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HINATUAN WATER DISTRICT OPERATIONS MANUAL 2024

INTRODUCTION

This Operation Manual of Hinatuan Water District (HWD) contains general information about the agency, its function, mandates, and operating procedures and organization.

This manual is created to provide its readers knowledge about the water district's responsibilities and structures. Its purpose is to document the requisites to effectively manage and sustainably operate the water district. It covers the institutional and legal requirement of managing the water district, the demands of ensuring water safety, the nature and requirements of operating and maintaining the water distribution system, and its administration, commercial, financial and social aspects.

The manual is composed of several parts as follows:

General Information. Contains the brief history of HWD, mandates and functions, its mission and vision, and areas of operation.

Organization and Responsibilities. The organizational structure as of year 2024, as well as the duties and responsibilities of each section are shown.

Operational Control and Supervision. The powers of the authority are described in this part as well as the supervisory and operational controls.

Operating Procedures. Contains the step-by-step procedures and work instructions of HWD. Activity flow charts are used to illustrate the different processes involved in daily operations.

Hopefully, the Manual will be an aid in understanding the institutional, operational, financial, and management issues involved, and thus enable them to participate more effectively in advancing the objectives of the water sector.

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DEFINITION OF TERMS

- **Available Chlorine Content –** is amount of chlorine in a chlorine compound which determines its potential disinfecting power.
- **Chlorine Demand –** is the total amount of chlorine needed to oxidize all the materials in the water that react with chlorine within a given period. It is the difference between the amount of chlorine added to water and the amount of residual (remaining) chlorine at the end of a specific contact period. If no residual chlorine is detected, it means that the chlorine demand was so great it exhausted the chlorine; thus, the chlorine infused into the water (dosage) was insufficient.
- **Chlorine Residual –** is the total amount of chlorine (combined and free available chlorine) remaining in water at the end of a specific contact period following the infusion of chlorine for a continuing process of disinfection.
- **Chlorine Dosage –** is the quantity of chlorine applied to a specific quantity of water. It is expressed in milligrams per liter (mg/L) of chlorine.
- **De-Chlorination –** removes excessive levels of chlorine from the water. It commonly involves the use of an activated carbon filter to remove the odor, taste and other objectionable traces of excess chlorine in the water.
- **Dosage Rate –** is the amount of chlorine applied per unit time. It is usually in grams/day or kg/day.
- **Shock Chlorination –** dosage of 200 mg/L for 3-4 hours. Is recommended whenever a well, reservoir or pipeline is new, repaired or found to be contaminated.
- **Super Chlorination –** means applying chlorine at very much higher than the usual dosages. If a system design or requirements do not allow adequate contact time for the normal dosages of chlorine to eliminate the pathogens and undesirable substances in the water, super chlorination could be resorted to. It provides a chlorine residual of 3.0-5.0 mg/L, which is ten times the recommended minimum breakpoint chlorine concentration. Retention time is approximately five (5) minutes.

GENERAL INFORMATION

1.1 Profile

The **HINATUAN WATER DISTRICT (HWD)**, a government owned and controlled corporation, was created on September 6, 1980 by virtue of the Resolution No. 517 passed by the Sangguniang Bayan of Hinatuan. After complying with Local Water Utilities Administration (LWUA) minimum requirements. A conditional certificate of conformance (COC) No. 143 was awarded on November 6, 1980. The COC is the accreditation of LWUA for the newly built water district with specific standards under the authorization of Presidential Decree No. 198. The municipal government transferred the ownership and management of the whole existing water supply system to HWD.

HWD is classified as Category D water district per Local Water Utilities Administration's Certificate of Category issued on April 2, 2012 adopted by Board Resolution No. 06 series of 2012.

At present time HWD has 4,363 active service connections with fifty-one (51) hardworking employees, nine (9) regular employees, fourteen (14) casual employees, under the stewardship of Engr. Jose Hilario V. Pandili Jr. as General Manager. With the assistance and support of five (5) Board of Directors functioning as policy makers and with the cooperation of the staff, the Hinatuan Water District diligently and efficiently performs its mission to be of service to the people of Hinatuan.

