cater the projected increase of number of concessionaires linked to the comprehensive improvement and expansion of District's water system; construction of modern Administrative building was proposed. It was completed in November 2002 and Inaugurated on December 2 of same year.

In 2001, additional pumping stations were constructed in the areas of Brgy. Sapalibutad, Pandan and Tabun. Followed by four pumping stations namely; Punta

Verde Pumping Station, Mabini Pumping Station, Sapangbato Pumping Station and City Hall Pumping Station the next 2 years. These activities led to the completion of water line extensions covering 27,214 m in length at the abovementioned areas.

To ensure superior quality of water, ACWD Laboratory was conceptualized and constructed in May 2003 and June 2003, respectively. It was inaugurated on July 21, 2004 and received its accreditation from the Department of Health on August 2004 with a DOH Accreditation No. 189. The laboratory was awarded with an excellent rating in the 2009 Proficiency Testing for Microbiological Analysis by the National Reference Laboratory of the Department of Health and continued to operate up to present while continuously renewing its DOH Accreditation every three (3) years. Its services offered include bacteriological analysis for Total and Fecal Coliform and Heterotrophic plate count testing as well as Physical and Chemical analysis for 30 parameters using standard methods to the community, business correspondents and its nearby cities. At present, ACWD has seven (7) water treatments namely; EPZA, Sapalibutad, Punta Verde, Northville 15, Marquee Place, Metro Gate 2 and City Hall P.S.

From 2005 to present, another seven (7) pumping stations were subsequently constructed to address the increasing demand for potable water. As a result of the various improvement and expansion projects, the number of connections increased from 9,675 to 53,382 with an average monthly production of 1,600,000 cubic meters (as of June 2017).

3.2 General Information on the Supplier

ACWD supplies water to thirty (30) barangays or 289,162 households which represents 85% of coverage area's total population. Table 2 shows the ACWD's Summary Information.

Table 2: Angeles City Water District Summary Information (as of June 2017)

A. Production/Water Resources

INFORMATION	VALUE	Unit
a. Number of pumping stations	34	units
b. Number of reservoir	2	units
c. Number of Elevated Water Tanks	15	units
e. Average production (volume) per month	1,600,000	cu.m/mo
f. Average operating hours per month	641	hrs
Average Bulk Water Purchased per month	188,000	cu.m/mo
g. Average Billed Consumptions per month	1,200,000	cu.m/mo
h. Per Capita Daily Consumption	0.75	cu.m/connection
i. Non-Revenue Water (volume)	588,000	cu.m
j. % NRW to total production	23.21	%
k. Accounted water loss (volume)	16,437	cu.m
l. Unaccounted water loss (volume)	440,045	cu.m
m. Laboratory used for quality testing	2 (ACWD-owned & CRL for parallel testing)	units
n. Number of pumps undergoing water quality monitoring	34	units
o. Range of Years of Service	30	years
p. Range of Well Depths	80-200	meters

B. Customer

INFORMATION	VALUE	UNIT
a. Total Billed Connections	53,382	connections
b. Residential Connections	49,165	connections
c. Commercial/Industrial Connections	4,217	connections
d. Population Served	266,910	people
e. Ave. mo. duration of Water Interruptions hr.	8	hrs
f. Ave. mo. service connection inspected	241	connections
g. Ave. mo. service connection installed	221	connections

C. Distribution Networks

INFORMATION	VALUE	UNIT
a. Length of distribution Mains (50 mm to 700 mm diameter)	393.7665	km
a1. Geographic Area covered	4,800	hectares
b. Water quality monitoring sites in the distribution system	50	sampling points
c. Leaks reported (service connection/mo. average)	294	reported leaks
d. Leaks repaired (service connection/ mo. Average)	294	reported leaks
e. Leaks reported (mainline/mo. Average)	12	reported leaks
f. Leaks repaired (mainline/mo. Average)	12	reported leaks
g. Mainline leak repair re-action time	1	hr
h. Average mainline leak repair time	6	hrs

D. Human Resources Management

INFORMATION	VALUE	UNIT
a. Total number of employees	177	personnel
b. Number of Permanent employees	160	personnel
c. Number of Job Order Employees	17	personnel
d. Active Service connection/employee	303	

3.3 Stakeholders

Stakeholders play a vital role in bringing quality water to our customers. This part describes the stakeholders' roles and responsibilities, what component of the water supply the stakeholder is engaged, and the interaction mechanism with the water district.

Table 3: WSP Stakeholder Identification and Interaction

Stakeholders				Interaction mechanism[3]	Record of Interaction
Name	**Relationship to Drinking Water Supply Issues**	**Point of Contact with WD / WSP**	**Issues with Drinking Water Supply**		
Members of the Board of Directors	E	E-GM/ SH: Board Chairman	Appropriation of Funds	E: Twice a month board meeting	Minutes of meeting
Suppliers	D	E-Purchasing/GSO SH: Sales Representative	Availability of Materials	E: Request for Quotations	Purchase Order
Angeles City Local Government Unit	C, E	E-GM/ SH: City Mayor, City Councilor & Barangay Officials	Water Supply Concern	E: Communication Letters	Meetings
DPWH	G	E-Maintenance Supervising Engineer/ SH: DPWH	Contamination due to damage the pipelines of the water utility because of unco ordinated programs of the entities.	E: Communication Letters & Phone Calls	Received Calls & Letters
Clark Water	D	E-Customer Service Division Manager/ SH: Clark Water	Interruption of Service	E: Communication Letters & Phone Calls	Received Calls & Letters
Taguete Waterworks Inc.	D	E-General Manager/ SH: Taguete Waterworks Inc.	Interruption of Service	E: Communication Letters & Phone Calls	Received Calls & Letters
NWRB	E	E-Jesus David/ SH: NWRB	Water Permits	E: Letters	Received Letters
LWUA	E	E-Tracy Salunga/ SH: LWUA	Regulator	E: LWUA Issuances	Compliance on Issuances

3.4 Water Sources

Angeles City lies in the western portion of Pampanga Province which is located in the Central Plain of Luzon and is about 80 km north of Manila. It has a total land area of 6,432.82 hectares and is highly urbanized. Almost 85% of water supply in the city is supplied by Angeles City Water District.

Groundwater is used for drinking by about 50 percent of the people in the country and Angeles City Water District is one of the water utility that uses groundwater as its source. Based on the water rights granted by the National Water Resources Board (NWRB) since 2002, 49 percent of groundwater is consumed by the domestic sector, and the remaining shared by agriculture (32 percent), industry (15 percent), and other sectors (4 percent). About 60 percent of the groundwater extraction is without water-right permits, resulting in indiscriminate withdrawal.

The water table may rise or fall depending on several factors. Heavy rains may increase recharge and cause water table to rise. However, an extended period of dry weather may decrease recharge and cause the water table to fall. Based on the LWUA Groundwater data bank for ACWD, 7% of the wells have static water levels 7 meters and below while 16% have water levels reaching down to 55 m and 77% of the well have water level of up to 35 m.

Groundwater elevation and depth-to-water level from ground surface contour lines was generated by the study of LWUA in 2001. Figure 2 from the LWUA Groundwater data bank presents the ACWD wells' depth-to-water map in meters, referenced from the center of well discharge line down to the static water level. The generated contour lines are derived from the seven (7) plotted ACWD wells with static water level measurements. This map is useful in determining the areas with water level deeper than 7 m and the areas that are influenced by large-capacity pumping wells. It can be seen that within the vicinity of

Bagong Bayan Well, the water level is less than 7 m and becomes deeper towards EPZA Well and Feeder No. 2.

Figure 2: Depth-to-Water Level Map

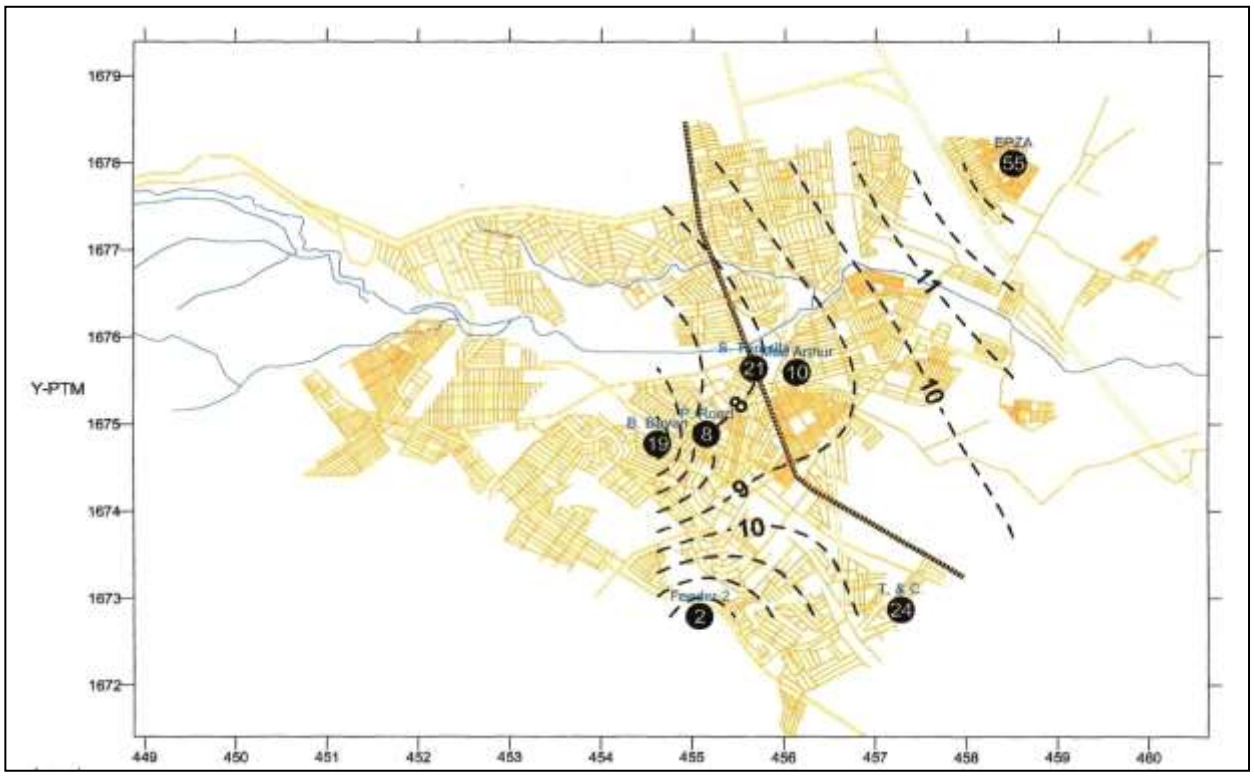


Figure 3 presents the Static Water Level Map where the static water level contour lines are presented as groundwater elevations referenced from the mean sea level. This map shows the general direction of groundwater flow under static condition, generally following the direction of the topography which is east-southeastward.

Figure 3: Static Water Level Map

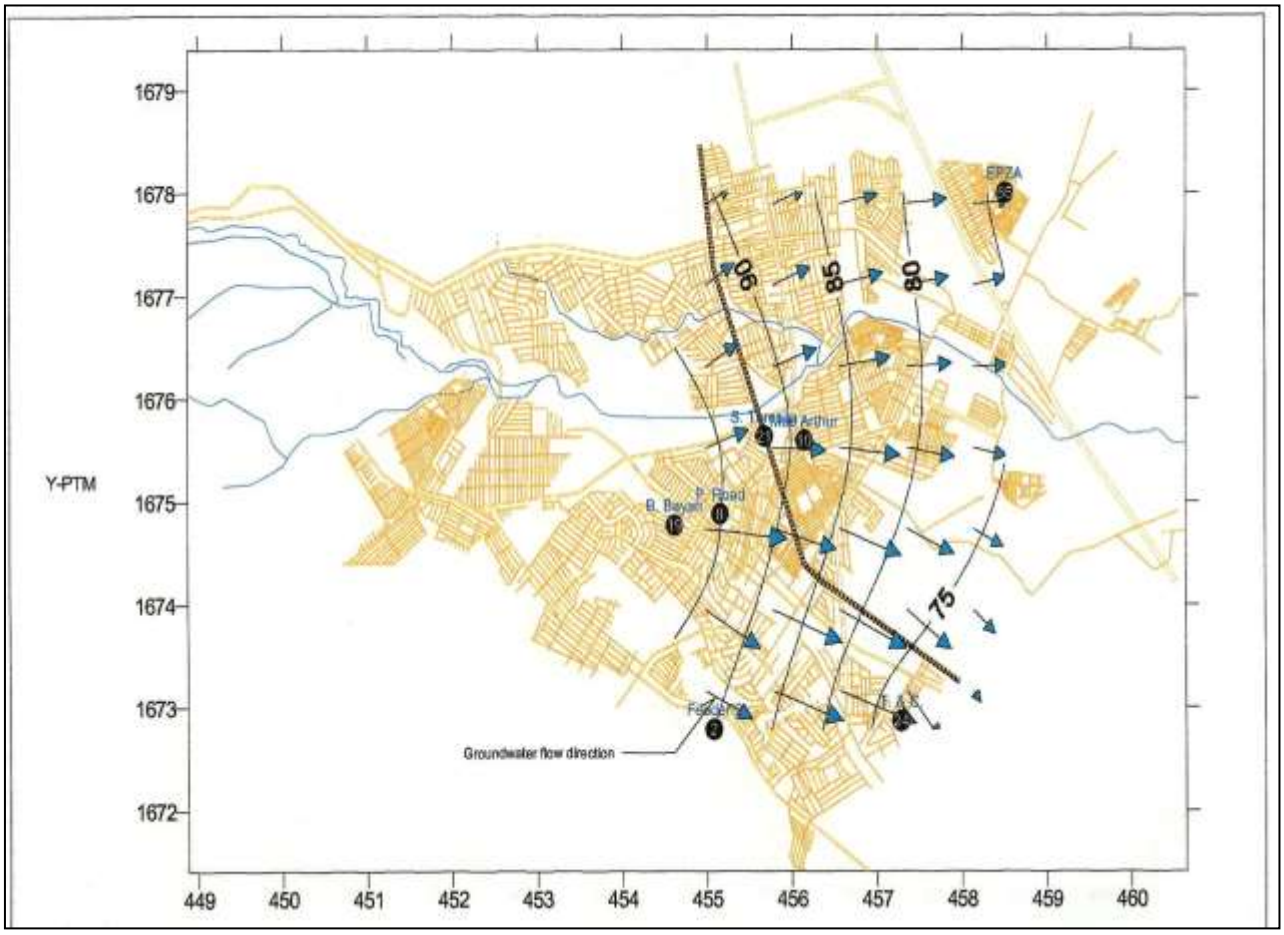
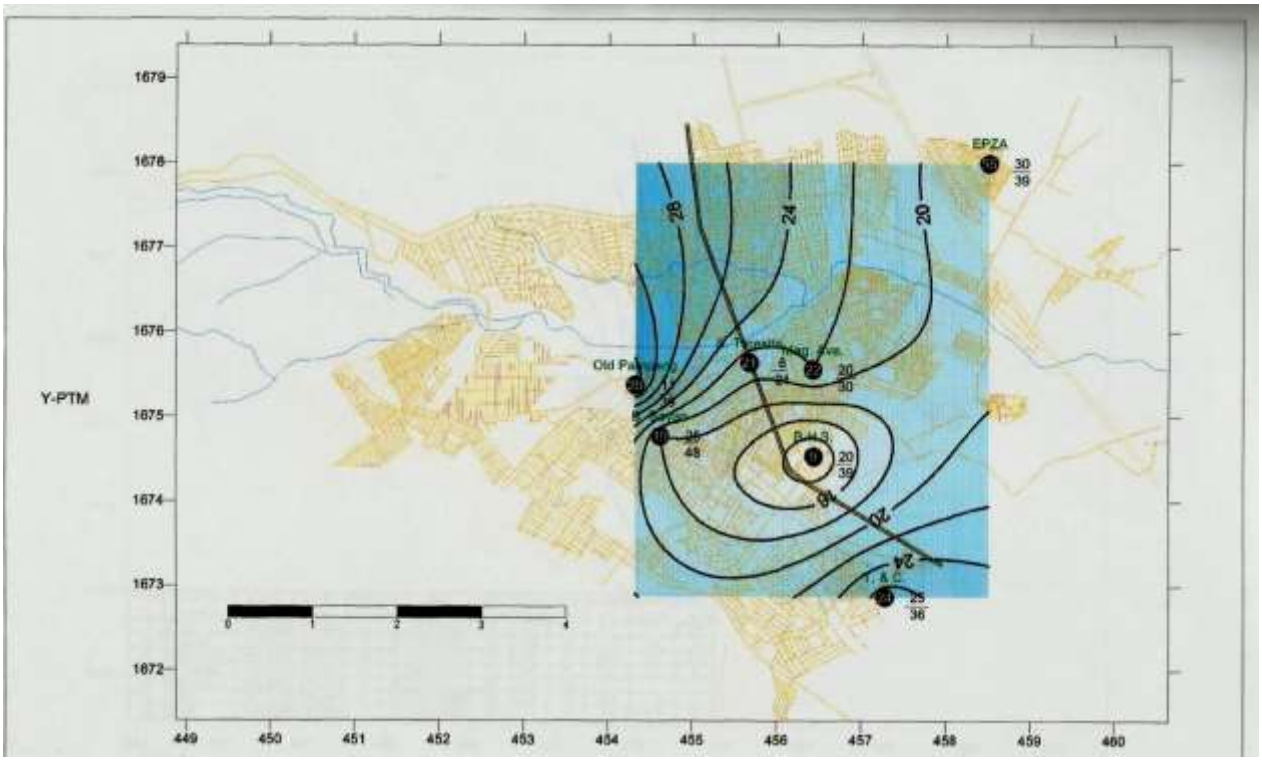


Figure 4 presents the Dynamic Water Level Map showing the water level contour in meters above the sea level. The map shows divergence of flow lines along Belen Homesite Pumping Station, labeled as “9” in the map, from the east towards the north and south direction wherein the diversions in those areas could be due to larger extraction rates or lower transmissivity or a combination of the two. **Figure 4** shows the ACWD Wells Pumping Water Level Map. Although the pumping water level contour lines for this map are valid only within the well points, they still represent an approximation of the trend of the pumping water level.

Figure 4: ACWD Wells Pumping Water Level Map



Pumping stations operated by Angeles City Water District as of June 2017 including their location, well depth, capacities and the discharge rate are listed in **Table 4**.

Table 4: Sources of Supply

	Source Types =Deep Well								
NAME OF P.S.	Source	Location	GEOGRAPHICAL COORDINATES			Well	Casing	Discharge Rate	Discharge Rate
Source	Type		LATITUDE	LONGITUDE	ALTITUDE (feet)	Depth (m)	Diameter(mm)	m^3/hr	L/s
ANUNAS	DW	River Side Brgy. Anunas, Angeles City	15°9'32.41" N	120°33'21.55" E	460	200	300	40	11.11
BAGUM BAYAN	DW	Alim St. Cor. Lualhati St. Brgy. Cut-Cut, Angeles City	15°8'33.38" N	120°34'44.90" E	357	152	200	74	20.56
BELEN HOMESITE	DW	Macapagal St. Brgy. Sto Cristo, Angeles City	15°08'24.85" N	120°35'46.66" E	299	200	300	128	35.56
CAPAYA I	DW	Brgy. Capaya I, Angeles City	15°8'24.86" N	120°37'10.80" E	211	195.4	250	70	19.44
CITY HALL	DW	City Hall Compound, Brgy. Pulung Maragul, A.C.	15°9'51.79" N	120°36'32.30" E	265	200	250	32	8.89
CUAYAN	DW	Brgy. Cuayan, Angeles City	15°8'59.60" N	120°32'43.20" E	512	200	300	26	7.22
EPZA	DW	Epza Resettlement Brgy. Pulung Cacutud	15°10'18.42" N	120°36'54.84" E	268	200	300	83	23.06
FEEDER # 1	DW	Fil-Am Friendship Hi-Way Brgy. Cut- Cut, Angeles City	15°7'27.09" N	120°35'00.62" E	302	76.3	300	105	29.17
FEEDER # 2	DW	Fil-Am Friendship Hi-Way Brgy. Cut- Cut, Angeles City	15°7'24.84" N	120°34'57.85" E	298	200	300	51	14.17
FEEDER # 3	DW	Villa Leoncia Brgy. Sto. Domingo, Angeles City	15°6'57.46" N	120°35'27.73" E	265	72	300	65	18.06
FEEDER # 4	DW	Villa Leoncia Brgy. Sto. Domingo, Angeles City	15°6'57.17" N	120°35'27.14" E	265	200	250	80	22.22
FEEDER # 5	DW	Fil-Am Friendship Hi-Way Brgy. Cut- Cut, Angeles City	15°7'45.70" N	120°34'33.08" E	360	83.87	300	114	31.67
FEEDER # 6	DW	Fil-Am Friendship Hi-Way Brgy. Cut- Cut, Angeles City	15°7'45.46" N	120°34'32.92" E	361	200	250	26	7.22
FEEDER # 7	DW	Nepo 3 St. Nepo Subd. Brgy. Cut-Cut, Angeles City	15°8'3.22" N	120°34'54.76" E	329	68.3	300	47	13.06

NAME OF P.S.	Source	Location	GEOGRAPHICAL COORDINATES			Well	Casing	Discharge Rate	Discharge Rate
Source	Type		LATITUDE	LONGITUDE	ALTITUDE (feet)	Depth (m)	Diameter(mm)	m^3/hr	L/s
FEEDER # 8	DW	Ilang Ilang St Corner Dama De Noche St Nepo Subd. A.C	15°8'12.22" N	120°34'46.62" E	345	200	250	59	16.39
FEEDER # 9	DW	Fil-Am Friendship Hi-Way Brgy. Cut- Cut	15°7'40.11" N	120°34'41.04" E	344	196.3	250	46	12.78
LNW	DW	Pampang Road Lourdes Northwest, A.C.	15°8'42.92" N	120°34'54.30" E	358	196	250	93	25.83
MABINI	DW	Mabini St. Brgy. Sn. Nicolas	15°8'16.13" N	120°35'14.52" E	333	200	300	155	43.06
MAGALANG AVE.	DW	Magalang Ave. Brgy. Ninoy Aquino	15°8'57.70" N	120°35'46.49" E	298	60	200	85	23.61
MARQUEE PLACE	DW	Maligaya Brgy. Pulung Maragul	15°9'33.71" N	120°36'46.16" E	261	190	300	110	30.56
MC. ARTHUR	DW	Mc. Arthur Hi-Way Brgy. Ninoy Aquino	15°8'58.51" N	120°35'35.83" E	313	172.27	250	87	24.17
METRO GATE	DW	Metro Gate Subd. Brgy. Capaya 1	15°8'38.34" N	120°36'48.10" E	250	183.2	300	65	18.06
METRO GATE II	DW	Metro Gate Subd. Brgy. Capaya 1	15°8'45.88" N	120°37'17.46" E	224	196.3	250	84	23.33
NORTHVILLE II	DW	Northville Resettlement Brgy. Cutud	15°10'17.44"N	120°37'48.80" E	216	98.63	250	120	33.33
PUNTA VERDE	DW	Punta Verde Subd. Brgy. Pulung Cacutud	15°10'7.69" N	120°37'18.01" E	248	200	250	108	30.00
ROBINSON	DW	Arayat Blvd. Brgy. Sto Nino	15°8'42.73" N	120°34'02.62" E	404	178.4	250	132	36.67
ROSEWOOD	DW	Fil-Am Friendship Hi-Way Brgy. Cut- Cut	15°8'14.98" N	120°33'38.75" E	421	189.53	250	48	13.33
SAPA LIBUTAD	DW	Brgy. Sapalibutad	15°9'38.39" N	120°37'15.62" E	236	200	300	87	24.17
SAPANG BATO	DW	Aguinaldo St. Brgy. Sapang Bato	15°9'59.58" N	120°30'45.91" E	793	181.8	250	36	10.00
ST. IGNATIUS	DW	Aquamarine St. Ignatius Ii Brgy Pandan	15°8'54.20" N	120°36'32.71" E	257	200	300	86	23.89
ST. VINCENT	DW	Purok 4 Brgy. Sto Nino	15°8'59.53" N	120°34'26.08" E	376	186.7	250	111	30.83
STA.TERESITA	DW	P. Balagtas Brgy. Sta. Teresita	15°8'59.77" N	120°35'20.24" E	336	264	300	30	8.33
TOWN & COUNTRY	DW	Town N Country Brgy. Sto Domingo	15°7'30.88" N	120°36'14.65" E	260	189	200	67	18.61
VILLA BELEN SOUTH	DW	Villa Belen South Subd. Brgy. Sto Cristo	15°8'15.81" N	120°36'10.67" E	266	200	300	70	19.44

Extracting water by drilling is the primary method of ACWD in constructing the well. Drilled sand and gravel wells usually are cased with steel pipe from land surface to the top of the water-bearing sand to prevent caving of the overlying materials. A length of commercially made well screen is placed immediately below the casing and opposite the water-bearing deposit to hold back the sand particles, yet permit free entry of water into the well. If the well is finished in water bearing sandstone or limestone formation, the overlying unconsolidated materials are cased out to prevent caving, and an open bore hole is constructed into or through the aquifer. Most of the pumping units of ACWD are submersible and the rest are turbine pumps. Water from groundwater are treated and distributed while maintaining appropriate water storage levels to reliably meet all water system demands. To date, ACWD has total of thirty-four (34) pumping stations and the Central Pumping station located at the Central Reservoir Complex. Nine (9) of which feeds water to the central reservoir, eleven (11) are direct pumping units, seven (7) have water treatment facilities, and seven (7) are fill and draw pumping units having a steel elevated tank as their reservoirs.

The Central Reservoir Complex serves as the central station wherein the central reservoir storage facility of a 5,000-cubic meter capacity is located. Nine (9) pumping stations feed water to it and water is transferred from central reservoir to the main lines with constant pressure to maintain sufficient water supply through the installation of five (5) units high-speed booster pumps. The central pumping station has an average daily production of 15,500 cubic meters of water to mainline. Two of the feeder pumping units are located at the complex, namely Feeder Pump Number 1 and Feeder Pump Number 2. The central control room is also located in the Central Reservoir Complex where the Variable Speed Drive regulates the pressure with respect to the booster pump output that is the greater the

demand for water, the greater number of booster pumps are required. The control room also contains the reduced voltage starter and soft starters.

3.5 Distribution

The ACWD water distribution system involves a Central Distribution System originating from the nine (9) Feeder Pumps interconnected with eleven (11) direct pumping units and fourteen (14) independent distribution network where six (6) of which has individual water treatment facility.

The combined output of the Central Distribution System is distributed to the 14 zones of Angeles City. Water from the nine feeder pumping units flows through the 6-inch or 8-inch diameter pipe to a ground level reservoir tank with a capacity of 5,000 cubic meters and this is distributed to the city proper by booster. The distribution system from the central reservoir complex is interconnected with the other eleven direct pumping units. The fourteen other pumping stations with independent distribution network are distributed by gravity by manner of an elevated tank such as that in Anunas, Cuayan, Sapangbato, Metrogate 1, City Hall, Marquee, Sapalibutad, EPZA, Punta Verde, Saint Ignatius, Saint Vincent, Villa Belen South and Northville 15. However, in Sapalibutad, EPZA, Punta Verde and Northville, there is an interconnection among them where valves will be adjusted regularly to regulate water flows depending upon the demand per area.

Table 5: Summary of Distribution and Transmission Lines (as of December 29, 2016)

REMAINING FUNCTIONAL OLD WATERLINES INTERCONNECTED TO OECF IMPROVEMENTS/EXPANSIONS (1988-1995)	
SIZE (mm)	***TOTAL LENGTH (km)***
200	0.2
150	6.023
100	2.89
75	0.924
63	1.999
50	10.143
TOTAL	**22.179**

OECF FUNDED WATERLINES IMPROVEMENT/EXPANSIONS (1995-1997)

SIZE (mm)	*TOTAL LENGTH (km)*
700	0.8845
600	1.2720
500	0.5495
450	2.0225
400	2.1938
350	3.2702
300	3.2115
250	4.5743
200	6.8129
150	11.0855
100	36.2016
75	101.1635
TOTAL	**173.2418**

ACWD FUNDED WATERLINES (EXPANSIONS) AFTER OECF IMPROVEMENTS/EXPANSIONS (1998-Present)

Year	*TOTAL LENGTH (km)*
1998-2000	9.4380
2001	4.3910
2002	15.3180
2003	27.2140
2004	5.0000
2005	7.1800
2006	11.1950
2007	14.5260
2008	5.7240
2009	1.6060
2010	1.5330
2011	0.9660
2012	4.4840
2013	4.4400
2014	2.9560
2015	8.1840
2016	4.9200
TOTAL	**129.0750**

TURNED OVER SUBDIVISION WATERLINES (1999-PRESENT)

SIZE (mm)	*TOTAL LENGTH (km)*
200	0.7880
150	9.5418
100	18.8495
75	14.5828
50	26.5817
TOTAL	**70.3437**
GRAND TOTAL	**394.8395**

From the pumping stations, water is distributed to its customers through a network of pipelines – primary, secondary and tertiary mains. The pipeline materials may be

PVC, PE or steel wherein size ranges from 50 mm to 300 mm and is broken down as shown in **Table 5**.

As of December 2016, almost 90% of our customers have a 24-hr uninterrupted water supply, while around 10 % have intermittent water due to low pressure or no water at all due to inadequacy of the water supply.

There are total of twenty (20) zones where water is distributed to numerous service connections.

The water quality of the distributed water is in compliance with the Philippine National Standard for Drinking Water (PNSDW). Regular examination of the bacteriological and physical-chemical quality in the distribution lines are performed at the ACWD laboratory. However, to the areas where a water treatment facility is present, a regular examination of iron and manganese is performed in a prescribed schedule. Samples are taken from the pumping stations to the distribution lines.

Complaints on water quality and quantity received by the customer service either by phone calls, email or personal appearance of the complainant are investigated by the Production Department specifically the laboratory. Actions are then taken to address every detail of the complaint indicated in the job order forms. In general, water produced by ACWD is intended for general consumption by ingestion from drinking and food preparation and other domestic purposes as well as for commercial and industrial use. Conforming to the standards of PNSDW ensure that ACWD water as supplied is safe and potable.

The **Table 6** on the next page illustrates the summary of Angeles City Water District Water Supply System.

Table 6: Details of Pumping Stations

System	Water Sources	MOTORS				PUMPS						MONTHLY PRODUCTION	TOTAL PRODUCTION PER SYSTEM
	(Pumping Stations)	Ratings	Volts	Amperage	Type	Capacity		Bowl Dia.	Riser Dia.	TDH	Pressure		
		Hp		Ampere	*	lps	gpm	Inches	Inches	m	Psi	cu.m	cu.m.
1	Feeder Pump No. 1	40	440	35	T	51	808.45	10	8	23	6	78,259.00	1,476,300
	Feeder Pump No. 2	20	440	21	S	18.5	293.26	4	6	50	7	38,213.00	
	Feeder Pump No. 3	60	440	77	T	34.9	553.23	10	8	58	40	48,700.00	
	Feeder Pump No. 4	40	440	52	S	26.3	416.91	6	6	45	42	70,631.00	
	Feeder Pump No. 5	25	440	27	T	15	237.78	10	8	40	0	84,323.00	
	Feeder Pump No. 6	25	440	34	S	17	269.48	6	6	20	0	19,724.00	
	Feeder Pump No. 7	20	440	27	T	22.45	355.88	8	6	47	20	35,547.00	
	Feeder Pump No. 8	30	230	84	S	16.38	259.8	7	6	51	20	44,165.00	
	Feeder Pump No.9	25	440	35	S	12.5	198.15	7	4	65	0	34,488.00	
	Capaya I	30	440	42	S	19.4	308.23	7	6	60	68	27,420.00	
	Bagong Bayan PS	30	220	80	S	29	459.71	4	4	85	42	49,446.00	
	Mabini PS	50	440	52	S	44.3	702.24	6	6	52	42	118,234.00	
	Sta. Teresita PS	15	220	42	S	7	110.96	4	4	65	24	21,127.00	
	Rosewood PS	50	440	52	S	18.61	296.5	4	6	230	80	34,206.00	
	Mc Arthur Hiway PS	20	220	54	S	22	348.74	4	4	32.6	40	61,871.00	
	Magalang PS	25	220	68	S	20	317.04	4	4	50	38	61,797.00	
	Town & Country PS	30	220	80	S	22	348.74	4	4	75	68	43,407.00	
	Belen Homesite PS	50	220	130	T	33	523.12	8	6	53.6	42	97,924.00	
	Lourdes Northwest	40	440	59	S	25.55	405.1	7	6	77	14	68,791.00	
	Robinsons Homes PS	50	440	65	S	48.3	765.65	6	6	65	52	96,337.00	
	St. Ignatius	50	460	74	S	21.67	343.21	7	6	82	74	42,788.00	
	St.Vincent	50	460	74	S	28.61	453.5	7	6	86	50	82,254.00	

System	Water Sources	MOTORS				PUMPS						MONTHLY PRODUCTION	TOTAL PRODUCTION PER SYSTEM
	(Pumping Stations)	Ratings	Volts	Amperage	Type	Capacity		Bowl Dia.	Riser Dia.	TDH	Pressure		
		Hp		Ampere	*	lps	gpm	Inches	Inches	m	Psi	cu.m	cu.m.
1	Villa Belen	40	460	59	S	18.88	299	7	6	72	52	52,073.00	
	Metrogate PS	50	440	52	S	53.3	844.91	6	6	65	26	44,265.00	
	Cuayan PS	25	220	54	S	15.2	240.95	4	4	60	28	14,734.00	
	Metrogate II PS	30	460	42	S	25.52	404.66	7	6	51	14	11,640.00	
	EPZA PS	50	220	130	T	38	602.38	8	6	45	30	51,635.00	
	Sapalibutad PS	25	220	68	S	30	475.56	6	6	45	27	30,498.00	
	Punta Verde PS	25	220	64	S	29.14	461.93	4	6	119	20	11,803.00	
2	Anunas PS	30	220	80	S	21.6	342.4	6	6	65	26	20,223.00	20,223
3	Sapangbato PS	40	440	52	S	14	221.93	4	4	110	30	21,457.00	21,457
4	City Hall PS	20	220	54	S	22	348.74	4	4	20	8	19,328.00	19,328
5	Marquee Place PS	30	220	70	S	33.12	525.02	5	6	111	20	9,872.00	9,872
6	Northville PS	30	220	69	S	31.73	502.98	5	6	99	20	60,245.00	60,245

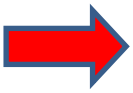
3.5.1 Intended Users and Uses of Water

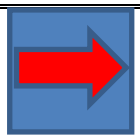
Water is provided to the general population. These include domestic, commercial and government offices within Angeles City areas. The water supplied is intended for general consumption such as drinking, personal hygiene, clothes washing, for cooking and foodstuff preparation.

3.5.2 Process Flow Diagram

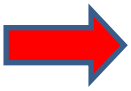
The process flow diagram of the water network of Angeles City is based on the inputs and description of each process step stated in the table 9 below:

A. Groundwater System Process Flow Diagram (Central P.S.)

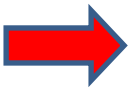
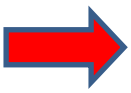
Process/ Step	Symbol	Description	Responsible Unit
SOURCE		FP #1 (300mm Ø Casing x 76.3m Deep) FP #2 (300mm Ø Casing x 200m Deep) FP #3 (300mm Ø Casing x 72m Deep) FP #4 (250mm Ø Casing x 200m Deep) FP #5 (300mm Ø Casing x 83.87m Deep) FP #6 (250mm Ø Casing x 200m Deep) FP #7 (300mm Ø Casing x 68.3m Deep) FP #8 (250mm Ø Casing x 200m Deep) FP #9 (250mm Ø Casing x196.3m Deep)	Production Department / Operation Division
INSPECTION		200 & 300 mm PVC Pipes and 500 mm Steel Pipe Transmission Line	Engineering Department / Maintenance Division
TREATMENT		Ultra Violet Hydro-Optic Disinfection System	Production Department / Operation Division
STORAGE		5000 m³. Concrete Tank with Booster Pump	Production Department / Operation Division

TREATMENT		Chlorination	Production Department / Operation Division
TRANSPORT		700 mm Steel Pipe Distribution Line	Engineering Department / Maintenance Division
INSPECTION		Hourly Sampling Residual Chlorine	Production Department / Operation Division / Laboratory Section

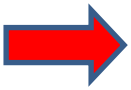
B. Groundwater System Process Flow Diagram (Water Treatment Facility for Epza, Sapalibutad & Punta Verde P.S.)

Process/ Step	Symbol	Description	Responsible Unit
SOURCE		EPZA P.S. (300mm Ø Casing x 200m Deep) Punta Verde P.S. (250mm Ø Casing x 200m Deep)	Production Department / Operation Division
TREATMENT		Sapalibutad P.S. (300mm Ø Casing x 200m Deep)	Production Department / Operation Division
STORAGE		50,000 Gallons Elevated Steel Tank	Production Department / Operation Division
TRANSPORT		150 mm P.E. and PVC Pipe Distribution Line	Engineering Department / Maintenance Division
INSPECTION		Random Sampling Residual Chlorine and Water Quality Analysis	Production Department / Operation Division / Laboratory Section

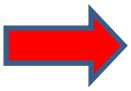
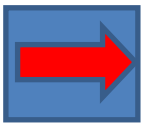
C. Groundwater System Process Flow Diagram (Water Treatment Facility for Northville and Marquee Place P.S.)

Process/ Step	Symbol	Description	Responsible Unit
SOURCE		Northville P.S. (300mm Ø Casing x 190m Deep) Marquee Place P.S. (300mm Ø Casing x 190m Deep)	Production Department / Operation Division
TREATMENT		Oxidation (Chlorine Dioxide), Aeration, Sedimentation and Filtration	Production Department / Operation Division
STORAGE		27 m^3 Concrete Cistern Tank	Production Department / Operation Division
TRANSPORT		150 mm Steel Pipe with Booster Pump	Production Department / Operation Division
TREATMENT		Disinfection by Chlorination (Calcium Hypochlorite)	Production Department / Operation Division
STORAGE		50,000 Gallons Elevated Steel Tank	Production Department / Operation Division
TRANSPORT		150 mm P.E. and PVC Pipe Distribution Line	Engineering Department / Maintenance Division
INSPECTION		Random Sampling Residual Chlorine and Water Quality Analysis	Production Department / Operation Division / Laboratory Section

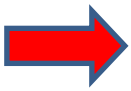
D. Groundwater System Process Flow Diagram (Water Treatment Facility for City Hall P.S.)

Process/ Step	Symbol	Description	Responsible Unit
SOURCE		City Hall P.S. (250mm Ø Casing x 200m Deep)	Production Department / Operation Division
TREATMENT		Oxidation (Chlorine Dioxide), Sedimentation, Filtration, Disinfection by Chlorination (Calcium Hypochlorite)	Production Department / Operation Division
TRANSPORT		100 mm P.E. Pipe Distribution Line	Engineering Department / Maintenance Division
INSPECTION		Random Sampling Residual Chlorine and Water Quality Analysis	Production Department / Operation Division / Laboratory Section

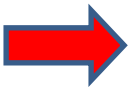
E. Groundwater System Process Flow Diagram (Water Treatment Facility for Metrogate II P.S.)

Process/ Step	Symbol	Description	Responsible Unit
SOURCE		Metrogate II P.S. (250mm Ø Casing x 196.3m Deep)	Production Department / Operation Division
TREATMENT		Oxidation (Chlorine Dioxide), Aeration, Sedimentation and Filtration	Production Department / Operation Division
STORAGE		27 m^3 Concrete Cistern Tank	Production Department / Operation Division
TRANSPORT		150 mm Steel Pipe with Booster Pump	Production Department / Operation Division
TREATMENT		Disinfection by Chlorination (Calcium Hypochlorite)	Production Department / Operation Division
TRANSPORT		150 mm P.E. and PVC Pipe Distribution Line	Engineering Department / Maintenance Division
INSPECTION		Random Sampling Residual Chlorine and Water Quality Analysis	Production Department / Operation Division / Laboratory Section

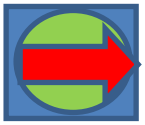
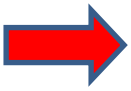
F. Groundwater System Process Flow Diagram (Anunas & St. Vincent P.S.)

Process/ Step	Symbol	Description	Responsible Unit
SOURCE		Anunas P.S. (300mm Ø Casing x 200m Deep) St. Vincent P.S. (250mm Ø Casing x 186.7m Deep)	Production Department / Operation Division
TREATMENT		Ultra Violet Hydro-Optic Disinfection System	Production Department / Operation Division
STORAGE		50,000 Gallons Elevated Steel Tank	Production Department / Operation Division
TREATMENT		Disinfection by Chlorination (Calcium Hypochlorite)	Production Department / Operation Division
TRANSPORT		150 mm P.E. and PVC Pipe Distribution Line	Engineering Department / Maintenance Division
INSPECTION		Random Sampling Residual Chlorine and Water Quality Analysis	Production Department / Operation Division / Laboratory Section

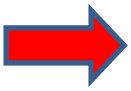
G. Groundwater System Process Flow Diagram (Cuayan, Metrogate I & Sapangbato P.S.)

Process/ Step	Symbol	Description	Responsible Unit
SOURCE		Cuayan P.S. (300mm Ø Casing x 200m Deep) Metrogate I P.S. (300mm Ø Casing x 186.5m Deep) Sapangbato P.S. (250mm Ø Casing x 186.1m Deep)	Production Department / Operation Division
TREATMENT		Disinfection by Chlorination (Calcium Hypochlorite)	Production Department / Operation Division
STORAGE		50,000 Gallons Elevated Steel Tank	Production Department / Operation Division
TRANSPORT		150 mm P.E. and PVC Pipe Distribution Line	Engineering Department / Maintenance Division
INSPECTION		Random Sampling Residual Chlorine and Water Quality Analysis	Production Department / Operation Division / Laboratory Section

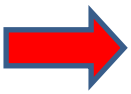
H. Groundwater System Process Flow Diagram (Villa Belen South P.S.)

Process/ Step	Symbol	Description	Responsible Unit
SOURCE		Villa Belen South P.S. (300mm Ø Casing x 200m Deep)	Production Department / Operation Division
TREATMENT		Ultra Violet Hydro-Optic Disinfection System and Chlorination (Calcium Hypochlorite)	Production Department / Operation Division
TRANSPORT		150 mm P.E. and PVC Pipe Distribution Line	Engineering Department / Maintenance Division
INSPECTION		Random Sampling Residual Chlorine and Water Quality Analysis	Production Department / Operation Division / Laboratory Section

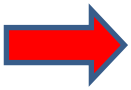
I. Groundwater System Process Flow Diagram (Robinson & St. Ignatius P.S.)

Process/ Step	Symbol	Description	Responsible Unit
SOURCE		St. Ignatius P.S. (300mm Ø Casing x 200m Deep) Robinson P.S. (250mm Ø Casing x 178.4m Deep)	Production Department / Operation Division
TREATMENT		Disinfection by Chlorination (Calcium Hypochlorite)	Production Department / Operation Division
TRANSPORT		150 mm P.E. and PVC Pipe Distribution Line	Engineering Department / Maintenance Division
INSPECTION		Random Sampling Residual Chlorine and Water Quality Analysis	Production Department / Operation Division / Laboratory Section

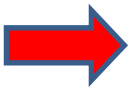
J. Groundwater System Process Flow Diagram - Direct Pumping (Bagong Bayan,Belen Homesite, Capaya I, Lourdes Northwest, Mabini, Magalang Ave., Mc Arthur, Sta. Teresita, Rosewood and Town & Country P.S.)

Process/ Step	Symbol	Description	Responsible Unit
SOURCE		Bagumbayan P.S. (200mm Ø Casing x 152m Deep) Belen Homesite P.S. (300mm Ø Casing x 200m Deep) Capaya I P.S. (250mm Ø Casing x 195.4m Deep) Lourdes Northwest P.S. (250mm Ø Casing x 200m Deep) Mabini P.S. (300mm Ø Casing x 200m Deep) Magalang Ave. P.S. (200mm Ø Casing x 60m Deep) McArthur P.S. (250mm Ø Casing x 200m Deep) Sta. Teresita P.S. (300mm Ø Casing x 264m Deep) Rosewood P.S. (250mm Ø Casing x 189.53m Deep) Town & Country P.S. (200mm Ø Casing x 189m Deep)	Production Department / Operation Division
TREATMENT		Disinfection by Chlorination (Calcium Hypochlorite)	Production Department / Operation Division
TRANSPORT		150 mm P.E. and PVC Pipe Distribution Line	Engineering Department / Maintenance Division
INSPECTION		Random Sampling Residual Chlorine and Water Quality Analysis	Production Department / Operation Division / Laboratory Section

K. Groundwater System Process Flow Diagram (Little Baguio P.S.)

Process/ Step	Symbol	Description	Responsible Unit
SOURCE		Bulk Water from Clark Water	Production Department / Operation Division
STORAGE		500m^3 Glass Fiber Reinforced Polyester Panel	Production Department / Operation Division
TRANSPORT		150 mm P.E. and PVC Pipe Distribution Line	Engineering Department / Maintenance Division
INSPECTION		Random Sampling Residual Chlorine and Water Quality Analysis	Production Department / Operation Division / Laboratory Section

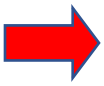
L. Groundwater System Process Flow Diagram (Woodland P.S.)

Process/ Step	Symbol	Description	Responsible Unit
SOURCE		Bulk Water from Taguete WaterWorks	Production Department / Operation Division
TRANSPORT		150 mm P.E. and PVC Pipe Distribution Line	Engineering Department / Maintenance Division
INSPECTION		Random Sampling Residual Chlorine and Water Quality Analysis	Production Department / Operation Division / Laboratory Section

Legends:

Storage

Treatment

 Transport

Inspection

3.6 Water Treatment

The ACWD utilizes 5 different treatment processes in the 7 water supply systems. The number of processes is dependent on the supply system as shown in **Table 7**;

Table 7: Pumping Stations and its Treatment Processes

System	Water Sources (Pumping Stations)	TYPE OF TREATMENT				
		Chemical Oxidation by Pre-chlorination	Aeration	Sedimentation	Filtration	Disinfection by Post-chlorination
1						
	Bagong Bayan PS					
	Belen Homesite PS					
	Capaya 1					
	Cuayan					
	EPZA PS					
	Feeder Pump No. 1					
	Feeder Pump No. 2					
	Feeder Pump No. 3					
	Feeder Pump No. 4					
	Feeder Pump No. 5					
	Feeder Pump No. 6					
	Feeder Pump No. 7					
	Feeder Pump No. 8					
	Feeder Pump No. 9					
	Lourdes Northwest PS					
	Mabini PS					
	Magalang PS					
	Mc Arthur Hiway PS					
	Metrogate I PS					
	Metrogate II PS					
	Punta Verde PS					
	Robinsons Homes PS					
	Rosewood PS					
	Sapalibutad PS					
	St. Ignatius Subd. PS					

	St. Vincent PS					
	Sta. Teresita PS					
	Town & Country PS					
	Villa Belen South PS					
2	Anunas PS					
	Clark Water - Margot 1					
	Clark Water - Margot 2					
	Clark Water - Little Baguio					
3	Sapangbato PS					
4	City Hall PS					
5	Marquee Place PS					
6	Northville PS					

ANGELES CITY WATER DISTRICT'S DISTRIBUTION LINE

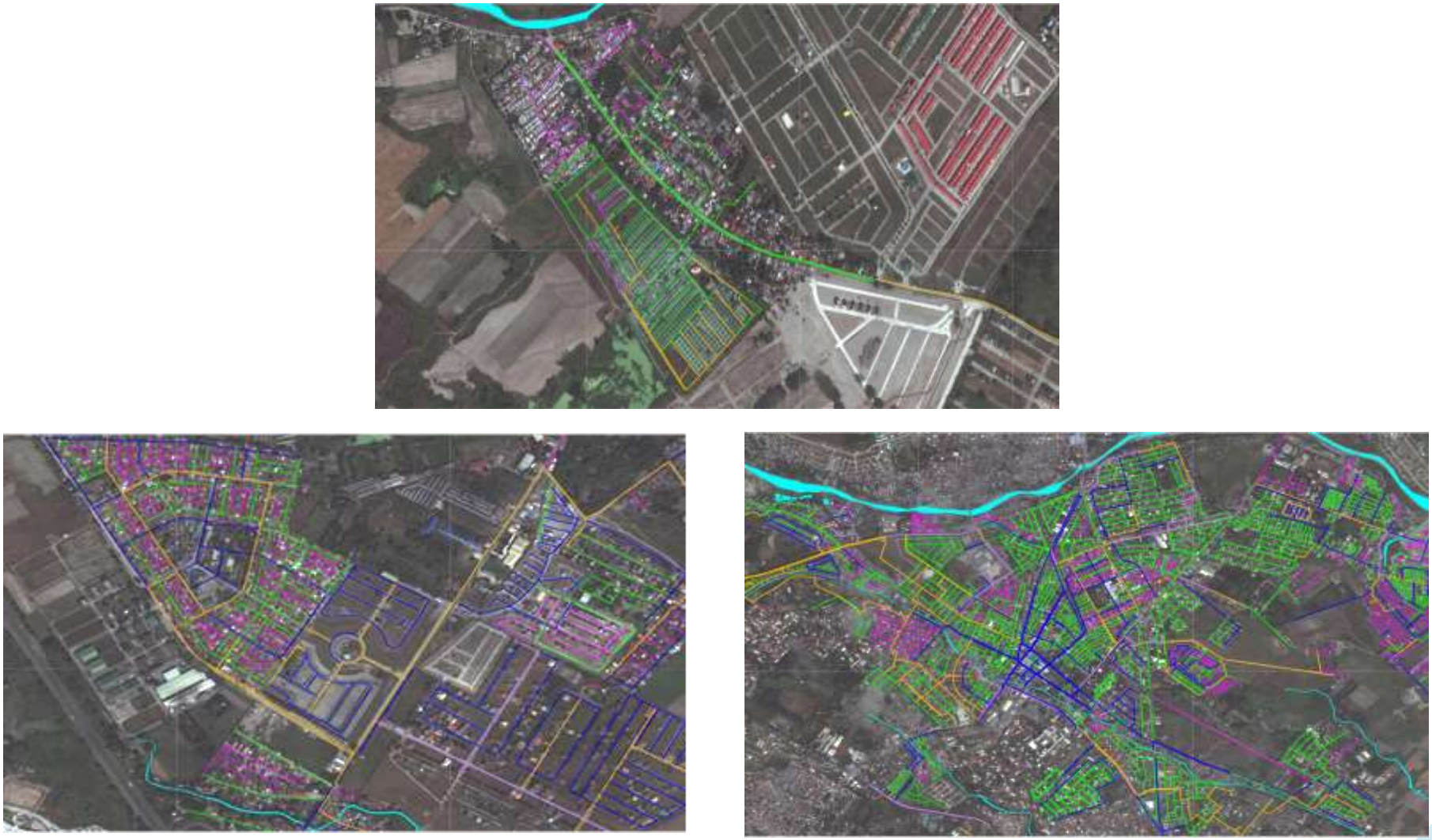


Figure 5: ACWD Water Distribution Lines System 1

Figure 6: ACWD Water Distribution Lines System 2

Figure 7: ACWD Water Distribution Lines System 3

Figure 8: ACWD Water Distribution Lines System 4

Figure 9: ACWD Water Distribution Lines System 5

Figure 10: ACWD Water Distribution Lines System 6

Failure to provide adequate protection and effective treatment will expose the community to the risk of outbreaks of intestinal and other infectious diseases and other water-related diseases too. To ensure safe and potable water for the consumers of ACWD, the following processes are undertaken:

3.6.1 Disinfection

Disinfection is categorically important in the supply of safe drinking-water. The destruction of microbial pathogens is essential and very commonly involves the use of reactive chemical agents such as chlorine. Chlorine is used as the main water disinfectant. In drinking-water treatment, disinfection is an effective barrier to many pathogens in drinking-water, especially bacteria and is used for groundwater subjected to fecal contamination. Residual disinfection is used to provide a partial safeguard against low level contamination and regrowth within the distribution system.