1.2 Mandate

HWD is responsible for (a) acquiring, installing, improving, maintaining and operating water supply and distribution systems for domestic, industrial, municipal and agricultural uses for residents and lands within boundaries of such district, (b) providing, maintaining and operating wastewater collection, treatment and disposal facilities.

1.3 Mission

A water district that will strive to provide adequate, safe and potable water to ensure full satisfaction of customers, committed to uplift the standard of its employees adopting new technologies on water conservation and management while safeguarding the interest of our natural resources.

1.4 Vision

To be partner in the development and progress of the municipality in sustaining life thru excellent water service, ready to meet the challenges and demand of the future with utmost concern of our national resources.

1.5 Pumping Stations of Hinatuan Water District

1. PUMPING STATION 1
   Location: Purok 2, Bitoon, Hinatuan, Surigao del Sur

2. PUMPING STATION 2
   Location: Purok 1, Bitoon, Hinatuan, Surigao del Sur

3. PUMPING STATION 3
   Location: Purok 8 Banacod, Tidman, Hinatuan, Surigao del Sur

4. PUMPING STATION 4
   Location: Baribe, Bitoon, Hinatuan, Surigao del Sur

5. PUMPING STATION 5
   Location: Sitio Bingcongan, Hinatuan, Surigao del Sur

6. PUMPING STATION 6
   Location: Tiwi, Hinatuan, Surigao del Sur

7. TIWI PUMPING STATION
   Location: Tiwi, Hinatuan, Surigao del Sur
   (Turn-over by Barangay)

8. MAWIS PUMPING STATION
   Location: Mawis, Tidman, Hinatuan, Surigao del Sur
   (Turn-over by Barangay)

9. TARUSAN PUMPING STATION
   Location: Tarusan, Hinatuan, Surigao del Sur
   (Turn-over by Barangay)

10. ROXAS PUMPING STATION
    Location: Roxas, Hinatuan, Surigao del Sur
    (Turn-over by Barangay)

1.6 Areas of Operation

Barangays Served by Hinatuan Water District as of Year 2024

1. Aquino
2. Sto. Niño
3. Maharlika
4. Lacasa
5. Sasa
6. Bitoon
7. Roxas
8. Tiwi
9. Tarusan
10. Tidman
11. Bigaan (Sitio Bingcongan)
12. Caguyao, Bislig City
13. Dugmanon
14. San Juan

1.7 Administration

The most important factor for the success of a water district is the quality of the people who manage and operate it. They need to work within clear, supportive administrative system that channels their capabilities and enables them to fulfill their unique functions within the organization. Hinatuan Water District is composed of a Board of Directors, a General Manager and the staff. The Board establishes policies and regulations to carry out the business affairs of the water district while the management and operating staff, headed by the General Manager, handle the day-to-day operations.

1.7.1 The Board of Directors

All powers, privileges and duties of the district is exercised and performed by and through the Board. While all powers and authority of the water district are vested in its Board, its specific and proper functions are the following:

1. To enact policies and rules for the water district
2. To set the overall goals and objectives of the organization
3. To approve budgets, plans, major contracts, and undertakings
4. To evaluate the performance of the water district and its management

The Board should limit itself to fulfilling these functions, using Board Meetings as their venue. These meetings are recommended not to exceed two in a month. Holding meetings too frequently would force the management to spend an excessive amount of time on preparing for and attending them, thereby undermining management performance.

The transparency, improvement and systemization in governance are overseen by the Board of Directors. The BOD is the guardian of fairness, transparency and accountability in all major financial and business dealings of the WD in order to serve its mandate.

1.7.2 Management Functions

The General Manager, on the other hand, is responsible for the following functions:

1. Implementing the policies and rules set by the Board
2. Fulfilling the goals and objectives of the water district
3. Preparing the effective plans and recommendations for Board Approval
4. Making accurate and timely reports to keep the Board updated on the water district's performance in relation to fulfilling its goals and objectives.