Disinfection is the most important water treatment process. Chlorination is employed primarily for microbial disinfection. This is achieved by using calcium hypochlorite granules dissolved in water then mixed with the main supply. Once impurities have been removed from the water, the right dosage of chlorine is added to control pathogenic bacteria and other harmful organisms.

The following are the three (3) steps undertaken for the disinfection process.

i. Well Disinfection

Well is disinfected using a mixture of 20 kg of granulated calcium hypochlorite and 100 liters of water. This is done as the preliminary treatment of pathogenic organisms, oxidizable matters and organic matters. After several hours, water is drawn out of the well until pumped water is free from chlorine odor. This is usually done when a new pumping station is to be in operation or when a pumping station is repaired and rehabilitated.

ii. Ultra Violet Hydro-Optic Disinfection System

The Ultraviolet disinfection system is a non-chemical process that provides rapid, effective inactivation of microorganism through physical process. When bacteria, viruses and protozoa are exposed the germicidal wavelengths of UV light, they are rendered incapable of reproducing and infecting. The UV light also demonstrated effectiveness against pathogenic organism, including those responsible for cholera, polio, typhoid, hepatitis and other bacterial, viral and parasitic diseases.

Drinking water treatment plants can benefit by using UV since it can easily inactivate chlorine-resistant pathogens like Cryptosporidium and Giardia, while reducing chlorine usage and by-product formation. An important advantage of UV is a chemical-free process that adds nothing to the water except UV light and it does not create carcinogenic disinfection by-products that affects the quality of water.

iii. Distribution Line Disinfection (Post-chlorination)

The distribution line is disinfected in a daily basis using a chlorination equipment to ensure continuous and effective disinfection. Solution of calcium hypochlorite is prepared in a separate mixing tank, diluted and allowed to settle so that only clear and supernatant liquid is withdrawn from the solution storage tank to the chlorinator where chlorine is injected into the discharge line located after the pump and motor.

When sufficient dosage of chlorine is applied to water, microorganisms of sanitary significance are destroyed and all the oxidizable matter is reacted upon. After all of these reactions have taken place, at the end of a specified contact time, there remains a certain minute quantity of chlorine in the water. This is detected as residual chlorine. Residual chlorine of 0.3 – 0.5 ppm is maintained until the water reaches the consumer and the farthest point in the distribution system. Presence of residual chlorine in water is an indication of the sufficiency of the treatment or chlorination, and is therefore an assurance of protection of the bacteriological quality.

For most of the water sources of Angeles City Water District where no contamination in the raw water quality with regards to the physical and chemical aspects undergo only disinfection as treatment and for some with storage facilities.

3.6.2 Chemical Oxidation by Pre-chlorination

Chemical oxidation is a process which uses an oxidizing chemical such as chlorine that removes or assists in the removal of iron and manganese. The oxidizing chemical is put into the water by a feed pump. In this process, dissolved iron and manganese in water is oxidized into its insoluble form.

3.6.3 Aeration

Aeration is the process of bringing air into direct contact with water. This process is designed to achieve efficient removal of gases by air stripping. Oxygen transfer is

achieved by allowing water to flow in numerous nozzle sprays with the air blowing through the flowing water. Addition of oxygen will remove some taste and odor causing compounds in stored water. Raw water at EPZA, Sapalibutad, Punta Verde, Marquee Place, Metrogate 2 and Northville Pumping Station contain significant amount of hydrogen sulfide, iron and manganese. Hydrogen sulfide gas will be oxidized with the addition of oxygen. This aeration process is also used for oxidation and precipitation of iron and manganese. Aeration process is not included in the City Hall Pumping Station Water Treatment Facility since the raw water quality of the pumping station does not contain hydrogen sulfide.

3.6.4 Sedimentation

Sedimentation is the process of gravity settling and deposition of comparatively heavy suspended material in water. In this process, the oxidized materials, which are in solid form are allowed to settle down in a certain period of time to allow oxidation to take place. The resulting solid particles are then filtered out. The large residues that settle at the bottom of the tank are then removed through the drain, while some of the smaller residues are further removed via filtration.

3.6.5 Filtration

The filtration step involves the final removal of iron and manganese and any other impurities that remain in water. As water passed through the filter, insoluble iron and manganese will build up in the media and are removed by backwashing. In this process, turbidity is also reduced.

Seven of the thirty-four pumping stations have problems of water quality and they undergo water treatment. The process flow diagrams of the abovementioned pumping stations and map of Angeles City distribution system are shown in **Annex I**.

Other supplementary steps of the entire process of the water supply system are the following:

Storage

After disinfection, water is kept in suitable storage facilities to prevent contamination.

Distribution

After treatment, the water is distributed to households and other business establishments. It passes through larger pipes where service connections are tapped.

3.7 Water Quality Required

To ensure safe and acceptable water, the ACWD adheres to comply with the standards set by the Philippine National Standards for Drinking Water (2017 PNSDW).

Table 8 shows the parameters monitored and **Table 9** shows the frequency of monitoring.

Table 8: Water Quality Parameters

Parameter	2017 PNSDW LIMIT	ACWD LIMIT
Total Coliform	<1.1 MPN	<1.1 MPN
Fecal Coliform	<1.1 MPN	<1.1 MPN
HPC	<500 CFU	<500 CFU
Turbidity	5 NTU	5 NTU
Color	10 TCU	10 TCU
pH	6.5 - 8.5	6.5 - 8.5
Hydrogen Sulfide	0.05 mg/L	0.05 mg/L
Residual Chlorine	0.3 - 1.5 mg/L	0.3 - 1.5 mg/L
Chlorine Dioxide	0.2 -0.4 mg/L	0.2 -0.4 mg/L
Total Dissolved Solids	600 mg/L	600 mg/L
Total Hardness	300 mg/L	300 mg/L
Chlorides	250 mg/L	250 mg/L
Nitrates	50 mg/L	50 mg/L
Sulfates	250 mg/L	250 mg/L
Aluminum	0.2 mg/L	0.2 mg/L
Copper	0.2 mg/L	0.2 mg/L
Iron	1 mg/L	0.5 mg/L
Manganese	0.4 mg/L	0.2 mg/L
Arsenic	0.01 mg/L	0.01 mg/L
Cadmium	0.003 mg/L	0.003 mg/L
Chromium	0.05 mg/L	0.05 mg/L
Lead	0.01 mg/L	0.01 mg/L

Table 9: Frequency of ACWD Water Quality Monitoring

COLLECTION POINT	TESTING	PARAMETERS	FREQUENCY
SOURCE	Microbiological	Total Coliform	Monthly
		Fecal coliform	
		HPC	
	Physical	Turbidity	Semi-Annual
		Color	
	Chemical	pH	
		Hydrogen sulfide	
		Total Dissolved Solids	
		Total Hardness	
		Chlorides	
		Nitrates	
		Sulfates	
		Aluminum	
		Copper	
		Iron	
		Manganese	
		Arsenic	
		Cadmium	
		Lead	
TREATMENT	Chemical	Residual chlorine	3 Times Daily
		Iron	Weekly
		Manganese	
DISTRIBUTION (Elevated Tank / Households)	Microbiological	Total Coliform	Monthly
		Fecal coliform	
		HPC	
	Physical	Color	Semi-annual
		Turbidity	
	Chemical	Residual chlorine	Daily
		pH	Semi-annual
		Hydrogen sulfide	
		Total Dissolved Solids	
		Total Hardness	
		Chlorides	
		Nitrates	
		Sulfates	
		Aluminum	
		Copper	
		Iron	
		Manganese	
		Arsenic	
		Cadmium	
		Lead	

Annex II shows the summary of water quality concentrations history of Angeles City Water District. This includes the Bacterial, Physical- Chemical water quality results. As displayed, ACWD complied with PNSDW parameters for 2017 gaining a **Passed** descriptive rating.

IV. RISK ASSESSMENT, HAZARD TABLE AND EXISTING CONTROL MEASURE

Most of the hazard problems identified are common to the pumping stations located at the western part of Angeles City. As shown, it is in this geographic location that traces of iron and manganese were higher. ACWD designed Water Treatment Facilities to these sources; however, to the other water sources, the main hazard identified are only of bacteriological quality as well as some suspended solids caused by intrusion of water due to the identified causes in the distribution network.

After rigorous review and water testing conducted by ACWD with consideration of all potential presence of Chemical, Biological and Physical hazards that could be linked to water supply; WSP Team have determined the existing and possible hazards that may arise using the method of **Semi- Quantitative** approach through historical events documented, onsite visits and records.

Table 10 shows the most common water quality problems encountered, noting their potential hazards and causes, from source to distribution network.

Table 10: ACWD Typical Water Quality Problems, Potential Hazards and Causes

PROBLEMS	HAZARD	TYPE OF HAZARD	CAUSES
Groundwater	Presence of Iron Presence of Manganese Presence of Hydrogen Sulfide Presence of sand/sediments	Chemical Chemical Chemical Physical	Naturally present in the source
Distribution	Presence of coliforms and suspended solids	Microbial and Physical	Low water pressure Illegal connection Use of booster pumps System leaks

In order to rate the likelihood and severity of the hazard events; WSP team adopted the risk matrix and Priority Level as shown in **Table 11** and **Table 12**, respectively. This aid in identifying the degree of priority level and calculation of the risk score.

As a result, Clogging of chlorine injection points, under/overdosing at post chlorination, intrusion of contaminants through leaking and deteriorated pipes at low pressure were scored with highest priority risks, thus, needed immediate action. To accomplish this; regular cleaning and declogging of injection points as preventive measure to maintain 0.3 to 1.5 ppm residual chlorine along the distribution lines.

See **Annex III** for the hazard identification and risk assessment from catchment to distribution system including consumer premises.

Table 11. Risk Factor Matrix

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

Table 12. Priority Level

Priority Level		Risk Score	Action Levels
Level	Type		
1	High	15 - 25	Requires immediate control measures
2	Moderate	6 - 14	Requires determination of additional control measure
3	Low	1 - 5	Should be documented and revisited in the future

V. IMPROVEMENT / UPGRADE PLANS

For sustainable quality of water delivered to consumers, an improvement or upgrade plans were formulated for each signifigant risks with ineffective or no existing controls identified in the reassessment of risk taking into account as well as the other less significant risk. Every risk hazard identified in improvement plans have designated personnel responsible for implementation.

This continuous improvement range from simple changes in the day to day working and processes . These plans should be monitored to confirmed improvements have been made and are effective.

See **Annex IV** for the improvement/upgrade plans from catchment to distribution system.

VI. MONITORING OF THE CONTROL MEASURE

To highly utilized the monitoring activity, WSP team identified the type of monitoring procedures of existing and proposed control measures and or corrective actions associated with the system. Variety of measures was determined by the type and frequency of hazards and hazardous events documented.

Operational Monitoring activities includes defining and validating the monitoring of control measures.Procedures were established and Personnels were assigned with regard to their competencies to demonstrate that the controls continue to work, to detect deviation and ensure that action can be taken in timely manner.

See **Annex V** for the monitoring of the control measures.

VII. VERIFICATION

To check compliance with the WSP, the team uses different methods, procedures or tests in addition to those used in regular monitoring of the specific process steps. Verifying water quality from sources to distribution always includes bacteriological and physical-chemical testing done by the laboratory.

The different procedures of verifications are enumerated in **Annex VI.**

VIII. MANAGEMENT PROCEDURES

This procedure outlines the streamlined management systems as displayed to provide a clear picture of way of working. The process typically takes place and assigns responsibilities as part of the implementation of programs. The procedure were communicated to Personnels responsible for the undertaking of activities (see **Table 13**)

Table 13: List of Standard Operating Procedures

SOP	DESCRIPTION	DOCUMENT REFERENCE
	Title	**Agency-Department-Division-Form No.**
Electro-Mechanical	Preventive Maintenance of Chemical Dosing Pump	ACWD-PROD-E/MECH-WP01
	Preventive Maintenance of Filter Tanks	ACWD-PROD-E/MECH-WP02
	Conduct Pump Performance Test	ACWD-PROD-E/MECH-WP03
	Pullout and Installation of Submersible Pump and Motor	ACWD-PROD-E/MECH-WP04
Pump Operation	Direct Pump Operation Procedure	ACWD-PROD-OPRN-OP01
Pump Operation (Storage)	Pump Operation Procedure (Storage)	ACWD-PROD-OPRN-OP02
Water Treatment Operation Procedure	Chlorine Solution Preparation	ACWD-PROD-OPRN-OP03
	Water Treatment Operation Procedure (City Hall)	ACWD-PROD-OPRN-OP04
	Water Treatment Operation Procedure (Northville 15 and Marquee Place P.S.)	ACWD-PROD-OPRN-OP05
	Water Treatment Operation Procedure (Sapalibutad, Puntaverde And Epza P.S.)	ACWD-PROD-OPRN-OP06
Maintenance Repair (Water Mains)	Mainline / Service Line Leakage Repair	ACWD-ENG-MAINT-FC01
	Mainline Leak Repair Procedure	ACWD-ENG-MAINT-WP01
Illegal Connection	Disconnect from Mainline	ACWD-ENG-MAINT-FC02
Sample Collection and Analysis	Microbiological Analysis Process	ACWD-PROD-LAB-FC01
	Physical-Chemical Analysis Process	ACWD-PROD-LAB-FC02

(See **Annex VII** for management procedures.)

IX. SUPPORTING PROGRAMS

To achieve the Intended program outcomes, WSP team determined the necessary supporting programmes and activities that ensure that the WSP approach is embedded in the water utilitiy's operations. There may be activities that may entail activities and indirectly support the water safety. **Table 14** shows the list of supporting programs.

Table 14: List of Supporting Programs

SUPPORTING PROGRAM	PURPOSE	Examples
Training and Awareness	To ensure organization understand water safety plan and the influence of their actions	WSP Training
		Competency Requirements
		Induction Training
		Hygiene and Sanitation Procedures
		Documentation and Record Keeping
		QC Inspection and QA of Materials
		Construction Workmanship
		Customer Assessment
Research and Development	To support decisions made to improve or maintain water quality	Understanding Potential Hazards
		Research into better indicators of contamination
Calibration	To ensure that critical limit monitoring is reliable and of acceptable accuracy	Calibration schedules
		Self-calibration equipment
Quality Control Program at the Laboratory	To ensure reliability of results of test analysis.	QC Assurance Training
		QC Program
Customer Complaint Protocol	To ensure that customers are responded to if water quality questions are raised	Call Centers
		Complaints Training
Preventive Maintenance Program	To ensure that the malfunction of important processes are minimized and all assets are in good working order	Maintenance Program
		Reservoir and Tank Cleaning
		Flushing Program
		Preventive Maintenance for Chlorinator
		Preventive Maintenance for Control Panels
Material and Chemicals Specification	To control chemical hazards derived from materials and chemicals used in water production, storage, cleaning and laboratory activities	Materials Specification Development
		Material Safety Data Sheet
Purchasing	To ensure acceptable quality of goods purchased from suppliers.	Contract Review
		Suppliers Evaluation Report
		Safety Stock Procedure
		Periodic Plant visit on selected suppliers

X. REVIEW AND AUDIT

To validate the effectiveness of the program; The WSP team will periodically meet and review the overall plan and learn from experiences and new procedures (in addition to regular reviewing the WSP through analysis of the data collected as part of the monitoring process). The program review and audit also allows in identification of program's strengths and weaknesses; check if it is on track, what is critically important or modified as necessary the program accordingly. The review process is critical to the implementation of WSP as it forms the basis for modification of interventions and the quality of activities being conducted from which future assessment can be made. The key actions to be done in any review and audit of the WSP are the following (1) Review the WSP following an incident, emergency or near actual situation, (2) Determine the cause of the incident, emergency or near situation and sufficiency of the response and (3) Review WSP as necessary including updates to supporting programs.

The WSP manual will be reviewed a year after its date of implementation. ACWD WSP team include in the plans and improvement in the creation of an internal quality audit. The organization shall conduct internal audits at planned intervals so as to determine whether the system in place conforms to the arrangements established.

XI. REVISE WSP FOLLOWING AN INCIDENT

It is necessary to ensure that existing hazard events are covered by Angeles City Water District. At least once a year, the team is required to review the WSP to reduce or possibly eliminate the severity of incidents. In any case, emergencies or unforeseen event arise affecting the quality and safety of water; there will be an immediate action to be taken or modification if necessary to prevent occurrence of hazard events.

Table 15 enlists the entire activities subject for review with corresponding object and concerned Department/Division.

Table 15: Activities Subject for Review

ACTIVITIES	OBJECTIVE	CONCERNED
Creation of Customer Satisfaction Assessment through Survey	To have a reflection of customer satisfaction / confidence level in the services delivered by ACWD	Commercial / Customer Service
Creation of a Water Conservation Plan	To increase awareness on Water Conservation to ACWD concessionaires and employees	Human Resources
Creation of an Internal Quality Audit Trained Internal Quality Auditors	To create a better systematic and independent examination of all WSP related activities and its results	Management
Creation of Calibration Program for all Flow Meters to all Pumping Stations	To ensure high accuracy in reading	Production
Improve leak detection program	To increase detection of leakage in mainline and/or service line	Maintenance
Installation of generator set	To prevent service interruption	Production
Intensive Monitoring and treatment of sulfate	To comply with the PNSDW	Production
Creation of dosing management plan for chlorine	To prevent underdosing/overdosing	Production
Installation of online chlorine analyzer	To regularly check residual chlorine at a real time.	Production
Develop Water Quality Monitoring program at the mainlines	To facilitate water quality monitoring at mainline	Production
Installation of Pressure Gauges along Distribution Networks	To facilitate pressure monitoring	Production
Determination of Valve Status in the distribution networks.	To ensure that valves are for operational or for replacement	Construction
Implement 24/7 Maintenance Program	To hasten emergency response on leakage repair	Maintenance
Implement pH and Hydrogen sulfide daily monitoring	To ensure proper treatment operation	Production
Competency Requirement	To achieve professionalized service	Human Resources
Information Awareness Orientation on WSP to all ACWD employees	To ensure that information, inclusive of policies are properly disseminated to employees	Human Resources

XII. RECORD KEEPING AND DOCUMENTATION

In addition to the actual water safety plan there should also be a range of records that will form part of the water safety plan setting up and implementation process as well as monitoring and any necessary corrective actions taken, incident response records, validation and verification. These can essentially be divided into four types of record:

- support documentation for developing the water safety plan;
- records generated by the water safety plan system;
- documentation of methods and procedures used; and
- records of test results

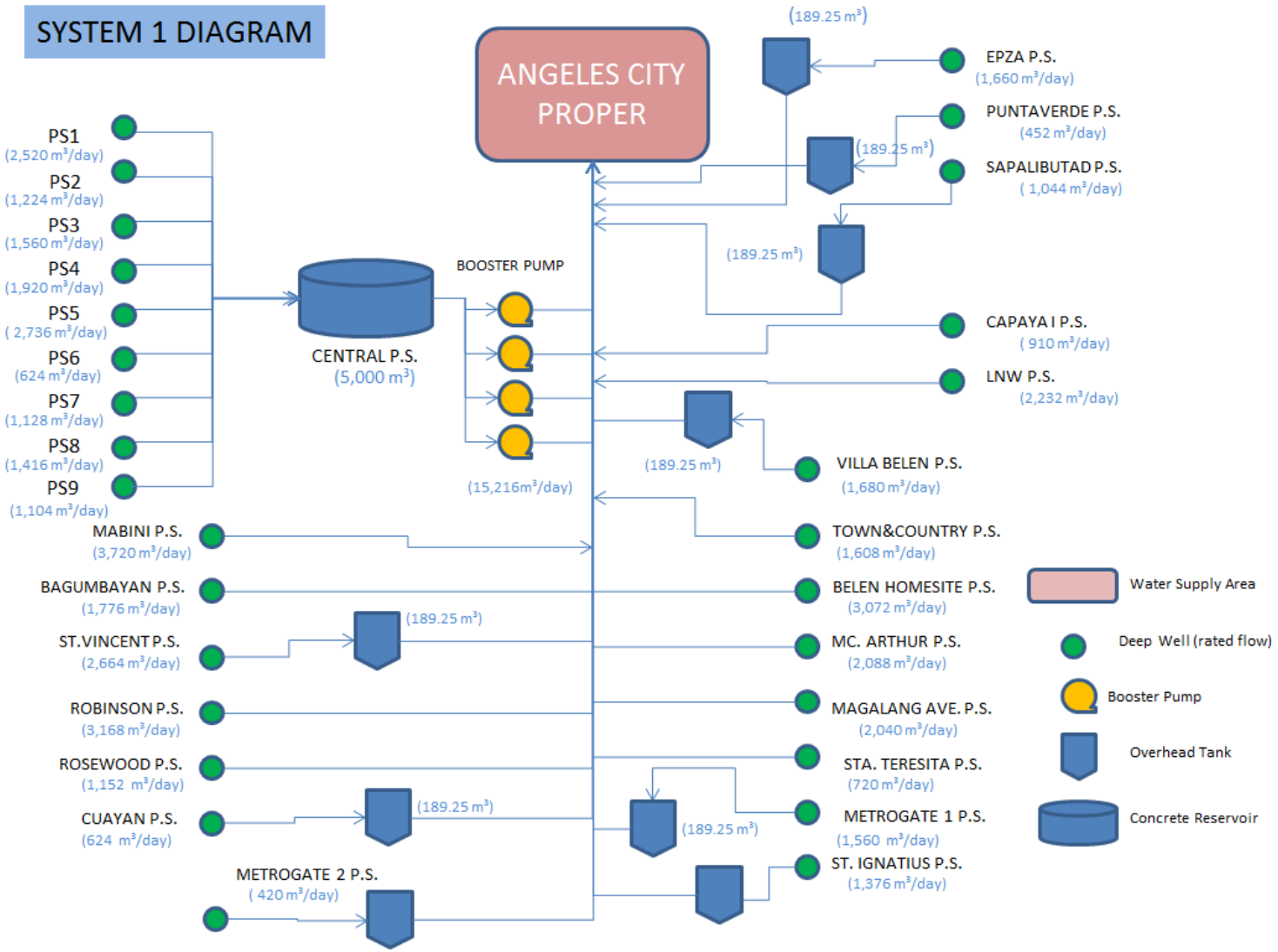
Water safety plan system records are kept to demonstrate adherence of the system to the water safety plan. By tracking records generated by the water safety plan system, an operator or manager can become aware that a process is approaching its operational or critical limit. Review of records can be instrumental in identifying trends and in making operational adjustments. Periodical review of water safety plan records is recommended so trends can be noted and appropriate actions decided upon and implemented.

Documentation and records systems should be kept as simple and focused as possible. The level of detail in the documentation of procedures should be sufficient to provide assurance of operational control when coupled with a suitably qualified and competent operator. Mechanisms should be established to periodically review and, where necessary, revise documents to reflect changing circumstances. Documents should be assembled in a manner that will enable any necessary modifications to be made easily. A document control system should be developed to ensure that current versions are in use and obsolete documents are discarded.

Appropriate documentation and reporting of incidents/emergencies should also be established. The organization should learn as much as possible from an incident to improve preparedness and planning for future events. Review of an incident may indicate necessary amendments to existing protocols, and may suggest that upgrading of the water system is required.