Most of these functions he/she fulfills indirectly but through the management team and the operating staff. As such, leadership, decision-making, communication, staff development, and problem solving are the focus of his day-to-day activities. Being in-charge of the day-to-day operations of the water district, it is the manager's responsibility to ensure the success and sustainability of the public utility. While the Board may not interfere in the way the manager runs the operation, the Manager must answer to the Board for results.

1.7.3 Policy Formulation

A policy is a committed guideline. It is a principle that guides the performance of certain activities leading to the attainment of the water district's goals. It may be a broad statement of general guidelines, or a specific set of procedures detailing how certain tasks (e.g., handling of the Utility's funds) must be done. Whether they are broad or specific statements, policies are best communicated and implemented in written directives or resolutions. Written rules provide a ready reference for the management and staff, make it possible to ascertain whether they are being followed or not, and to hold the persons accountable. Verbal policies are not effective, as they have a way of being misinterpreted. As time passes, even the initiators themselves sometimes get lost as to their original intent or interpretation. In general, policies may be classified into three types as to their origin:

1. Originated Policy – This type of policy comes from the Board. It is designed to provide guidelines to management in the operation of the system.
2. Appealed Policy – This type of policy arises when problems of operation at the lower level cannot be properly or consistently handled. Management therefore "appeals" to the Board for guidelines.
3. Imposed Policy – This type of policy is set to comply with existing laws, government regulations, court rulings and the like. Social practices and public influence may result in imposed policies. Some of the important areas that should be covered by written water district policies are outlined below:

1.7.3.1 Important Policy Areas for Local Water Districts

1. **By Laws**. Establish internal guidelines for the Board itself: e.g., how often and where to meet, establishment of a quorum, board elections, etc.
2. **Utility Rules and Regulations.** Establish policies and procedures for dealing with the public.
3. **Personnel Rules/Regulations.** These policies seek to ensure proper code of conduct among the staff.
4. **Staffing Patterns/Remunerations.** Establish guidelines on the number and qualifications and remuneration of staff to be hired.
5. **Hiring.** These policies set the guidelines and checks on the hiring of new staff. As a rule, all requirements for additional staff must be cleared with the Board, usually through the proposed *plantilla* which, once approved can then be already implemented without further clearance. However, specific Board approval must be obtained before the actual appointment of higher-level staff. The policy must be in accordance with the existing rules and regulations issued by the Civil Service Commission (CSC).
6. **Tariff Formulation.** Establish guidelines on tariff formulation. Tariff strategy must enable the water district to operate sustainably and effectively in relation to its purpose of supplying water. It must consider the requirements to obtain approval from LWUA, and often, the measures needed to gain acceptance by the public.
7. **Budgets.** Establish guidelines on budget formulation, timetable and content.
8. **Delegation of Authority.** Establish guidelines on what decisions are to be delegated and to whom,

Example: Delegated Check Signatories: "In the absence of the General Manager, the joint signatories shall be the Cashier and the Officer-in-Charge"

9. **Matters Requiring Board Action.** Establish guidelines on what need to be submitted for Board clearance before management can act on it.
10. **New Connections and Disconnections.** Establish guidelines on the requirements for new connections, how much to be charged as well as when to disconnect.

    Example: Connection Policy: All connection costs are to be borne by the customer. This is translated in the connection rules/regulations and amount of connection fees.
11. **Delinquent Accounts.** Set Guidelines for handling delinquent accounts, including when a delinquent account is to written off as bad debts. It is futile to maintain long standing debts as active as they will only distort the financial figures. However, records should still be kept and diligent attempts made to collect these accounts as if they were not written off.
12. **Dealing with Illegal Connections.** The penalty should include penal and financial impositions based on provisions of prevailing laws.
13. **Goal Setting.** Normally, these establish annual and intermediate goals (e.g., semi-annual, quarterly) for the water district. Goals can be set based on the number of people to be served or number of connections.
14. **Performance Standard.** The Board should define performance standards that management should attain, and monitor results against these standards on a quarterly basis.
15. **Funding Sources.** Board policies should be established on where to get funds for meter replacement or expansion projects or emergency repairs.