ANNEX I: PUMPING STATIONS SCHEMATIC DIAGRAMS

A. System 1



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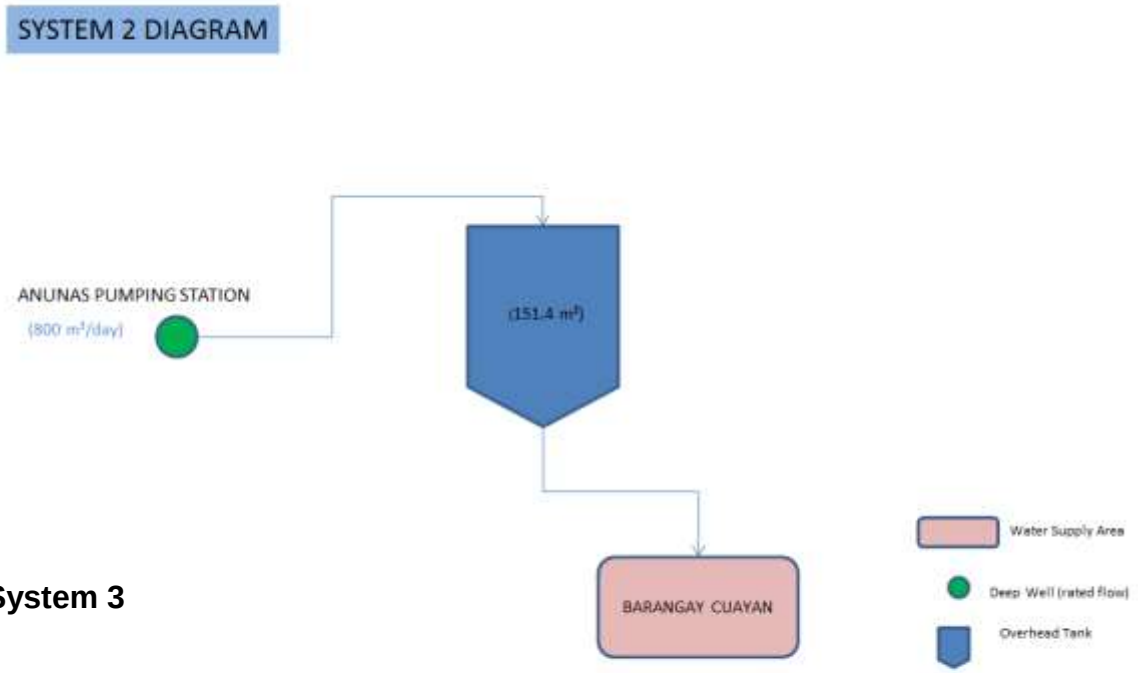
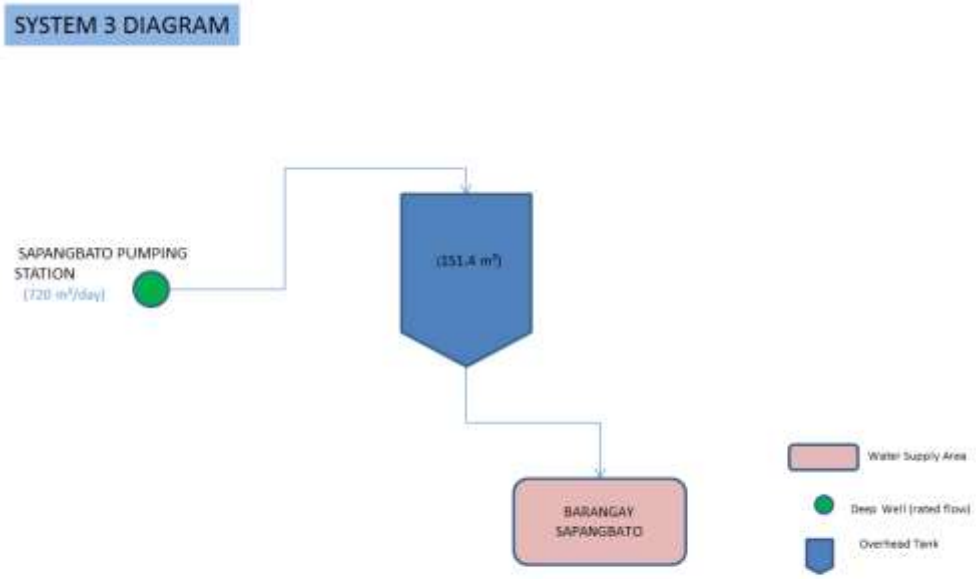


C. System 3



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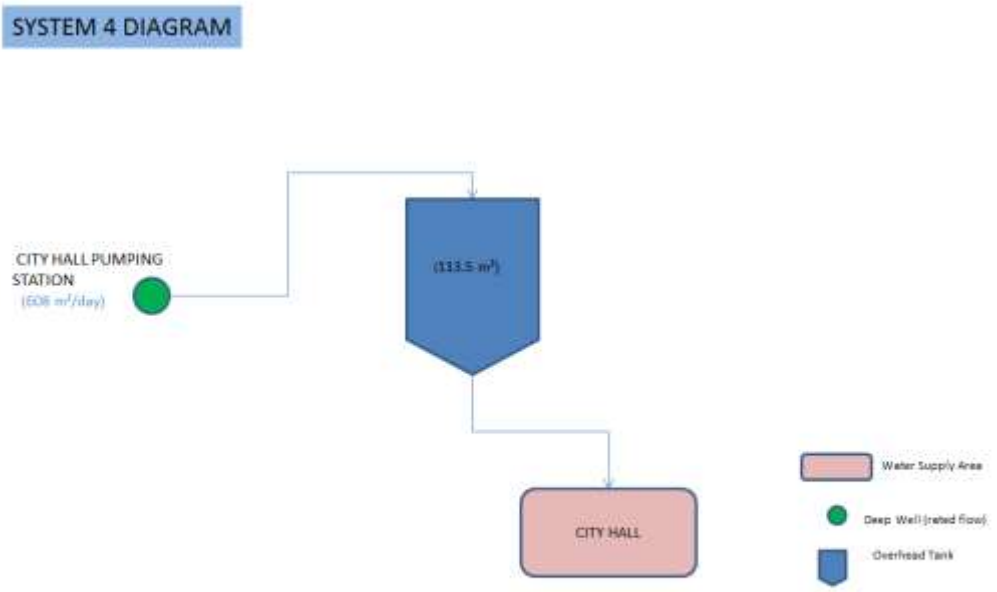
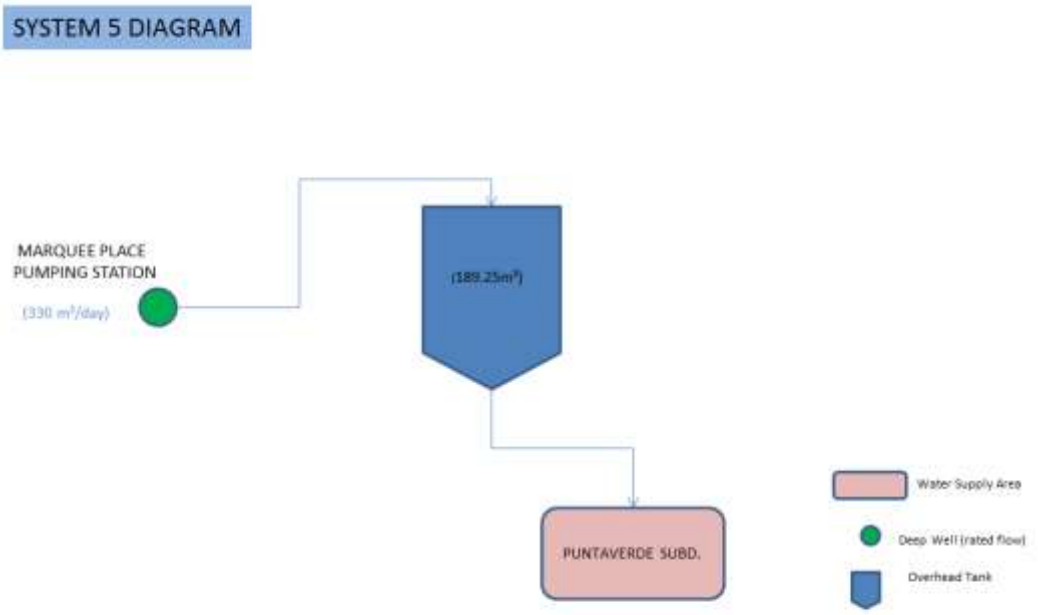
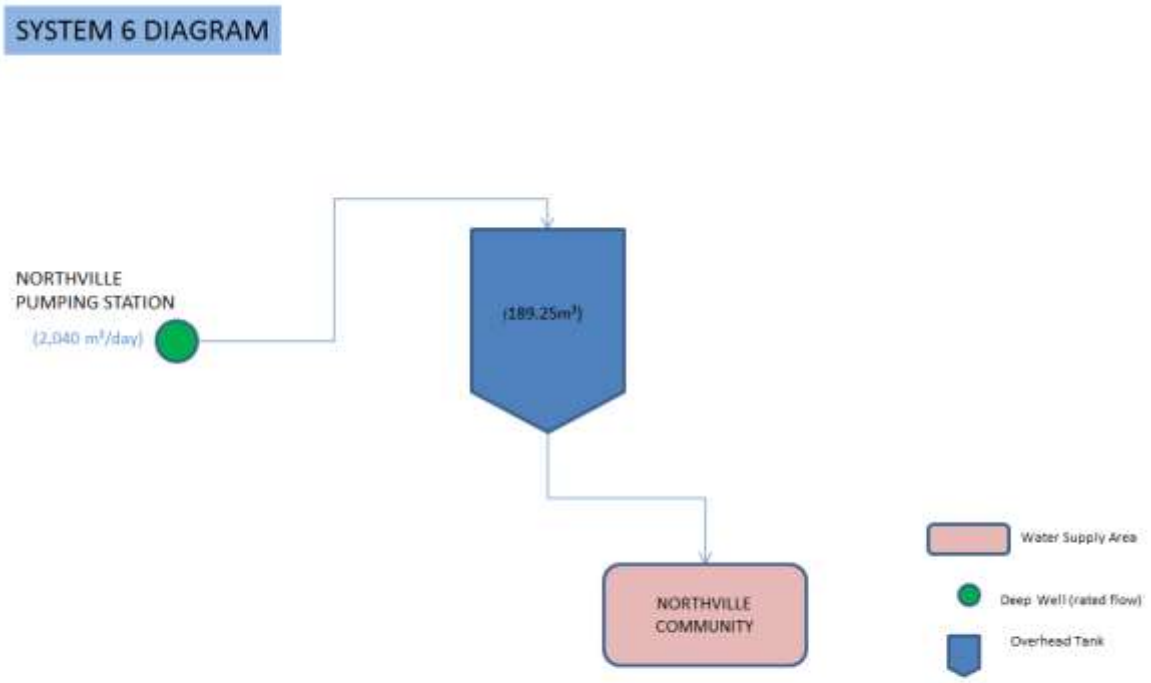


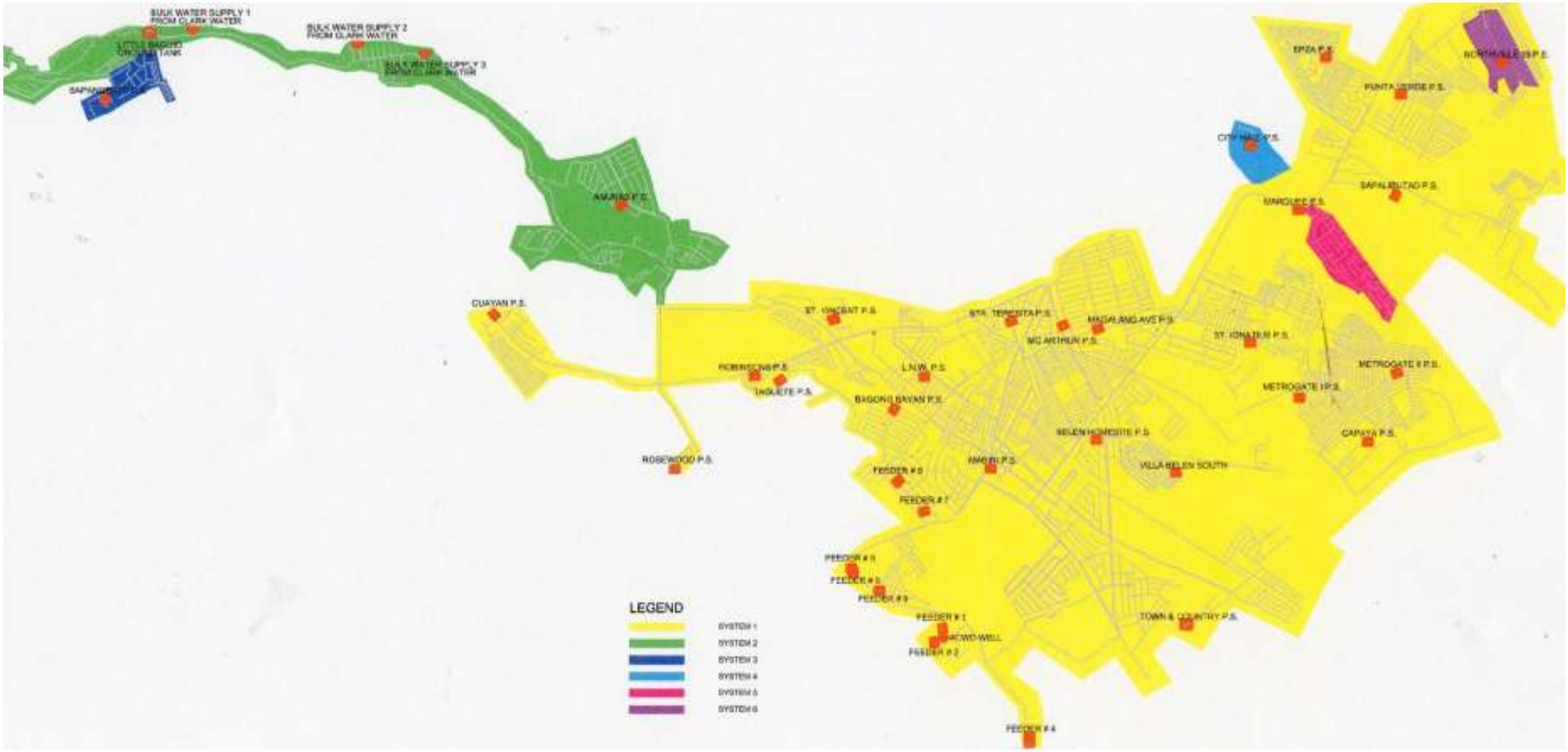
E. System 5



F. System 6


SYSTEM 6 DIAGRAM
NORTHVILLE
PUMPING STATION
(2,040 m³/day)
(189.25m³)
NORTHVILLE
COMMUNITY
Water Supply Area
Deep Well (rated flow)
Overhead Tank

H. Map of Angeles City and Distribution System



ANNEX II: QUALITY OF WATER (AS OF AUGUST 2017):

A. BACTERIAL RESULTS

LOCATION		Multiple Tube Fermentation Technique		Heterotrophic Plate Count
		Most Probable No. per 100 mL		
		Total Coliform	Fecal Coliform	Result in CFU / mL
1	Marquee PS (Tank 1)	< 1.1	< 1.1	1
2	Marquee PS (Tank 2)	< 1.1	< 1.1	< 1
3	Marquee (NP after PS)	< 1.1	< 1.1	< 1
4	Marquee Clubhouse (C)	< 1.1	< 1.1	< 1
5	Marquee Sports Complex, Madison Drive (EP)	< 1.1	< 1.1	< 1
6	City Hall PS	< 1.1	< 1.1	1
7	Hall of Justice (NP after tank)	< 1.1	< 1.1	2
8	4088 CabioBakal, Sapalibutad (EP)	< 1.1	< 1.1	< 1
9	Generic Pharmacy, Sapalibutad (C)	< 1.1	< 1.1	< 1
10	EPZA PS (nearest tank outlet)	< 1.1	< 1.1	< 1
11	Blk 51 Lot 3 EPZA Rest.(NP after PS)	< 1.1	< 1.1	< 1
12	493 Phase 3, BagongSilang, Brgy. Cutud (EP)	< 1.1	< 1.1	< 1
13	ACWD Sub- Collecting office,PulungCacutud (C)	< 1.1	< 1.1	< 1
14	Punta Verde PS (after tank)	< 1.1	< 1.1	< 1
15	White Angel St., Punta Verde Subd. (NP)	< 1.1	< 1.1	< 1
16	African Tulip St. Punta Verde Subd. (EP)	< 1.1	< 1.1	6
17	Northville PS (after tank)	< 1.1	< 1.1	< 1
18	Blk 23 Lot 9, Northville (NP)	< 1.1	< 1.1	7
19	Blk 144 Lot 2 Amboka St. Northville (EP)	< 1.1	< 1.1	< 1
20	Che2x Store, Northville Cutud (C)	< 1.1	< 1.1	< 1
21	S & S Hulk Gym, Northville, Cutud (C)	< 1.1	< 1.1	< 1
22	Rosewood PS	< 1.1	< 1.1	< 1
23	Dalbergia St., Rosewood Subd. Brgy. Cutcut (NP)	< 1.1	< 1.1	< 1
24	Purok 3 Fil-Am Hiway,Brgy. Anunas (Carlo Dog Shop) (EP)	< 1.1	< 1.1	< 1
25	Cuayan PS	< 1.1	< 1.1	< 1
26	# 158 Purok 3 Before Brgy. Hall (NP)	< 1.1	< 1.1	< 1
27	Purok 5 Phase 2, Brgy. Cuayan (EP)	< 1.1	< 1.1	< 1
28	Edna Store, Brgy. Cuayan (C)	< 1.1	< 1.1	< 1
29	Anunas PS (Before UV)	< 1.1	< 1.1	< 1
30	Anunas PS (After UV)	< 1.1	< 1.1	< 1

LOCATION		Multiple Tube Fermentation Technique Most Probable No. per 100 mL		Heterotrophic Plate Count
		Total Coliform	Fecal Coliform	Result in CFU / mL
31	Anunas PS (after tank)	< 1.1	< 1.1	< 1
32	Nile St., Brgy. Anunas (NP)	< 1.1	< 1.1	< 1
33	Aqua 46/ Friendship Hi-way, Meliton Ave., Anunas (EP, C)	< 1.1	< 1.1	< 1
34	Sapang Bato PS (after tank)	< 1.1	< 1.1	< 1
35	Aguinaldo St., (near PS) Brgy. Sapang Bato (NP)	< 1.1	< 1.1	< 1
36	Little Baguio Reservoir	< 1.1	< 1.1	< 1
37	Sapang Bato Collecting Office (C, EP)	< 1.1	< 1.1	< 1
38	Yahoo.com Store/ Sapang Bato (C)	< 1.1	< 1.1	< 1
39	Sta. Teresita PS (Zone 3)	< 1.1	< 1.1	< 1
40	2098 Balagtas St. (infront INC), Brgy. Sta. Teresita	< 1.1	< 1.1	< 1
41	Brgy. Outpost ,Brgy. Sta. Teresita. (NP)	< 1.1	< 1.1	< 1
42	Cesca Store/ 4023 ArawMalansik St., Brgy. Sta. Teresita (EP)	< 1.1	< 1.1	< 1
43	Feeder 2	< 1.1	< 1.1	1
44	Central (after UV 1)	< 1.1	< 1.1	4
45	Central (after UV 2)	< 1.1	< 1.1	< 1
46	Central Reservoir (NP after reservoir)	< 1.1	< 1.1	< 1
47	Media Prep Room, ACWD Lab	< 1.1	< 1.1	< 1
48	386 San Juan St T&C BrgySto Domingo (EP)	< 1.1	< 1.1	< 1
49	Feeder 3	1.1	1.1	1
50	Feeder 4	< 1.1	< 1.1	1
51	Feeder 5	< 1.1	< 1.1	< 1
52	Feeder 6	< 1.1	< 1.1	3
53	Feeder 7	< 1.1	< 1.1	< 1
54	Feeder 8	< 1.1	< 1.1	< 1
55	Feeder 9	< 1.1	< 1.1	< 1
56	Sapalibutad after tank	< 1.1	< 1.1	4
57	4088 CabioBakal, Sapalibutad (EP)	< 1.1	< 1.1	6
58	Bagong Bayan PS	< 1.1	< 1.1	< 1
59	5058 Alim St., Brgy. Bagong Bayan (NP)	< 1.1	< 1.1	< 1
60	5253 Habagat St., Brgy. Bagong Bayan (EP)	< 1.1	< 1.1	< 1
61	LNW PS	< 1.1	< 1.1	< 1
62	Admin Bldg., Brgy. Lourdes Northwest (NP, C)	< 1.1	< 1.1	< 1
63	3111 Kalayaan St., Brgy. Lourdes Northwest (EP)	< 1.1	< 1.1	< 1
64	Mabini PS	< 1.1	< 1.1	< 1
65	Meter Calibration, Mabini St., Brgy. San Nicolas(NP)	< 1.1	< 1.1	< 1

LOCATION		Multiple Tube Fermentation Technique Most Probable No. per 100 mL		Heterotrophic Plate Count
		Total Coliform	Fecal Coliform	Result in CFU / mL
66	# 72 Sylvia St., Neposubd. (EP)	< 1.1	< 1.1	2
67	Tia Maria Carinderia, Mabini St., Brgy. San Nicolas(C)	< 1.1	< 1.1	< 1
68	Robinsons PS	< 1.1	< 1.1	< 1
69	Birch Drive, Robinsons Subd. (NP)	1.1	< 1.1	52
70	St. Vincent PS (Before UV)	2.6	1.1	25
71	St. Vincent PS (After UV)	< 1.1	< 1.1	7
72	St. Vincent PS (Distribution)	< 1.1	< 1.1	< 1
73	# 242 Purok 2, Old Pampang (NP)	< 1.1	< 1.1	< 1
74	828 Presentacion St. Villa Rosario, Old Pampang(EP)	< 1.1	< 1.1	< 1
75	Big J Carwash / Del Rosario, Old Pampang (EP, C)	< 1.1	< 1.1	< 1
76	Collados Eatery / Brgy. Bagong Bayan	< 1.1	< 1.1	< 1
77	Town & Country PS	< 1.1	< 1.1	< 1
78	386 San Juan, Brgy. Sto. Domingo (NP)	< 1.1	< 1.1	< 1
79	32 San Martin St., Brgy. San Jose (EP)	< 1.1	< 1.1	< 1
80	Montoya Bakery, 1517 Jesus St., Brgy. PulungBulo (C)	< 1.1	< 1.1	< 1
81	BelenHome Site PS	< 1.1	< 1.1	< 1
82	#264 Macapagal St. Belenhomesite, Brgy. Sto. Cristo (NP)	< 1.1	< 1.1	< 1
83	Abserve Air Conditioning, Belenhomesite, Brgy. Sto. Cristo	< 1.1	< 1.1	< 1
84	Villa Belen South PS (after tank)	< 1.1	< 1.1	< 1
85	Villa Belen South PS (after UV)	< 1.1	< 1.1	17
86	Villa Belen South Guardhouse, Main Gate, Brgy. Sto. Cristo (NP)	< 1.1	< 1.1	< 1
87	Pampanga Trading Corp., P. Gomez/ T. Claudio St. Brgy. Salapungan (C)	< 1.1	< 1.1	< 1
88	Mc Arthur PS	< 1.1	< 1.1	< 1
89	Willie Cortez, Mc Arthur Hi-way, Ninoy Aquino (NP)	< 1.1	< 1.1	399
90	B. Aquino St.,Mc Arthur (EP)	< 1.1	< 1.1	228
91	Magalang Ave. PS	< 1.1	< 1.1	10
92	#4104 9th St., Marisol, Brgy. Ninoy Aquino (EP)	< 1.1	< 1.1	< 1
93	St. Ignatius PS	< 1.1	< 1.1	6
94	St. Ignatius Guardhouse	< 1.1	< 1.1	< 1
95	# 044 Santol Road, Brgy. Tabun (EP)	< 1.1	< 1.1	< 1
96	Metrogate PS 1 (after tank)	< 1.1	< 1.1	< 1
97	Blk 4 Lot 3, Venus St./Pulot St. Metrogatesubd. (NP)	< 1.1	< 1.1	< 1
98	Aqua Cabana, # 4131 Cor. Lazatin& Garcia Sts., Capaya 2	< 1.1	< 1.1	< 1
99	Metrogate PS 2	< 1.1	< 1.1	< 1

LOCATION		Multiple Tube Fermentation Technique		Heterotrophic Plate Count
		Most Probable No. per 100 mL		
		Total Coliform	Fecal Coliform	Result in CFU / mL
100	Blk 122 Lot 12, Metrogate 2, Brgy. Capaya I (EP)	< 1.1	< 1.1	< 1
101	Capaya 1 PS	< 1.1	< 1.1	< 1
102	Remedios Compound, Brgy. Capaya 1 (NP)	< 1.1	< 1.1	83
103	Leah Store, 3002 Brgy. Capaya 1 (C)	< 1.1	< 1.1	< 1
104	#44 Magalang Ave., Marisol (Ice Flakes) (NP)	< 1.1	< 1.1	< 1
105	Mango St. corner Nectarine, Metrogate 2 (NP)	< 1.1	< 1.1	2
106	11 Mabato St., Brgy. PulungBulo (EP)	< 1.1	< 1.1	2
107	Exedy Car Accessories, Mc Arthur Hi-way, Brgy. Virgin De los Remedios (C)	< 1.1	< 1.1	1

C – commercial
NP – nearest point
EP – end point

B. Physical-Chemical Results

	NAME OF PUMPING STATION		PARAMETERS TESTED (CONCENTRATION IN PPM)									
			TURBIDITY	COLOR	pH	H_2S	Res. Cl_2	TDS	HARDNESS	CHLORIDES	FLUORIDES	NITRATES
1	FEEDER PUMP # 1											
2	FEEDER PUMP # 2											
3	FEEDER PUMP # 3											
4	FEEDER PUMP # 4	Distribution	0.47	1.05	6.99			392.00	280.50	15.25	0.195	1.70
5	FEEDER PUMP # 5	Distribution	1.12	0.60	7.20			260.00	148.00	11.25	0.61	0.80
6	FEEDER PUMP # 6	Distribution	0.28	0.75	6.89			230.00	131.00	11.49	0.59	0.60
7	FEEDER PUMP # 7											
8	ANUNAS PS	Distribution	0.77	1.00	6.50	0.010	0.85	240.00	177.00	11.49	0.735	1.90
		Nile St., Riverside Subd., Anunas, Angeles City	0.93	0.70	6.53	0.008	0.93	240.00	109.50	6.99	0.465	2.10
9	BAGONG BAYAN PS											
10	BELEN HOMESITE PS	Distribution	0.23	0.25	7.11	0.003	0.78	246.00	119.50	14.25	0.065	1.60
		Abserve Commercial, Brgy. Sto. Cristo, Angeles City	0.28	0.25	7.00	0.007	1.77	452.00	283.50	23.49	0.215	2.00
11	CUAYAN PS	Distribution	0.16	2.70	6.50	<MDL	0.70	260.00	134.50	9.75	0.49	2.50
		Purok 5, Cuayan, Angeles City	0.33	1.40	6.50	0.006	0.71	240.00	114.00	7.25	0.51	1.45
12	CITY HALL PS	Distribution	0.20	1.00	7.81	0.008	0.47	176	180.5	17.49	0.075	0.8
		Bureau of Fire Protection, Brgy. Pulung Maragul, Angeles City	0.52	0.95	7.56	0.01	0.37	256.00	126.00	14.25	0.26	1.30
13	EPZA PS	Distribution	0.43	1.25	7.79	<MDL	0.61	356.00	220.50	15.49	<MDL	0.75
		ACWD Sub-collecting Office, EPZA, Pulung Cacutud	0.11	0.95	7.08	0.01	0.58	220.50	240.50	32.74	0.13	1.70
14	MABINI PS											
15	MAGALANG AVE. PS	Distribution	0.18	0.40	6.98	0.006	0.92	264.00	166.00	24.24	0.61	3.45
		Mother's Car Detailing, Magalang Ave., Angeles City	0.18	1.10	7.05	0.008	0.87	144.00	160.50	17.74	0.60	3.00
16	MC ARTHUR HI WAY PS	Distribution	0.32	0.75	7.04	0.003	0.80	260.00	177.00	18.74	0.36	2.80
		Exedy Car Accessories, Mc Arthur Highway, Brgy. Ninoy Aquino	0.21	1.20	7.20	0.010	0.76	272.00	145.00	18.74	0.28	3.00
17	METROGATE 1 PS	Distribution	0.66	0.70	7.06	<MDL	1.03	234.00	113.00	14.25	0.19	0.70
		Venus cor. Pluto St., Metrogate Subd., Capaya, Angeles City	2.54	2.70	6.80		0.85					
17	METROGATE 2 PS	Distribution	0.54	1.95	6.79	<MDL	0.63	240.00	149.50	9.75	0.14	0.85
		Mango cor. Nectarine St., Metrogate Subd., Capaya, Angeles City	1.02	1.25	6.91		0.54					
18	ROBINSONS PS	Distribution	0.57	4.00	7.89		0.96	250.00	111.50	6.25	<MDL	1.10
		Forest Park Homes, Arayat Blvd., Brgy. Pampang, Angeles City	0.36	0.25	7.59	<MDL	0.88	280.00	139.50	12.75	<MDL	1.30
19	SAPALIBUTAD PS	Distribution	3.49	2.75	7.98	0.005	0.49	236.00	170.50	14.25	0.24	0.50
		Generic Pharmacy, Brgy. Sapalibutad, Angeles City	3.32	2.40	7.93	0.008	0.95	262.00	175.00	17.24	0.365	1.05
20	SAPANG BATO PS	Distribution	0.53	0.45	7.34	<MDL	0.54	266.00	117.50	7.75	<MDL	1.30
		Yahoo.com Store, Brgy. Sapangbato, Angeles City	0.53	1.05	7.28	0.015	0.46	232.00	119.50	7.49	<MDL	1.30
21	STA. TERESITA PS											
22	TOWN & COUNTRY PS	Distribution	0.44	0.15	7.92	0.010	0.76	222.00	129.50	9.25	0.385	1.60
		Sn. Joaquin cor. Sn. Andres St., Town and Country Homes, Brgy. Sto. Domingo, Angeles City	0.82	0.20	8.05	<MDL	0.68	404.00	236.50	23.74	0.22	2.10
23	ROSEWOOD PS	Distribution	0.97	2.85	6.52	<MDL	0.57	580.00	426.50	37.24	0.775	1.00
		B5 L8 Dalbergia St., Rosewood Subd, Angeles City	0.18	2.85	6.51	<MDL	0.37	620.00	381.00	38.99	0.58	1.10
24	PUNTA VERDE PS	Distribution	0.85	0.55	7.81	<MDL	0.79	402.00	195.00	27.74	0.315	1.00
		White Angel St., Punta Verde Subdivision, Angeles City	0.87	2.00	7.89	<MDL	0.74	358.00	107.00	32.49	0.215	1.20
25	MARQUEE PS	Distribution	3.91	3.15	8.16	0.003	0.87	286.00	125.50	20.49	<MDL	1.10
		Clubhouse, Marquee Subdivision, Angeles City	3.62	3.00	8.12	0.006	0.84	272.00	159.50	16.49	0.19	1.20
26	NORTHVILLE PS	Distribution	1.08	0.21	7.51	0.010	0.54	446.00	226.00	19.49	0.145	0.70
		Che-che Store, Northville 15 Resettlement, Brgy. Cutud	0.74	1.40	7.50	0.007	0.40	408.00	236.00	24.99	0.32	2.20
27	FEEDER PUMP # 8											
28	ST. IGNATIUS PS	Distribution	0.39	0.70	6.80	<MDL	0.48	202.00	131.50	16.25	0.145	0.70
		Guardhouse, St. Ignatius, Angeles City	0.33	0.60	7.00		0.41					
29	ST. VINCENT PS	Distribution	0.30	0.50	7.54	0.013	0.45	212.00	167.50	11.75	<MDL	1.50
		Big J Carwash, St. Vincent, Angeles City	0.23	2.50	7.04	0.011	0.31	226.00	141.50	13.75	<MDL	1.55
30	VILLA BELEN PS	Distribution	0.23	1.00	6.87	0.011	0.76	272.00	144.50	23.24	0.57	0.90
		Clubhouse, Villa Belen, Angeles City	0.18	0.40	6.81	0.007	0.74	281.00	136.50	34.49	0.135	1.00
31	FEEDER PUMP # 9											
32	LOURDES NORTHWEST PS											
32	CAPAYA 1 PS	Distribution	1.83	0.85	6.76		0.94	198.00	125.50	11.25	0.39	1.00
		Remedios Compound, Capaya, Angeles City	0.76	1.40	6.95		0.90					

	NAME OF PUMPING STATION		PARAMETERS TESTED (CONCENTRATION IN PPM)								
			SULFATES	Al	Cu	Fe	Mn	As	Cd	Cr	Pb
1	FEEDER PUMP # 1										
2	FEEDER PUMP # 2										
3	FEEDER PUMP # 3										
4	FEEDER PUMP # 4	Distribution	192.90	<MDL	<MDL	0.265	0.029	<MDL	<MDL	<MDL	<MDL
5	FEEDER PUMP # 5	Distribution	37.56	<MDL	<MDL	0.070	0.028	<MDL	<MDL	<MDL	<MDL
6	FEEDER PUMP # 6	Distribution	38.25	<MDL	<MDL	0.085	0.030	<MDL	<MDL	<MDL	<MDL
7	FEEDER PUMP # 7										
8	ANUNAS PS	Distribution	40.81	<MDL	<MDL	0.022	0.003	<MDL	<MDL	<MDL	<MDL
		Nile St., Riverside Subd., Anunas, Angeles City	42.90	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL
9	BAGONG BAYAN PS										
10	BELEN HOMESITE PS	Distribution	39.11	<MDL	<MDL	<MDL	0.006	<MDL	<MDL	<MDL	<MDL
		Abserve Commercial, Brgy. Sto. Cristo, Angeles City	204.53	<MDL	<MDL	<MDL	0.003	<MDL	<MDL	<MDL	<MDL
11	CUAYAN PS	Distribution	8.25	<MDL	<MDL	0.069	0.018	<MDL	<MDL	<MDL	<MDL
		Purok 5, Cuayan, Angeles City	10.81	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL
12	CITY HALL PS	Distribution	1.97	<MDL	<MDL	0.094	0.157	<MDL	<MDL	<MDL	<MDL
		Bureau of Fire Protection, Brgy. Pulung Maragul, Angeles City	0.35	<MDL	<MDL	0.064	0.111	<MDL	<MDL	<MDL	<MDL
13	EPZA PS	Distribution	7.44	0.025	<MDL	<MDL	0.132	<MDL	<MDL	<MDL	<MDL
		ACWD Sub-collecting Office, EPZA, Pulung Cacutud	177.79	<MDL	<MDL	0.024	<MDL	<MDL	<MDL	<MDL	<MDL
14	MABINI PS										
15	MAGALANG AVE. PS	Distribution	69.42	<MDL	<MDL	0.035	0.005	<MDL	<MDL	<MDL	<MDL
		Mother's Car Detailing, Magalang Ave., Angeles City	64.53	<MDL	<MDL	0.055	0.013	<MDL	<MDL	<MDL	<MDL
16	MC ARTHUR HI WAY PS	Distribution	65.23	<MDL	<MDL	0.065	0.020	<MDL	<MDL	<MDL	<MDL
		Exedy Car Accessories, Mc Arthur Highway, Brgy. Ninoy Aquino	134.53	<MDL	<MDL	0.055	0.005	<MDL	<MDL	<MDL	<MDL
17	METROGATE 1 PS	Distribution	23.60	<MDL	<MDL	0.135	0.170	<MDL	<MDL	<MDL	<MDL
		Venus cor. Pluto St., Metrogate Subd., Capaya, Angeles City							<MDL		<MDL
17	METROGATE 2 PS	Distribution	22.21	<MDL	<MDL	0.300	0.238	<MDL	<MDL	<MDL	<MDL
		Mango cor. Nectarine St., Metrogate Subd., Capaya, Angeles City							<MDL		<MDL
18	ROBINSONS PS	Distribution	97.56	<MDL	<MDL	0.040	0.028	<MDL	<MDL	<MDL	<MDL
		Forest Park Homes, Arayat Blvd., Brgy. Pampang, Angeles City	85.09	<MDL	<MDL	0.030	0.008	<MDL	<MDL	<MDL	<MDL
19	SAPALIBUTAD PS	Distribution	5.69	<MDL	<MDL	0.268	0.209	<MDL	<MDL	<MDL	<MDL
		Generic Pharmacy, Brgy. Sapalibutad, Angeles City	6.39	<MDL	<MDL	0.222	0.218	<MDL	<MDL	<MDL	<MDL
20	SAPANG BATO PS	Distribution	56.51	<MDL	<MDL	0.075	0.009	<MDL	<MDL	<MDL	<MDL
		Yahoo.com Store, Brgy. Sapangbato, Angeles City	65.23	<MDL	<MDL	0.040	0.012	<MDL	<MDL	<MDL	<MDL
21	STA. TERESITA PS										
22	TOWN & COUNTRY PS	Distribution	9.42	<MDL	<MDL	<MDL	0.011	<MDL	<MDL	<MDL	<MDL
		Sn. Joaquin cor. Sn. Andres St., Town and Country Homes, Brgy. Sto, Domingo, Angeles City	164.77	<MDL	<MDL	0.017	0.017	<MDL	<MDL	<MDL	<MDL
23	ROSEWOOD PS	Distribution	305.93	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL
		B5 L8 Dalbergia St., Rosewood Subd, Angeles City	294.07	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL
24	PUNTA VERDE PS	Distribution	11.04	<MDL	<MDL	0.082	<MDL	<MDL	<MDL	<MDL	<MDL
		White Angel St., Punta Verde Subdivision, Angeles City	14.07	<MDL	<MDL	0.089	<MDL	<MDL	<MDL	<MDL	<MDL
25	MARQUEE PS	Distribution	3.37	<MDL	<MDL	0.174	0.318	<MDL	<MDL	<MDL	<MDL
		Clubhouse, Marquee Subdivision, Angeles City	5.23	<MDL	<MDL	0.128	0.135	<MDL	<MDL	<MDL	<MDL
26	NORTHVILLE PS	Distribution	35.69	0.011	<MDL	0.036	0.189	<MDL	<MDL	<MDL	<MDL
		Che-che Store, Northville 15 Resettlement, Brgy. Cutud	30.81	<MDL	<MDL	0.035	0.160	<MDL	<MDL	<MDL	<MDL
27	FEEDER PUMP # 8										
28	ST. IGNATIUS PS	Distribution	23.14	<MDL	<MDL	0.135	0.057	<MDL	<MDL	<MDL	<MDL
		Guardhouse, St. Ignatius, Angeles City							<MDL		<MDL
29	ST. VINCENT PS	Distribution	11.11	<MDL	<MDL	0.080	0.009	<MDL	<MDL	<MDL	<MDL
		Big J Carwash, St. Vincent, Angeles City	68.02	<MDL	<MDL	0.055	0.013	<MDL	<MDL	<MDL	<MDL
30	VILLA BELEN PS	Distribution	37.79	<MDL	<MDL	0.060	0.010	<MDL	<MDL	<MDL	<MDL
		Clubhouse, Villa Belen, Angeles City	11.74	<MDL	<MDL	0.070	0.014	<MDL	<MDL	<MDL	<MDL
31	FEEDER PUMP # 9										
32	LOURDES NORTHWEST PS										
32	CAPAYA 1 PS	Distribution	24.88	0.015	<MDL	0.570	0.318	<MDL	<MDL	<MDL	<MDL
		Remedios Compound, Capaya, Angeles City							<MDL		<MDL

ANNEX III: RISK ASSESSMENT, HAZARD TABLE AND EXISTING CONTROL MEASURE

A. Groundwater Source

Risk Ref	Priority	Hazard	Hazardous event (source of hazard)	Raw Risk			Existing Control Measure	Effectiveness of existing control measure	Res. Risks		Proposed Control Measure	Validation	PCM Ref
				Likelihood	Severity	Score			Likelihood	Score			
CW01	L	M	Intrusion of Contaminants due to Pump Breakdown	2	5	10	Strict implementation of pump preventive maintenance program	Lessen incidence of pump breakdown thus reduce intrusion of contaminants	1	5			
		P		2	4	8			1	4			
		C		2	4	8			1	4			
CW02	M	M	Water supply interruption due to pump breakdown	3	5	15	PM of pumps	Lessen the water supply interruption as a result of effective Monitoring and PM of Pumps.	1	5			
		P					Regular Monitoring of Pumps						
		C											
CW03	H	M	Clogging of chlorine injection points	4	5	20	Clean/Maintain injection points regularly. Proper setting of chlorine dosage before injection.	Regular Cleaning lessen clogging problem	1	5			
CW04	L	M	Backflow risks	2	5	10	Regular monitoring/Inspection of check valves	Regular monitoring/Inspection eliminates backflow risks	1	5			
		P		2	4	8			1	4			
		C		1	4	4			1	4			
CW05	M	P	Excessive Fe content on groundwater source	5	3	15	Install water treatment facility	Water Quality results showed decreased amount of Fe, pass PNSDW standards	2	6	Upgrading of Water Treatment Facilities	Improvement of WTF resulting to Customer satisfaction.	PCM-CW-01

Risk Ref	Priority	Hazard	Hazardous event (source of hazard)	Raw Risk			Existing Control Measure	Effectiveness of existing control measure	Res. Risks		Proposed Control Measure	Validation	PCM Ref
		C		5	3	15			2	6			
CW06	M	P	Excessive Mn content on groundwater source	5	3	15	Control abstraction	Water Quality results showed decreased amount of Mn, pass PNSDW standards	2	6	Upgrading of Water Treatment Facilities	Improvement of WTF resulting to Customer satisfaction.	PCM-CW-01
		C		5	3	15	Install water treatment facility		2	6			
CW07	L	P	Contaminated groundwater source (naturally occurring elements)-Hydrogen Sulfide	5	4	20	Control abstraction	Water Quality results showed decreased amount of Sodium Hydrosulfide, pass PNSDW standards	1	4	Upgrading of Water Treatment Facilities	Improvement of WTF resulting to Customer satisfaction.	PCM-CW-01
		C		5	4	20	Install water treatment facility		1	4			
CW08	L	M	Intrusion of contaminants due to floodwater (well seal elevation below road ground level)	3	5	15	Control run-off infiltration using protective barrier	Use of barrier around the well prevent run-off from entering WELL	2	10	Elevate the area of Pumping station	Improvement of pumping station to prevent flood water intrusion.	PCM-CW-02
		P		3	4	12			2	8			
		C		3	4	12			2	8			

B. Treatment

Risk Ref	Priority	Hazard	Hazardous event (source of hazard)	Raw Risk			Existing Control Measure	Effectiveness of existing control measure	Res. Risks		Proposed Control Measure	Validation	PCM Ref
				Likelihood	Severity	Score			Likelihood	Score			
T01	L	M C	Power interruption, resulting to disruption of treatment operation (e.g. interruption of chlorination)	3 3	5 3	15 9	Standby generator set	•Back-up power is available at all times.	1 1	5 3			
T02	H	M C P	Clogging of chlorinator injection point	4 4 4	5 3 2	20 12 8	Regular maintenance	De-clogging schedule is strictly followed	2 2 2	10 6 4	Supervision and strict implementation of standard procedure	Supervisor / Operator Logs; SOP is disseminated to operators	PCM-T-01
T03	L	M C P	Defective chlorinator	4 4 4	5 3 2	20 12 8	•Preventive maintenance of chlorinators •Back-up unit	Spare units must be available at all times	1 1 1	5 3 2			
T04	L	C	Under dosing/No pre chlorination	2	3	6	Pre-setting of chlorine solution before injecting	Residual chlorine dioxide monitoring	1	3			
T05	L	M C	Leaks within the treatment plant (e.g. transport pipes, aerator/sedimentation tank, filter tanks, check valves)	2 2	5 3	10 6	Regular maintenance	Strictly follow maintenance procedure and schedule	1 1	5 3			
T06	L	C P	Clogged nozzle sprays in aerator	2 2	4 2	8 4	Implement PM of Aeration system	Strictly follow maintenance procedure and schedule	1 1	4 2			
T07	L	C P	Accumulated sediments of iron and manganese in sedimentation tank	3 3	4 3	12 9	Implement PM of Sedimentation Tanks	Strictly follow maintenance procedure and schedule	1 1	4 3			

Risk Ref	Priority	Hazard	Hazardous event (source of hazard)	Raw Risk			Existing Control Measure	Effectiveness of existing control measure	Res. Risks		Proposed Control Measure	Validation	PCM Ref
T08	L	M	Intrusion of Animals (Birds, reptiles, others) due to open manhole cover / defective Aeration/Sedimentation tank screens	2	5	10	Regular cleaning	Strictly follow maintenance procedure and schedule; Water Quality Monitoring	1	5			
		P		2	2	4	Tank cover should be well-maintained		1	2			
T09	M	C	Poor performance of filters due to irregular backwashing	3	3	9	Regular backwashing	Strictly follow backwashing procedure and schedule	2	6	Supervision and strict implementation of standard procedure	Supervisor / Operator Logs; SOP is disseminated to operators	PCM-T-01
T10	L	C	Depleted / Exhausted filter media	3	3	9	Filter media replacement and/or regeneration	Strictly follow regeneration / replacement procedure	1	3			
T11	L	M	Electro mechanical system failure	2	2	4	Preventive maintenance service	Strictly follow maintenance procedure and schedule	1	2			
T12	H	M	Under/overdosing at post-chlorination	4	5	20	Pre-setting of chlorine solution before injecting	Residual chlorine monitoring	2	10	Supervision and strict implementation of standard procedure	Supervisor / Operator Logs;SOP is disseminated to operators	PCM-T-01
T13	L	M	Accumulated residue/rust in the elevated water tank	2	5	10	PM of elevated water tank	Strictly follow maintenance procedure and schedule	1	5			
		C		3	4	12			1	4			

C. Distribution

Risk Ref	Priority	Hazard	Hazardous event (source of hazard)	Raw Risk			Existing Control Measure	Effectiveness of existing control measure	Residual Risk		Proposed Control Measure	Validation	PCM Ref
				Likelihood	Severity	Score			Likelihood	Score			
D01	M	M	Illegal tapping of water connections (exposed /above ground underground)	5	5	25	Continuous/regular inspection of suspected illegal tapping. And encourages the community to report any.	Strict enforcement of penalties to the person responsible for illegal tapping	2	10	Embed all exposed pipes prone to illegal tapping	Enclosure of every exposed pipes minimize the risk of unauthorized usage of water connections	
D02	H	M	Intrusion of contaminants through leaking pipes at low pressures such as a) Deteriorated pipes	5	5	25	a. Pressure managements to minimize negative pressure on water distribution lines b. Leak detection and repair	Establish regular pressure on areas with negative pressure and maintain chlorine residual from 0.3 to 1.5 mg/L	3	15	Rehabilitation of pipelines and continuous monitoring of chlorine residual	Reduce Non-Revenue Water	PCM-D-01
D03	L	M	b) Poor workmanship in pipe laying (new/repair)	1	3	3	Management plan on pipe laying by the supervisor	Strict supervision of pipelaying based on standard working procedure	1	3			
D04	M	M	Exposure to storm water run-off and other waters that carry and harbor microbial contaminants	3	5	15	None		2	10	Control run-off infiltration	Use of barrier around the repair site to prevent run-off from entering supply system mainline during leakage repair and flushing of affected area after repair	

Risk Ref	Priority	Hazard	Hazardous event (source of hazard)	Raw Risk			Existing Control Measure	Effectiveness of existing control measure	Residual Risk		Proposed Control Measure	Validation	PCM Ref
D05	L	P	Bursting of pipes due to poor quality materials and workmanship	3	2	6	Random testing of material	Strict compliance on quality inspection in purchasing of pipes	1	2			
D06	L	M	Contaminants enter through submerged pipelines in drainage/canals	1	5	5	service lines submerged in drainage are provided with protection	Replacement of submerge pipeline and provide GI Casing for service lines above maximum flow level of water on drainage	1	5			
D07	L	M	Contaminants enter through busted pipes accidentally damaged by other agencies	3	5	15	Close coordination with other agencies	Ensure that there is a representative from WD and agency involved during implementation of projects.	1	5			
D08	L	M P C	Water entering distribution is unsatisfactory as per PNSDW standards	1 1 1	5 3 4	5 3 4	Ensure that WSP of treatment plants are followed	Strict compliance on PNSDW Standard	1 1 1	5 3 4			

D. Storage

Risk Ref	Priority	Hazard	Hazardous event (source of hazard)	Raw Risk			Existing Control Measure	Effectiveness of existing control measure	Res. Risks		Proposed Control Measure	Validation	PCM Ref
				Likelihood	Severity	Score			Likelihood	Score			
S01	L	M P	Intrusion of Animals (Birds, reptiles, others) due to uncovered vent.	2 2	5 3	10 6	Installation of screen on vent and not easily detachable	Prevent intrusion of animals.	1 1	5 3			
S02	L	P	Presence of Sand Particles	2	2	4	Regular Cleaning and monitoring of reservoir	Regular cleaning and monitoring of reservoir ensures Water Quality at standard level	1	2			
S03	L	C M	Accumulated rust particles at Elevated water tank	3 3	3 5	9 15	Regular cleaning of Elevated water tank by installing drain pipe	Regular cleaning and monitoring of EWT ensures Water Quality at standard level	1 1	3 5			

ANNEX IV: SYSTEM IMPROVEMENTS/UPGRADE PLANS

A . Groundwater Source

PCM Ref.	Action (Proposed Control Measure)	Arising from (Hazardous Event)	Identified Specific Improvement Plan	Accountability	Cost / Funding Source	Due	Status
PCM-CW-01	Elevate the area of Pumping station	Intrusion of contaminants due to floodwater (well elevation below road ground level)	1. Identify the P.S. with low well elevation	Department Manager	Approved budget appropriation		Planning stage
			Rehabilitation of Cuayan P.S.				Planning stage
			2. Prepare program of works.	Water Utility Management Officer			Planning stage
			3. Implement program upgrade.	Water Utility Management Officer			Planning stage
PCM-CW-02	Upgrading of Water Treatment Facilities	Excessive Fe & Mn content on groundwater source	1. Improvement and upgrading of WTF Sapalibutad P.S (Construction of Concrete cistern and Aeration/ Sedimentation Tank)	Department Manager, Engr. Eugene Lopez, Engr. Jesus David, Engr. Alvin Mercado	4.8 million	3rd quarter of 2017	On-going

B. Treatment

PCM Ref.	Action (Proposed Control Measure)	Arising from (Hazardous Event)	Identified Specific Improvement Plan	Accountability	Cost / Funding Source	Due	Status
PCM-T-01	Supervision and strict implementation of standard working procedure	• Clogging of chlorinator injection point. • Poor performance of filters due to irregular backwashing. • Under/ overdosing at post-chlorination	1. Intensify Standard Operating Procedure	Operations Supervisor	(Administrative Costs e.g. visual aids, seminar expenses) /Internal Cash Generation	July 2017	In Progress
			2. Document an on-site monitoring program			July 2017	In Progress

C. Distribution

PCM Ref.	Action (Proposed Control Measure)	Arising from (Hazardous Event)	Identified Specific Improvement Plan	Accountability	Cost / Funding Source	Due	Status
PCM-D-01	Rehabilitation of pipelines (Old Lines) at Epza Resettlement Phase 1	Entry of Contaminants on Leaking Pipes	1. Identify pipes to be replaced	1. Construction Division Manager	Php 2,362,713.37 / Internal Cash Generation	August 2016	Completed
			2. Prepare Program of Work	2. Principal Engineer		September 2016	Completed
			3. Implement Rehabilitation Program	3. Water/Sewerage Maintenance Foreman		December 2016 to April 2017	Completed
	Rehabilitation of pipelines (Old Lines) at Epza Resettlement Phase 2	Entry of Contaminants on Leaking Pipes	1. Identify pipes to be replaced	1. Construction Division Manager		February 2017	Completed
			2. Prepare Program of Work	2. Principal Engineer		March 2017	Completed
			3. Implement Rehabilitation Program	3. Water/Sewerage Maintenance Foreman		May to August 2017	On-going