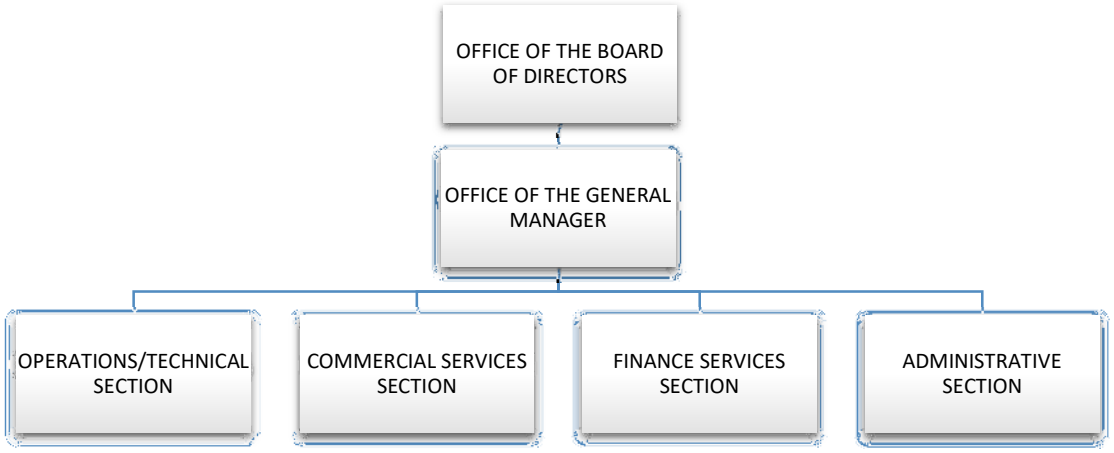
1.7.3.2 Policy Review

In any progressive undertaking, policies need to evolve in response to changing condition and needs. Thus, aside from periodic reviews to evaluate how effectively established policies contribute to the achievement goals, there may be changes in national policies, laws and ordinances, as well as in economic conditions, that may dictate the adjustment, amendment or formulation of new policies.

In reviewing a policy, the first step is to consider the spirit, intent, wisdom and fairness of a policy, and then its relevance. The way the policy is being implemented should also be reviewed. The intention of even the best-conceived policy may be negated due to the manner in which it is implemented. The Board should not hesitate to review, restate, amend or even reverse existing policies if it believes that by doing so, the best interest of the water district and the public will be served.