ANNEX V: MONITORING OF THE CONTROL MEASURES

A. Control Point and Assessment for Groundwater

PCM Ref	Process Step: Control Measure	Critical limit	What	Where	When	How	Who	Corrective action
CW01	Preventive maintenance of pump and motor	40% pump efficiency	Pump	Pump	Monthly	Pump performance test	Electromechanical	Pull out / Rehab
CW02	Clean/Maintain injection points regularly. Proper setting of chlorine dosage before injection.	Presence of Deposits	Injection points	Injection points location	Daily	Cleaning / declogging	Pump operator	Injection point declogged everyday
CW03	Regular monitoring/Inspection of check valve	Efficiently working check valve installed.	Check valve	Check valve location	Daily	Preventive Maintenance	Pump operator/ Electromechanical	Replace check valve
CW04	Install water treatment facility	0.4 ppm	Iron (Fe)	Well	Monthly	Colorimetric test	Laboratory and Operation personnel	Adjust chlorine dosage
		1.0 ppm	Manganese (Mn)	Well	Monthly	Colorimetric test	Laboratory and Operation personnel	Adjust chlorine dosage
	Control Abstraction	0.05 ppm	Hydrogen Sulfide (H2S)	Well	Monthly	Water Quality Monitoring	Laboratory and Operation personnel	Adjust chlorine dosage
CW05	Control run-off infiltration of flood water using protective barrier	Presence of Deposits	Water Quality	Well	During rainy Season	Visual Inspection	Operator-on-duty	Flush Discharge line

B. Control Point and Assessment for Storage

PCM Ref	Process Step: Control Measure	Critical limit	What	Where	When	How	Who	Corrective action
S01	Installation of screen on vent and not easily detachable	Vents not covered	vents	Elevated water tank/ reservoir	Monthly	Visual Inspection	Pump operator	Cover vent with screen
S03	Install drain pipe	Presence of deposits	Water quality	Elevated Water Tank	Monthly	Visual inspection	Pump operator	Flushing

C. Control Point and Assessment for Treatment

PCM Ref	Process Step: Control Measure	Operational limit	Critical limit	What	Where	When	How	Who	Corrective action
T01	Standby generator set	24 hours / 7 days a week	Power Interruption, Low voltage, single phase	Electric power	Standby generator for Pumping stations	Daily Monitoring	Warm-up daily	Operator / Electromech	Troubleshooting
T02	Regular maintenance of chlorinator injection point	0.50 - 1.00 ppm	below 0.3 ppm or above 1.5 ppm	Chlorine residual	Nearest sampling point after chlorination point	Weekly	Colorimetric test for residual chlorine/chlorine dioxide	Laboratory / Operator	Cleaning/repair of injection point

PCM Ref	Process Step: Control Measure	Operational limit	Critical limit	What	Where	When	How	Who	Corrective action
T03	Preventive maintenance of chlorinators	0.50 - 1.00 ppm	below 0.3 ppm or above 1.5 ppm	Chlorine residual	Nearest sampling point after chlorination point	Weekly	Colorimetric test for residual chlorine/chlorine dioxide	Laboratory / Operator / Electromechanical	Cleaning/repair
	Back-up chlorinator	According to unit specification	Less than 8 liters/hr (with back pressure)	Outlet flow	Back-up chlorinator	Every two weeks	Flow measurement	Electromechanical	Cleaning/repair
T04	Prechlorination: Pre-setting of chlorine solution (dosage) before injecting	As recommended by Laboratory	As recommended by Laboratory	Chlorine dosage	Chlorine solution container	Every refill	Visual inspection	Laboratory; Operations Head (Sr.WRFO)	Adjust chlorine dosage
T05	Regular maintenance for prevention of leaks	Zero	Presence	Leak	Treatment Plant	Daily	Visual inspection	Operator-on-duty	Repair
T06	Preventive Maintenance of Aeration system	Zero	Presence	Clog	Aeration /sedimentation tank	Daily	Visual inspection	Electromechanical / Operator-on-duty	Cleaning
T07	Preventive Maintenance of Sedimentation Tanks	Clear	Presence of deposits	Aerator Water	Aeration /sedimentation tank	Daily	Visual inspection	Electromechanical / Operator-on-duty	Cleaning

PCM Ref	Process Step: Control Measure	Operational limit	Critical limit	What	Where	When	How	Who	Corrective action
T08	Regular cleaning of aeration/sedimentation tank	Zero	Presence	Droppings/ Dirt	Aeration /sedimentation tank	Weekly	Visual inspection	Electromechanical / Operator-on-duty	Cleaning
	Tank cover should be well-maintained	Zero	Presence	Damage	Aeration /sedimentation tank	Weekly	Visual inspection	Electromechanical / Operator-on-duty	Repair
T09	Regular backwashing	0.5 ppm	1.0 ppm	Iron	Filtered water	Weekly	Colorimetric test for iron	Laboratory	Further backwashing
		0.2 ppm	0.4 ppm	Manganese	Filtered water	Weekly	Colorimetric test for manganese	Laboratory	Further backwashing
		Clear	Turbid	Turbidity	Filtered water	Every backwash	Visual inspection	Operator-on-duty	Further backwashing
T10	Filter media replacement and/or regeneration	According to filter specification	According to filter specification	Iron and manganese removal	Filtered water	Quarterly	Colorimetric tests for iron and manganese	Laboratory	Regeneration/ replacement of filter media
T11	Post-chlorination: Pre-setting of chlorine solution before injecting	As recommended by Laboratory	As recommended by Laboratory	Chlorine dosage	Chlorine solution container	Every refill	Visual inspection	Laboratory; Operations Head (Sr.WRFO)	Adjust chlorine dosage
T12	PM of elevated water tank	Clear	Presence of deposits	Water quality (physical)	Elevated water tank	Daily	Visual inspection	Operator-on-duty	Cleaning

D. Control Point and Assessment for Distribution

PCM Ref	Process Step: Control Measure	Operational limit	Critical limit	What	Where	When	How	Who	Corrective action
	Continuous/regular inspection of suspected illegal tapping. And encourages the community to report any.	No illegal connections	Illegal connections detected	Distribution pipeline	Distribution pipeline	Daily	Visual inspection	Inspector / ACWD Employees	Disconnect illegal tappings and encourage regularization of water connection
	a. Pressure managements to minimize negative pressure on water distribution lines	10 - 30 psi	Zero	Pressure	Low pressure areas	Peak hour	Valve manipulation	WRFO / WSMM	Adjust valve manipulation scheme
	b. Leak detection and repair	5 - 10 leakage repaired daily	Sign of leaks and deterioration	Distribution pipelines	Distribution pipelines	Daily	Ocular inspection and leak detection monitoring	Field personnel	Repair / replacement of deteriorated pipes
	Random testing of material	As recommended by End User	Adherence to standard specs of materials	Materials	Warehouse /General Services Office	Upon Delivery	Thorough Inspection	End user / TWG	Replacement / non acceptance of sub-standard materials

PCM Ref	Process Step: Control Measure	Operational limit	Critical limit	What	Where	When	How	Who	Corrective action
	Close coordination with other agencies	Regular meeting	Broken Pipeline	Distribution pipelines	Distribution pipelines	Project Implementation	Close monitoring	Field personnel	Re-aligned pipeline

ANNEX VI: VERIFICATION OF EFFECTIVENESS OF WSP

Verification of Activity	Location of Activity	Type of Activity	Frequency of Activity	Analyst	Recipient of analysis results	Action on unusual/failing result	3rd Party Recipient of Results
I. WATER QUALITY MONITORING	Consumer's Taps (Regular Sampling Point)	Water Quality Testing		ACWD Laboratory	Production Dept. / Laboratory		City Health Office / LWUA
a. MICROBIAL			Monthly			Adjustment of Chlorinator setting / dosage, Flushing	
b. PHY/CHEM			Semi-Annual			Flushing, Filter media regeneration/replacement, Adjustment of Chlorinator setting	
2. RESIDUAL CHLORINE TESTING	Consumer's Taps (Regular Sampling Point)	Water Quality Testing	Daily	Operations Division	Production Dept. / Laboratory	Increase / Adjust chlorine dosage	LWUA
3. WATER PRESSURE	Source	Monitoring	Hourly	Pump Operator, Foreman	Sr. WRFO	Protocol on low pressure	Production Dept. Head
4. VERIFICATION OF FIELD ACTIVITIES	Along Distribution Network	Detection / Inspection	As detected / confirmed	Commercial Department	Engineering Dept. / Maintenance Division	Disconnect directly from mainline	Barangay Council
a. Disconnection of detected illegal connection							
b. Plugging of illegal Connection							
c. Leak Detection	Along Distribution Network	Detection / Repair	As detected / reported	Maintenance Division	Engineering Dept. / Maintenance Division	Replace / Rehabilitation of pipelines	General Manager
d. Main Line Leak Repair							

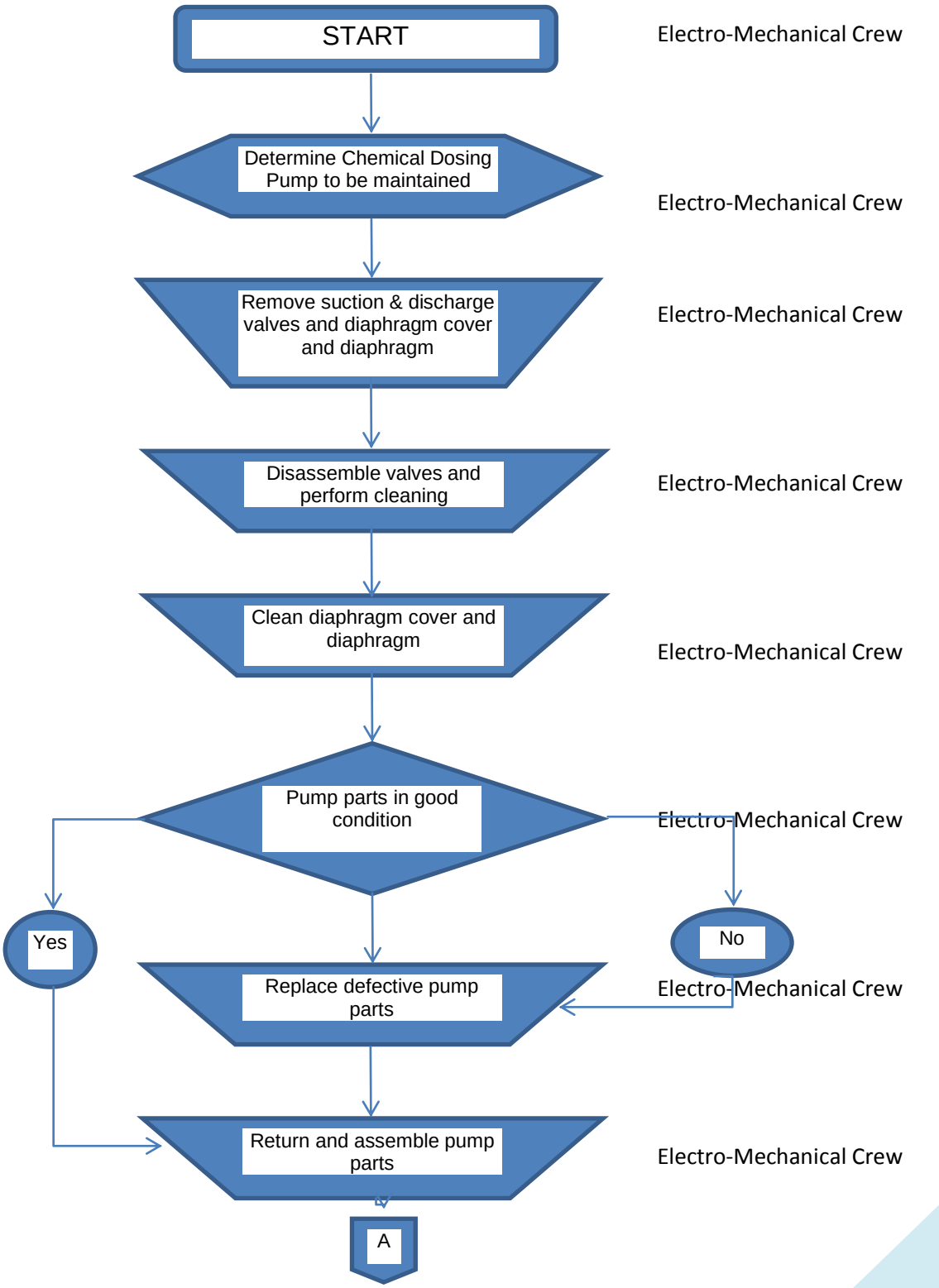
Verification of Activity	Location of Activity	Type of Activity	Frequency of Activity	Analyst	Recipient of analysis results	Action on unusual/failing result	3rd Party Recipient of Results
e. Cross Connection	Along Distribution Network	Improvement of pipelines	As detected / reported	Planning / Maintenance Division	Engineering Dept.		General Manager
e.1 Service line						Provide casing	General Manager
e.2 Mainline						Re-alignment of main distribution line	General Manager
e.3 Private wells		Internal Audit	as reported	Commercial Department	Engineering Dept. / Maintenance Division	Install or provide check valve	
f. Hygienic Practices	Along Distribution Network	Improvement sanitation practices	Anytime there is any field activity	Field Personnel	Engineering Dept. / Maintenance Head	Protocol on Hygienic practices	General Manager, WSP Team
g. Flushing	Blow-off and Fire Hydrants	Improvement of water quality	After repair / scheduled	Field Personnel	Production Department and Maintenance Head	Install additional blow-off and hydrant	General Manager
4. INSTRUMENT CALIBRATION	ACWD Laboratory	Internal Audit	Annual, Before Use	DOST / 3rd Party Calibrator	ACWD Laboratory	Repair or replace equipment	General Manager, DOH
5. REGULATORY COMPLIANCE	All pumping stations including selected consumer taps	External Audit		ACWD Laboratory			
a. Microbial			Monthly		Production Dept. Head	Protocol on Failed results	General Manager, LWUA
b. Physical / Chemical			Semi-Annual		Production Dept. Head	Protocol on Failed results	General Manager, LWUA
6. CUSTOMER FEEDBACK	Customer Service	Suggestion Box, Social Media	As Received	Customer Service Officer	Customer Division Head	Notify concerned depatment/s	General Manager, Customer

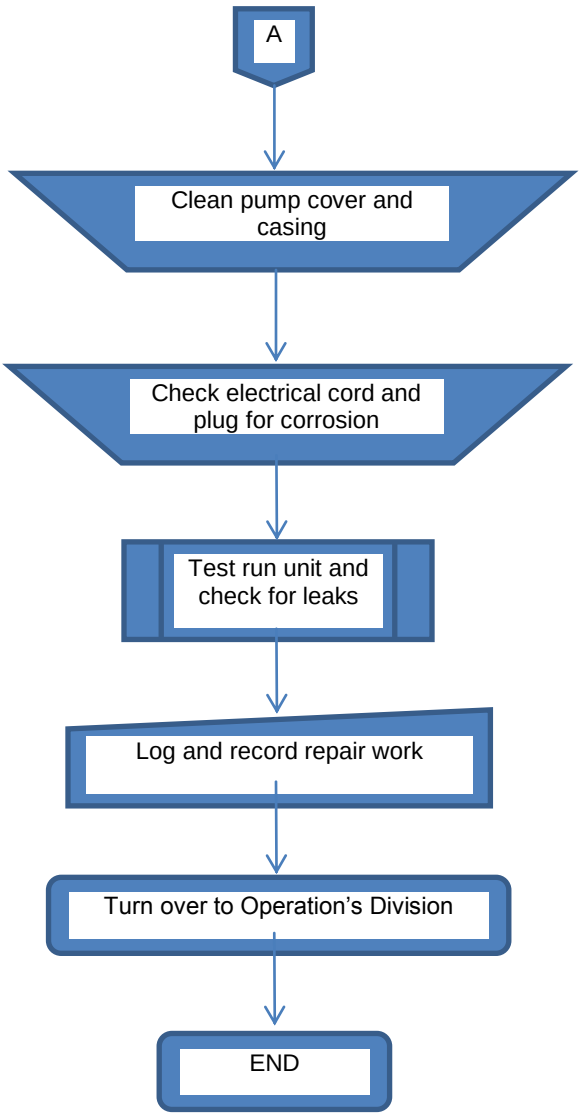
ANNEX VI I: STANDARD OPERATING PROCEDURES

A. Preventive Maintenance of Chemical Dosing Pump

ACWD-PROD-E/MECH-WP01

FLOWCHART **RESPONSIBILITY**

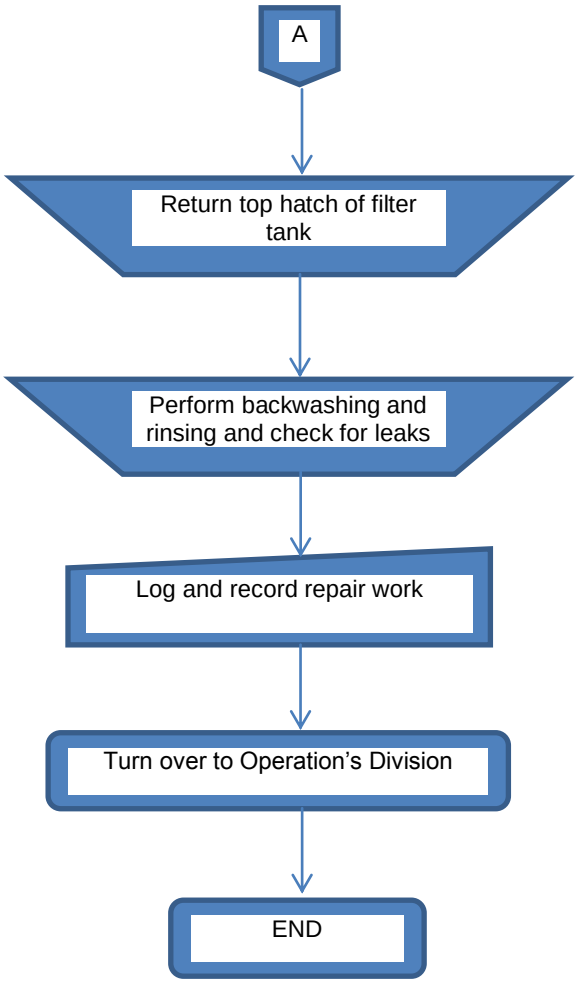


FLOWCHART	RESPONSIBILITY
	Electro-Mechanical Crew Electro-Mechanical Crew Electro-Mechanical Crew Electro-Mechanical Crew Water Facilities Operator

B. Preventive Maintenance of Filter Tanks
ACWD-PROD-E/MECH-WP02

FLOWCHART	RESPONSIBILITY
START	Electro-Mechanical Crew
Determine Filter Tank to be maintained	Electro-Mechanical Crew
Remove top hatch and side cover of filter tank	Electro-Mechanical Crew
Remove filter media, pebbles & flat stones from filter tank	Electro-Mechanical Crew
Clean tank inner walls & check under drain pipes & screens	Electro-Mechanical Crew
Return side cover of filter tank	Electro-Mechanical Crew
Refill filter with clean filter media, pebbles and flat stones	Electro-Mechanical Crew
Perform backwashing and rinsing	Electro-Mechanical Crew
A	

FLOWCHART **RESPONSIBILITY**



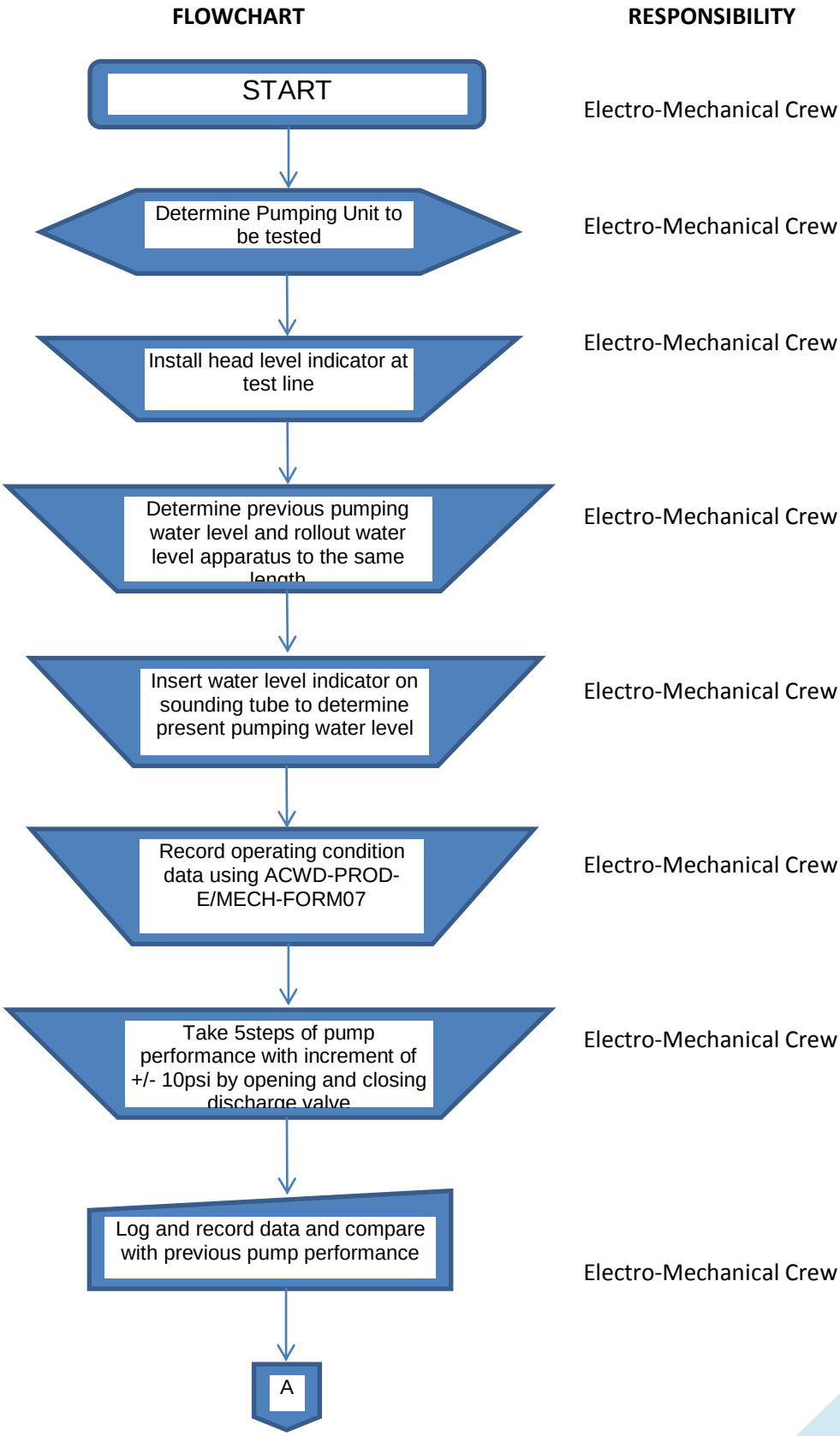
Electro-Mechanical Crew

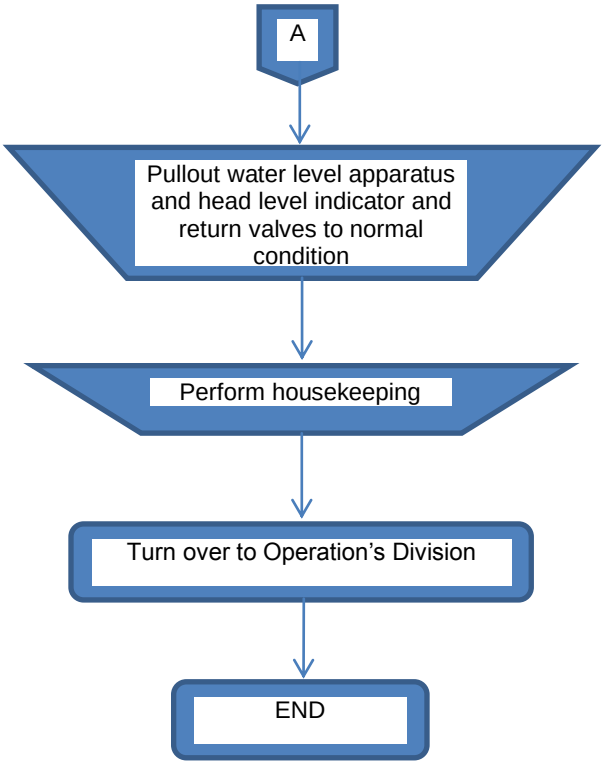
Electro-Mechanical Crew

Electro-Mechanical Crew

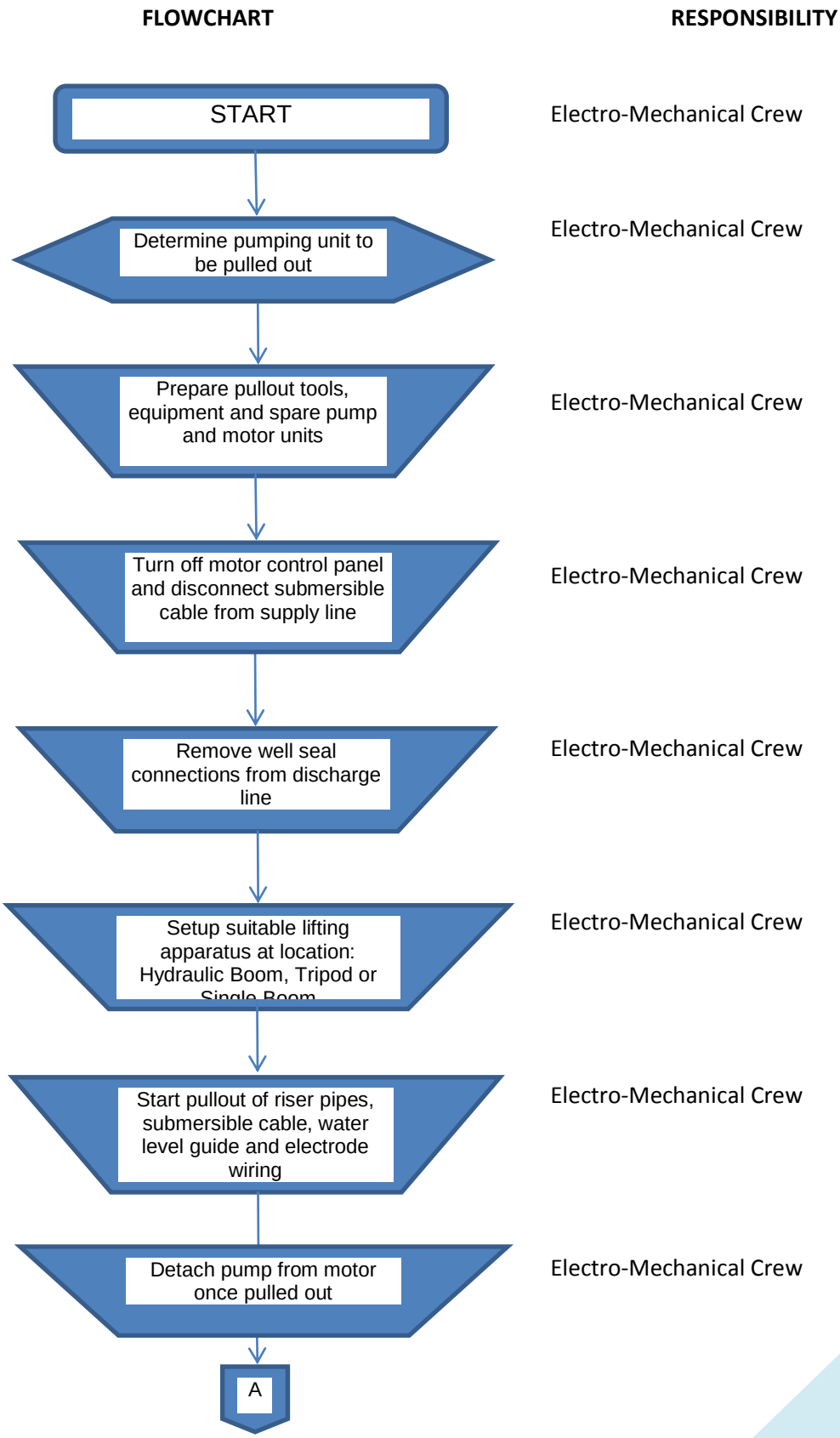
Water Facilities Operator

C. Conduct Pump Performance Test
ACWD-PROD-E/MECH-WP03

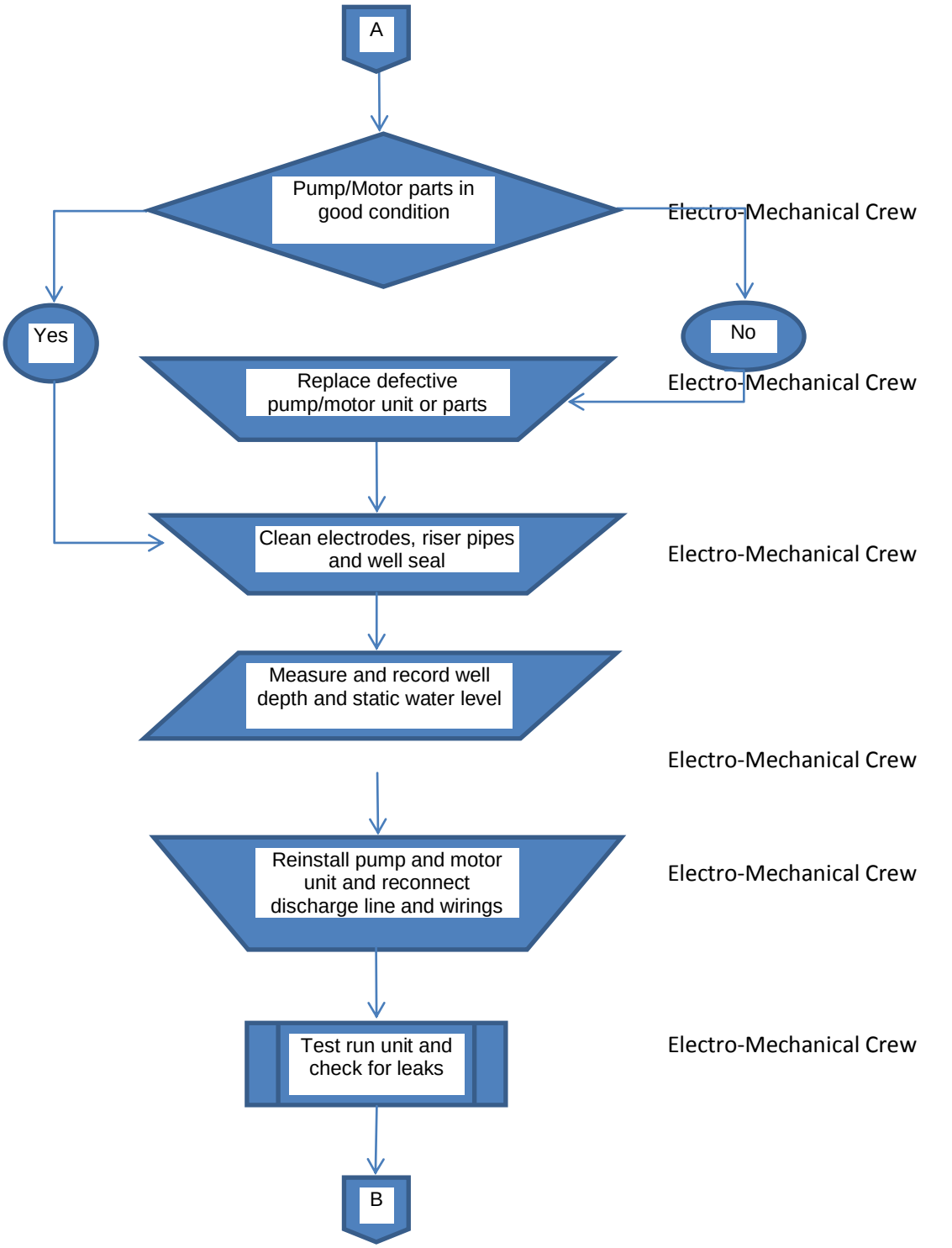


FLOWCHART	RESPONSIBILITY
	Electro-Mechanical Crew Electro-Mechanical Crew Water Facilities Operator

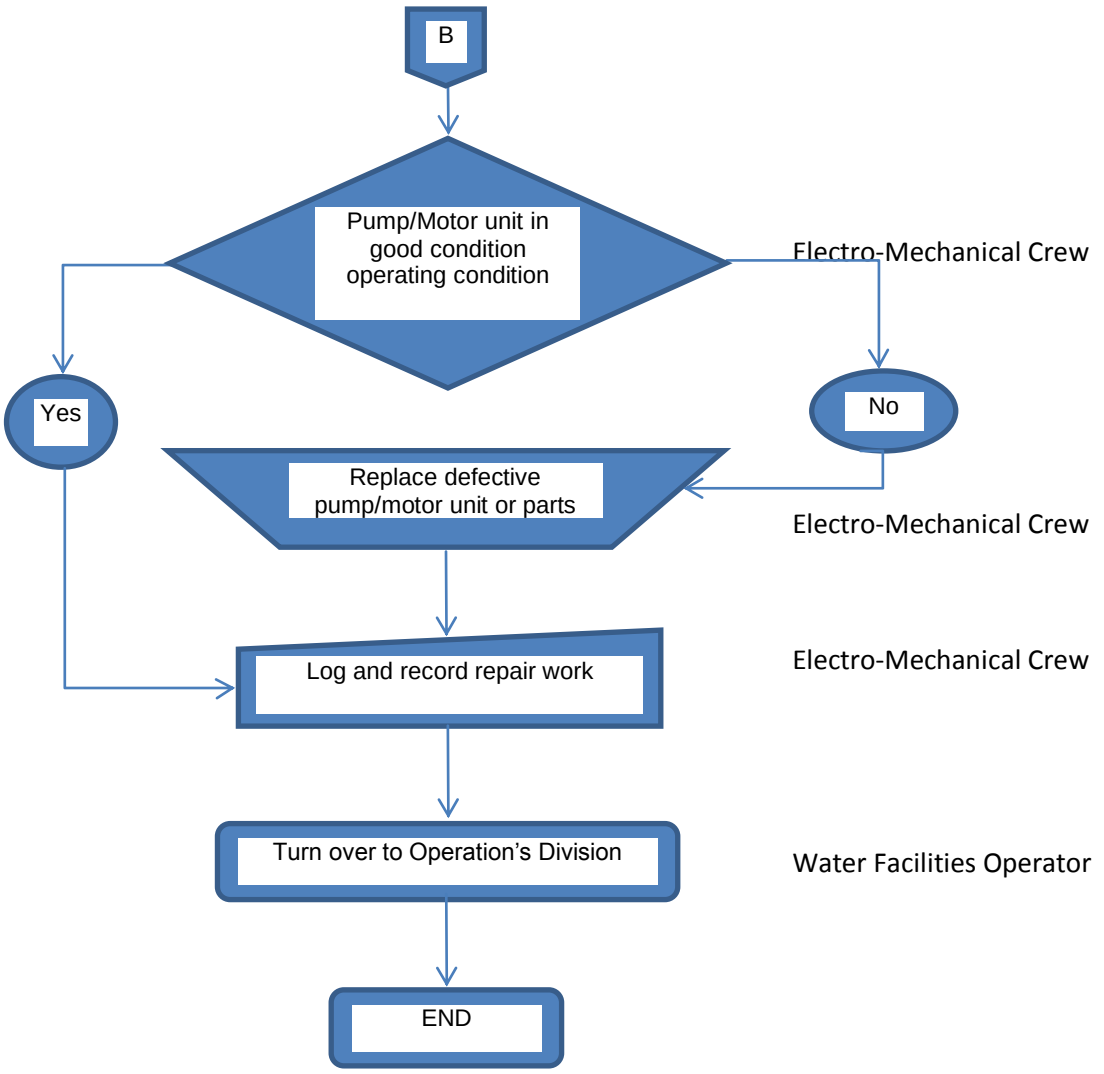
D. Pullout and Installation of Submersible Pump and Motor
ACWD-PROD-E/MECH-WP04



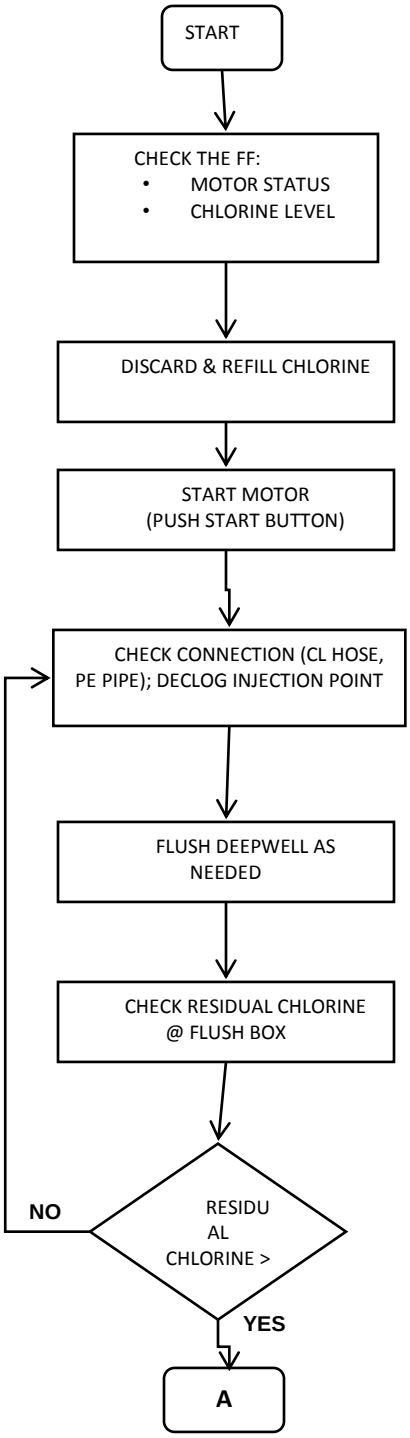
FLOWCHART **RESPONSIBILITY**

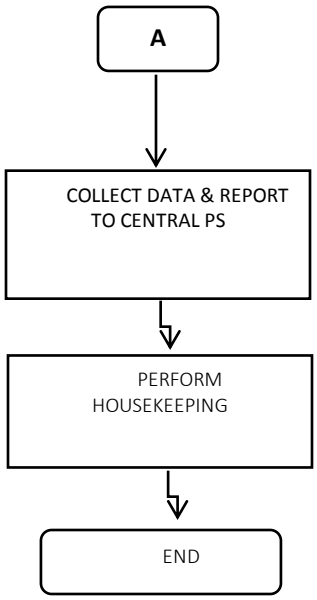


FLOWCHART **RESPONSIBILITY**



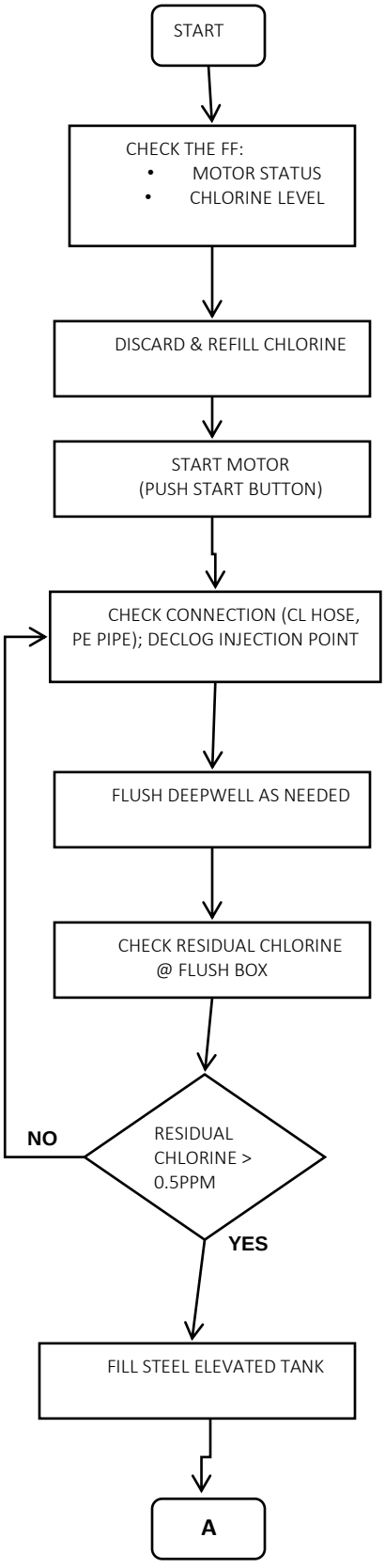
E. Direct Pump Operation Procedure
ACWD-PROD-OPRN-OP01

Flowchart	Responsibility
	
CHECK THE FF: • MOTOR STATUS • CHLORINE LEVEL	**Pump Operator**
DISCARD & REFILL CHLORINE	**Pump Operator**
START MOTOR (PUSH START BUTTON)	**Pump Operator**
CHECK CONNECTION (CL HOSE, PE PIPE); DECLOG INJECTION POINT	**Pump Operator**
FLUSH DEEPWELL AS NEEDED	**Pump Operator**
CHECK RESIDUAL CHLORINE @ FLUSH BOX	**Pump Operator**
RESIDUAL CHLORINE >	**Pump Operator**

Flowchart	Responsibility
	**Pump Operator** **Pump Operator**

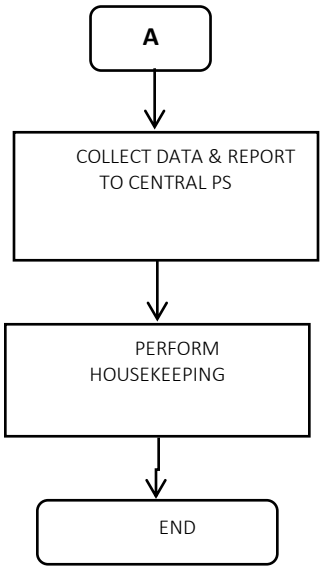
F. Pump Operation Procedure (Storage)
ACWD-PROD-OPRN-OP02

Flowchart



Responsibility

START	
CHECK THE FF: • MOTOR STATUS • CHLORINE LEVEL	**Pump Operator**
DISCARD & REFILL CHLORINE	**Pump Operator**
START MOTOR (PUSH START BUTTON)	**Pump Operator**
CHECK CONNECTION (CL HOSE, PE PIPE); DECLOG INJECTION POINT	**Pump Operator**
FLUSH DEEPWELL AS NEEDED	**Pump Operator**
CHECK RESIDUAL CHLORINE @ FLUSH BOX	**Pump Operator**
RESIDUAL CHLORINE > 0.5PPM	**Pump Operator**
FILL STEEL ELEVATED TANK	**Pump Operator**
A	



Pump Operator

Pump Operator

G. Chlorine Solution Preparation

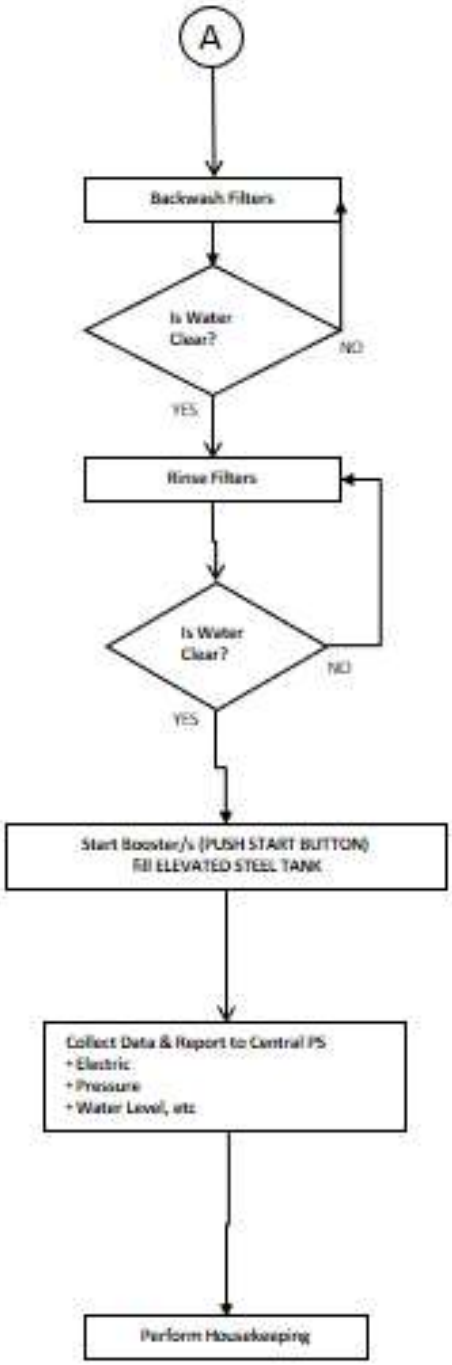
ACWD-PROD-OPRN-OP03

FLOWCHART	RESPONSIBILITY
START	Pump Operator
CHLORINE LEVEL < 20 LITERS	Pump Operator
DISPOSE RESIDUEAND CLEAN DRUM PROPERLY	Pump Operator
CHECK CHLORINATOR CONTROL POINTS (CL Hose, injection points, CL pump, feed rate)	Pump Operator
FILL DRUM WITH WATER UP TO 100L	Pump Operator
PUT CHLORINE UP TO REQUIRED LEVEL	Pump Operator
MIXED CHLORINE SOLUTIUON PROPERLY	Pump Operator
CHLORINE SOLUTION MIXED AND READY TO PUMP	Pump Operator
END	

H. Water Treatment Operation Procedure (City Hall)
ACWD-PROD-OPRN-OP04

FLOWCHART	RESPONSIBILITY
Check the ff: • Elevated Tank Level • Motor & Booster Status • Chlorine Level (Pre & Post)	Pump Operator
Refill Pre-chlorination tank	Pump Operator
Start Motor (PUSH START BUTTON)	Pump Operator
Flush deep well for 1 min (or as needed)	Pump Operator
Check Chlorinator Control Points (CL Hose , injection points, CL pump, feed rate)	Pump Operator
Check Residual Chlorine at Flush Box	Pump Operator
Reading is > 0.5ppm? (NO / YES)	Pump Operator
Fill SEDIMENTATION TANK	Pump Operator
Standby for 45 Minutes	Pump Operator
Purge Sedimentation Tank	Pump Operator
A	

FLOWCHART



RESPONSIBILITY

Pump Operator

Pump Operator

Pump Operator

Pump Operator

Pump Operator

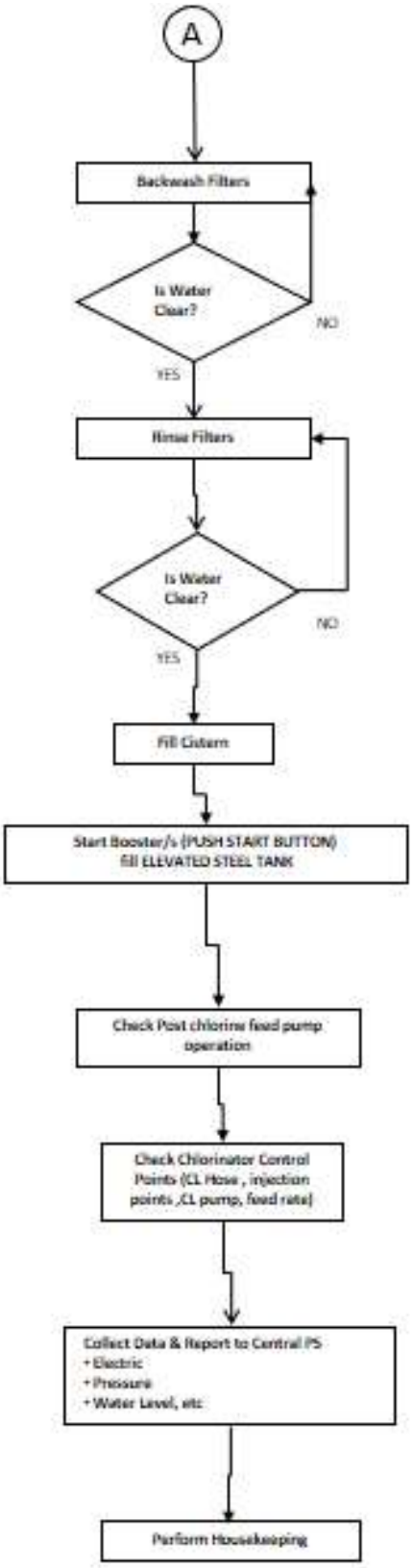
Pump Operator

Pump Operator

I. Water Treatment Operation Procedure (Northville 15 and Marquee Place P.S.)
ACWD-PROD-OPRN-OP05

FLOWCHART	RESPONSIBILITY
Check the ff: • Elevated Tank Level • Motor & Booster Status • Chlorine Level (Pre & Post)	Pump Operator
Refill Pre-chlorination tank	Pump Operator
Check Chlorinator Control Points (CL Hose , injection points, CL pump, feed rate)	Pump Operator
Start Motor (PUSH START BUTTON)	Pump Operator
Flush deep well for 1 min (or as needed)	Pump Operator
Check Residual Chlorine at Flush Box	Pump Operator
Reading is <0.5ppm? (YES / NO)	Pump Operator
Fill aeration/sedimentation tank Slowly Full OPEN Valve 2, full CLOSE Valve 1	Pump Operator
Start RECIRCULATING PUMP	Pump Operator
Standby for 45 Minutes	Pump Operator
Purge Aeration/Sedimentation Tank	Pump Operator
A	

FLOWCHART



RESPONSIBILITY

Pump Operator

Pump Operator

Pump Operator

Pump Operator

Pump Operator

Pump Operator

Pump Operator

Pump Operator

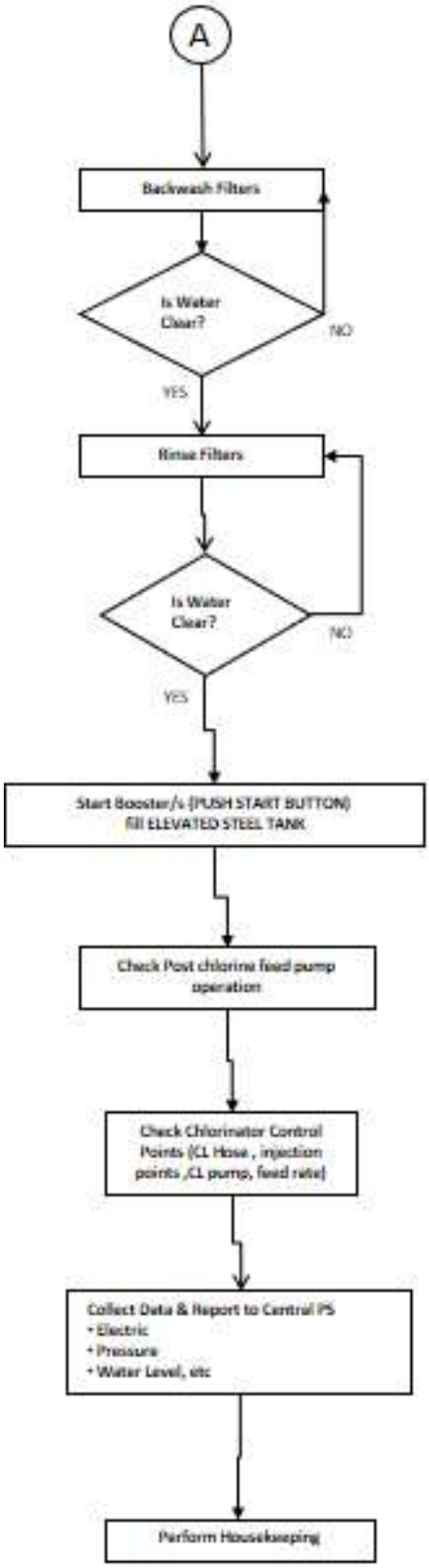
Pump Operator

Pump Operator

J. Water Treatment Operation Procedure (Sapalibutad, Puntaverde And Epza P.S.)
ACWD-PROD-OPRN-OP06

FLOWCHART	RESPONSIBILITY
Check the ff: • Elevated Tank Level • Motor & Booster Status • Chlorine Level (Pre & Post)	Pump Operator
Refill Pre-chlorination tank	Pump Operator
Start Motor (PUSH START BUTTON)	Pump Operator
Flush deep well for 1 min (or as needed)	Pump Operator
Check Chlorinator Control Points (CL Hose , injection points, CL pump, feed rate)	Pump Operator
Check Residual Chlorine at Flush Box	Pump Operator
Reading is <0.5ppm? (NO / YES)	Pump Operator
Fill aeration/sedimentation tank Slowly Full OPEN Valve 2, full CLOSE Valve 1	Pump Operator
Start RECIRCULATING PUMP	Pump Operator
Standby for 45 Minutes	Pump Operator
Purge Aeration/Sedimentation Tank	Pump Operator
A	

FLOWCHART



RESPONSIBILITY

Pump Operator

Pump Operator

Pump Operator

Pump Operator

Pump Operator

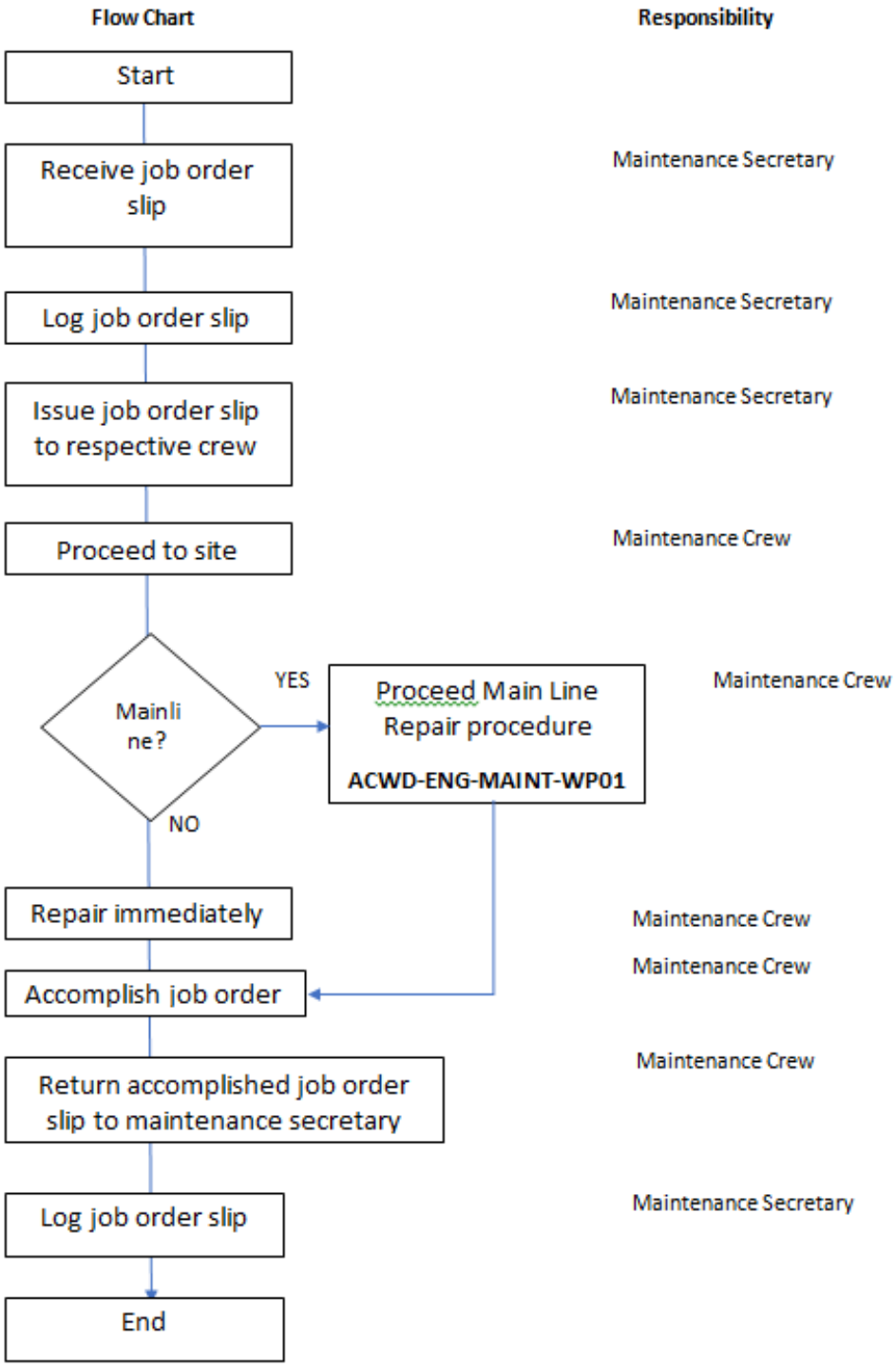
Pump Operator

Pump Operator

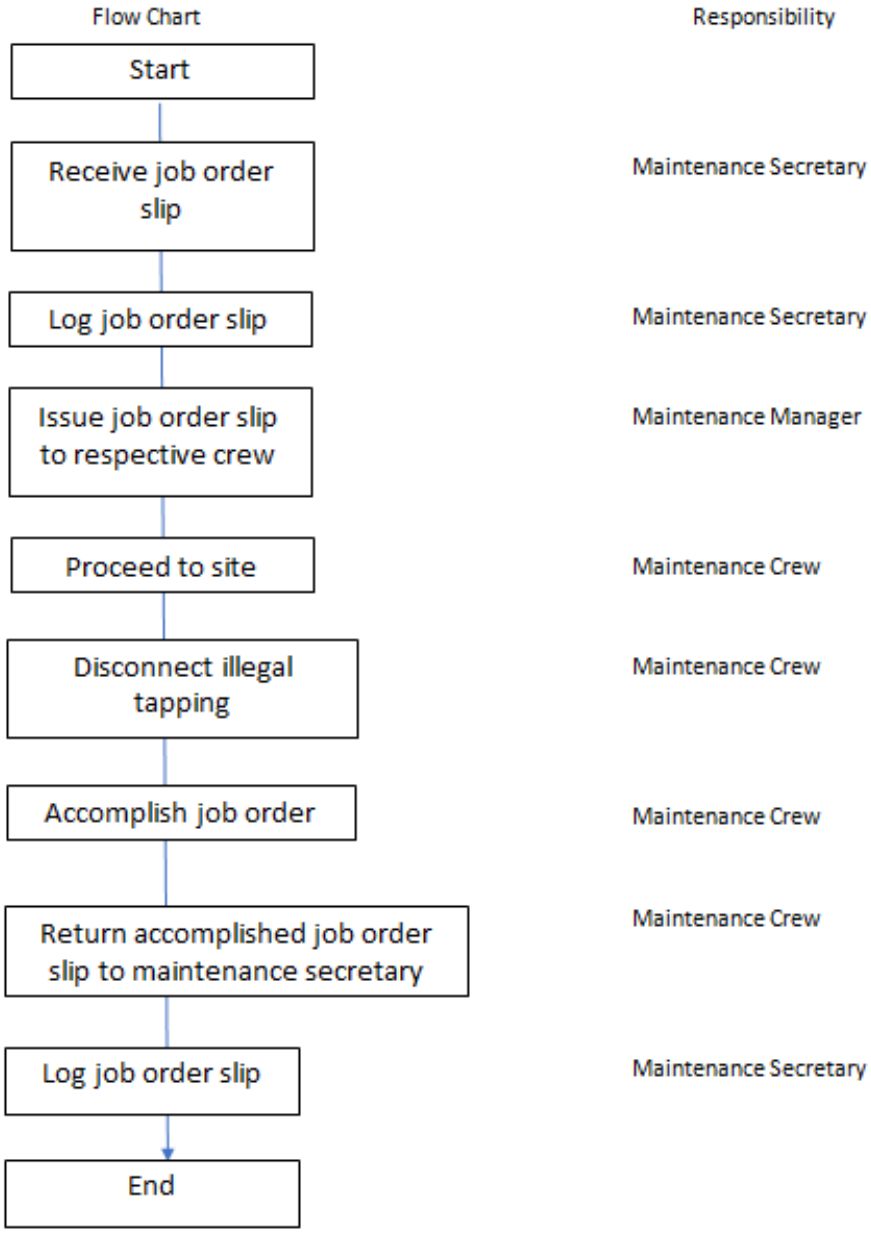
Pump Operator

Pump Operator

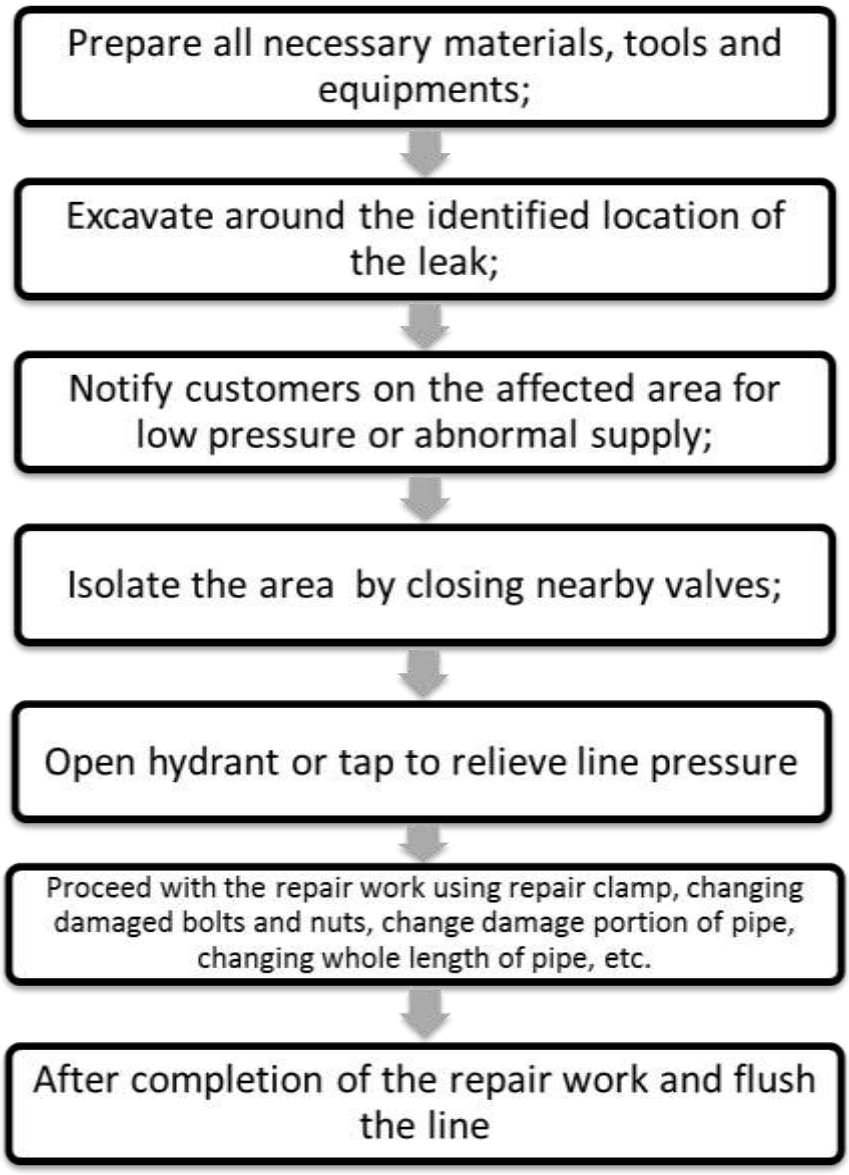
K. Mainline / Service Line Leak Repair
ACWD-ENG-MAINT-FC01



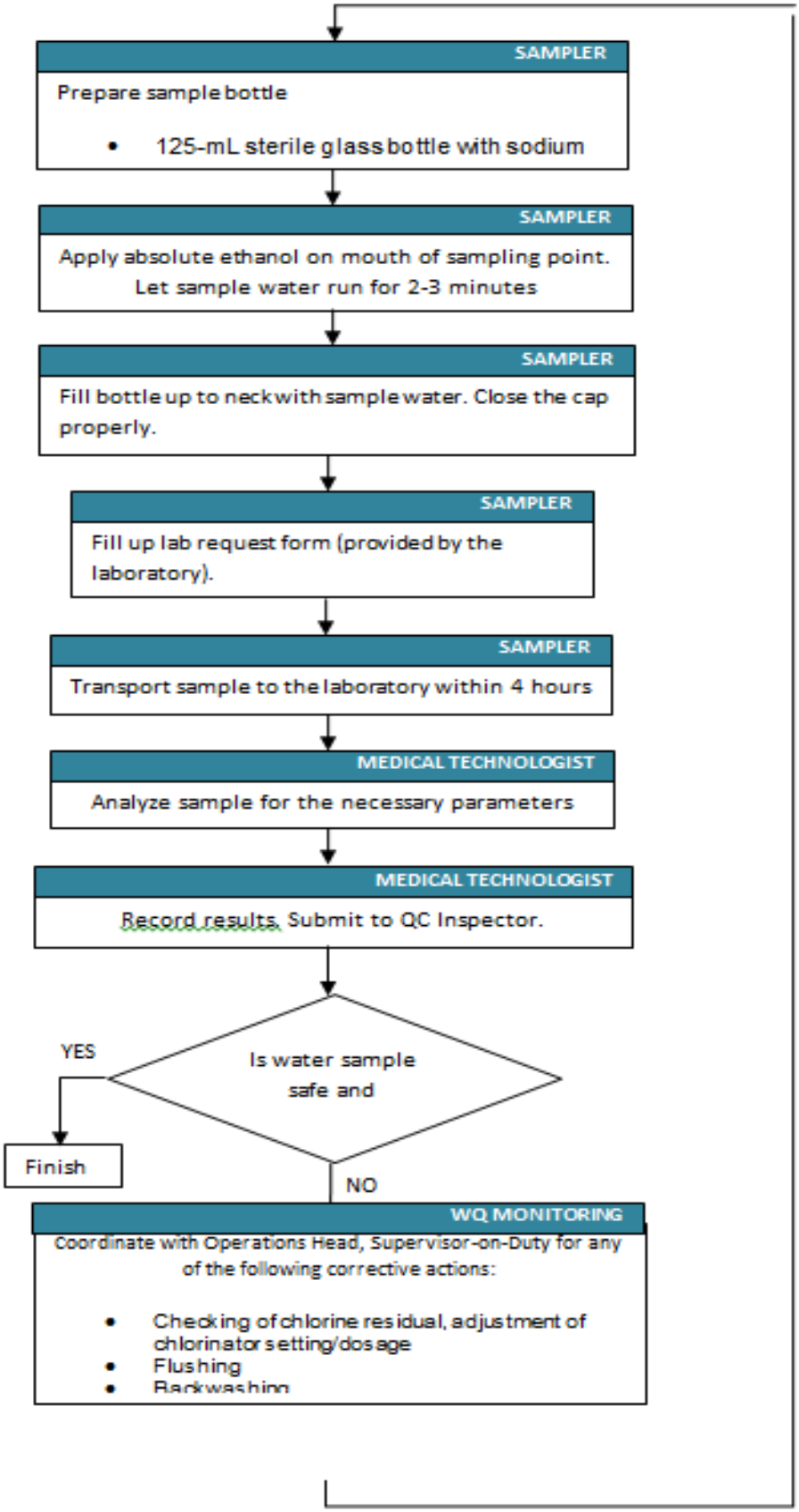
L. Disconnect from Mainline
ACWD-ENG-MAINT-FC02



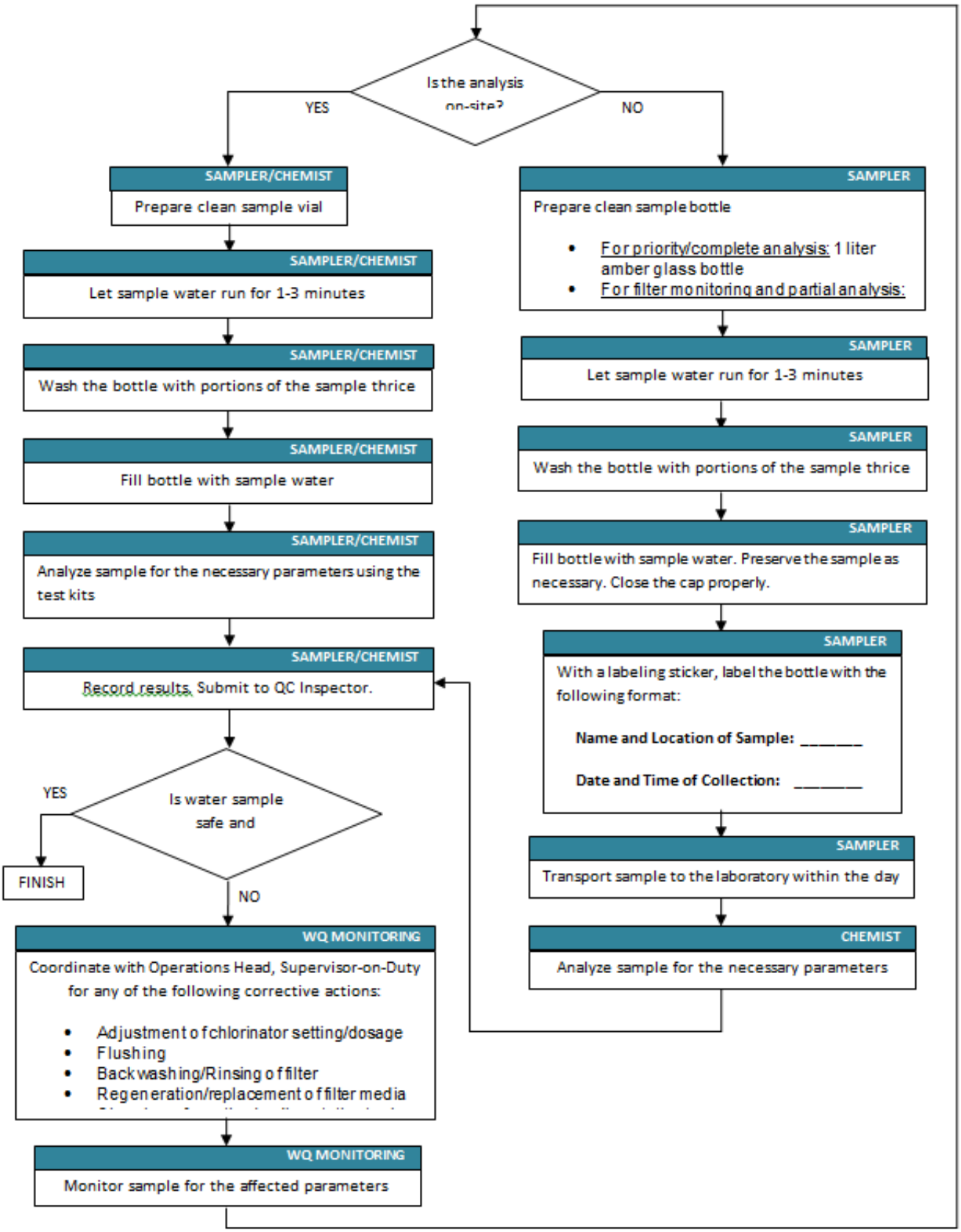
M. Mainline Repair Procedure
ACWD-ENG-MAINT-OP01



N. Microbiological Analysis Process Flow for Water Quality Monitoring
ACWD-PROD-LAB-FC01



O. Physical-Chemical Analysis Process Flow for Water Quality Monitoring
ACWD-PROD-LAB-FC02



Office Order

ANGELES CITY WATER DISTRICT
Pampang Road, Brgy. Lourdes Northwest, Angeles City
(045) 458-0384; (045) 458-0382; (045) 458-0372
(045)322-6422; (045)458-0371
Fax No.: (045)322-6926
E-mail address: angelescitywd@gmail.com
Website: http://www.angelescitywd.gov.ph/

OFFICE ORDER No. 3 Series of 2017
June 26, 2017

Subject: CREATION OF ACWD WATER SAFETY PLAN (WSP) TEAM

The following personnel of the Angeles City Water District will constitute the ACWD Water Safety Plan (WSP) Team, to wit:

1.	Edilberto B. Mallari	-Department Manager	- Assistant Team Leader
2.	Jesus C. David	-Sr. Water Utilities Mgmt. Officer	-Water Sources
3.	Alvin C. Mercado	-Water Maintenance Head	-Water Sources
4.	Delnar E. Sarmiento	-WaterUtilities Mgmt Officer A	-Water Sources
5.	Eugene C. Lopez	-Water Utlities Mgmt Officer B	-Water Sources
6.	Leonila B. Cabrera	-Sr. Quality Control Inspector	-Water Treatment/Monitoring
7.	Michaela B. Canlas	-Quality Control Inspector	-Water Treatment/Monitoring
8.	Oliver Jose Q. Panlilio	-Medical Technologist	-Water Treatment/Monitoring
9.	Marlon Depona	Chemist B	-Water Treatment/Monitoring
10.	Gerardo S. Nuqui	-Division Manager	-Distribution
11.	Diosdado Saylo	-Principal Engineer	-Distribution
12.	Julieta C. Cenzon	-Engineer B	-Distribution
13.	Robert Layson	-Supervising Engineer A	-Distribution
14.	Jordan Paul Gumba	-Engineer B	-Distribution
15.	Dante Tulawan	-Water Sewerage/Maintenance Man A	-Distribution
16.	Ailyn Cordero	-Division Manager A	-Customer Service
17.	Tracy T. Salunga	-Division Manager A	-Administrative
18.	Jelyn R. Rivera	-Sr. Corporate Accountant	-Finance
19.	Catherine Mabale	-Industrial Relations Management	-Secretariat

Approved by:

REYNALDO C. LIWANAG
General Manager

/ogm

Board Resolution

Republic of the Philippines
ANGELES CITY WATER DISTRICT
Pampang Road, Brgy. Lourdes Northwest, Angeles City
(045) 458-0372/458-0371; (045) 323-6422/322-6926
Fax No. (045) 888-1696
Website: www.acwaterdistrict.com

RESOLUTION OF THE ANGELES CITY WATER DISTRICT (ACWD) BOARD OF DIRECTORS ENJOINING ACWD TO ADOPT THE LOCAL WATER UTILITIES ADMINISTRATION (LWUA) MEMORANDUM CIRCULAR NO. 010-14 ISSUED ON DECEMBER 1, 2014 REQUIRING ALL WATER DISTRICTS (WD) AND RURAL WATERWORKS AND SANITATION ASSOCIATIONS (RWSA) TO DEVELOP AND IMPLEMENT THEIR RESPECTIVE WATER SAFETY PLAN (WSP) WHICH WILL FORM PART OF THE COMPONENTS IN EVALUATING WD's AND RSWA's PERFORMANCE

Resolution No. 21
Series of 2017

WHEREAS, the Department of Health (DOH) has issued on September 4 2014, Administrative Order (AO) 2014-0027 declaring the development and implementation of Water Safety Plan (WSP) by all drinking -water service providers as a national policy for drinking water quality management;

WHEREAS, in compliance to DOH AO 2014-0027 and LWUA MC No. 010-14, ACWD's WSP will cover and comprise the protection of the water sources, water treatment plants, pumps and reservoirs from risks that will endanger the quality of water being delivered to its concessionaires;

WHEREAS, the Management of ACWD will create a team who are experts in water quality monitoring to create and develop a Water Safety Plan.

WHEREAS, members of the WSP Team will come from the District's Operations and Technical Services Groups;

WHEREAS, the WSP team shall undergo rigorous training, workshops, and walkthroughs to identify and assess the hazards and risks that may jeopardize the quality of water being delivered to ACWD's concessionaires; and

WHEREAS, the WSP Team will conduct periodic meetings and consultations which will help them develop an appropriate Water Safety Plan.

NOW, THEREFORE, RESOLVE, as it is hereby *RESOLVED*, upon motion of Director Sambilay and duly seconded by Director Muñoz TO AUTHORIZE THE ACWD, THROUGH ITS GENERAL MANAGER, TO PURCHASE SERVICE VEHICLES FOR THE PERIOD 2017-2020

RESOLVED FURTHER, to furnish copy of this resolution to all others concern for their information and guidance.

Done in the City of Angeles this 19th day of June 2017 during the 11th Regular Meeting of the ACWD Board of Directors.

UNANIMOUSLY APPROVED.

BERNARDO P. CRUZ
Chairperson

HERNANDO S. ANGELES
Vice-Chairperson

MA. GRACELA G. MUÑOZ
Secretary

REFERENCES

ACWD Records, Angeles City Water District

Groundwater Databank Report, Local Water Utilities Administration

***Operation Manual,* Operation Division**, ACWD

Laboratory Quality Manual, ACWD Laboratory

Philippine National Standard for Drinking Water, Department of Health

Water Analysis Handbook, Hach

Water Safety Plan, Dasmarinas Water District

Water Safety Plan, World Health Organization

Water Safety Plan Manual**,** World Health Organization

Water Safety Plan, Maynilad Water

Water Safety Plans (WSP) *for Urban Piped Water Supplies in Developing Countries, Water*, Engineering and Development Centre

Standard Methods for Examination of Water and Wastewater, AWWA

Standard Operating Procedure for Bacteriological Testing, ACWD Laboratory

Standard Operating Procedure for Physical-Chemical Testing, ACWD Laboratory

Varian Atomic Absorption Spectrophotometer Manual, Varian