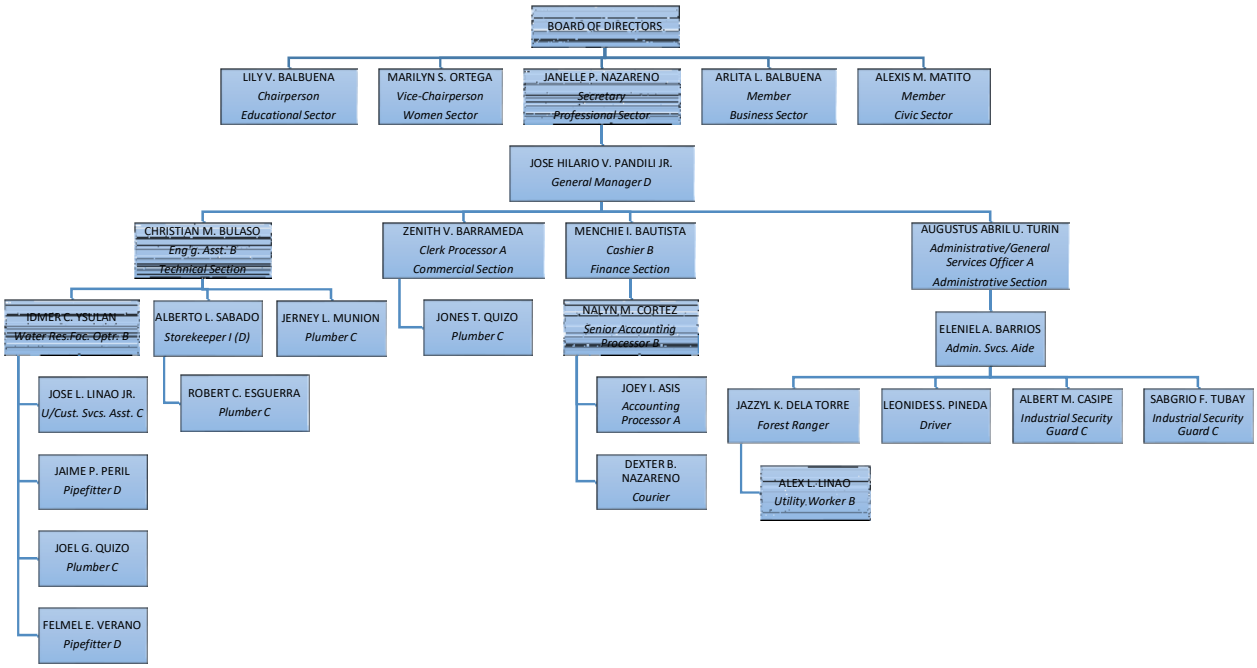
ORGANIZATION AND RESPONSIBILITIES

Hinatuan Water District is a Category D Water District based on the Revised Local District Manual on Categorization, Re-Categorization and Other Related Matters (LWD-MaCRO). It has a lean structure consisting of four (4) sections – Administrative Section, Finance Services Section, Commercial Services Section, and Operations/Technical Section. The Section Heads directly report to the General Manager who is primarily responsible for the management and performance of the district, and who in turn reports to the Board of Directors, the policy-making body of the water district.



A. *Operations/Technical Section* – is responsible for the management of the water systems maintenance operations, management of production and water distribution operations, and monitors the water quality.
B. *Commercial Services Section* – provides customer services to the concessionaire. Responsible for meter reading, billing and collection of water sales, monitoring of customer accounts, attending customer service requests and complaints, responsible for the marketing strategies/program implementation and public information, and in-charge of inspection and investigation regarding water connection.
C. *Finance Services Section* – is responsible for the recording and summarizing of financial transactions, preparation of financial reports and inventory management. Also responsible for the budget preparation and assist in allocation and distribution of budgets as well as monitoring the budget performance.
D. *Administrative Section* – is responsible for general service, and collection and disbursement of funds. In charge of procurement, assist in the implementation of special projects program. Also responsible for the recruitment and retention of highly qualified employees for the agency.

2.1 Hinatuan Water District Organizational Chart



OPERATIONAL CONTROL AND SUPERVISION

Technical Section:

- Plan and design mainline extension, improvement of HWD water system and other pumping facilities.
- Implement Program of Works for the extension, expansion and improvement of the water supply system.
- Undertake repair and maintenance of transmission and distribution pipelines including its appurtenances.
- Plan, design and implement programs of works for extension and improvement of office structures/facilities and civil works.
- Initiate programs on reduction of Non-Revenue Water (NRW).
- Determine water production requirements and ensure the steady supply of the water to the service area.
- Maintain water pumps and water treatment facilities.
- Monitor water system pressure, pumping water level and water quality in accordance with the standards set by the 2017 Philippine National Standards for Drinking Water (PNSDW 2017) and the World Health Organization (WHO).
- Conduct preventive maintenance and repairs of equipment and facilities, testing for newly purchased pump and motors for quality control acceptance and efficiency rating check-up.
- Flushing of Mains.

Commercial Section:

- Install service connection and undertake repair and maintenance of the same.
- Receive and process service application and attend to customer/concessionaire complaints and requests.
- Identify service expansion areas; Conduct marketing surveys and formulate program on concessionaire relations.
- Investigate illegal or unauthorized connections, and coordinate with Legal Counsel in the prosecution of offenders.
- Enforce disconnection of delinquent accounts.
- Recommend policies/procedure that will improve customer satisfaction.
- Ensure accurate meter reading and generates periodic billing of accounts.
- Follow-up all delinquent accounts and enhance collection efficiency.
- Maintain accurate and up-to-date concessionaire records. Provide accurate management of concessionaire accounts.
- Enforce utility rules and regulations as to billings, delinquencies and adjustments.
- Undertake calibration and maintenance of water meters.

Finance Services Section:

- Monitor budget utilization and recommend for budget supplemental and its revision.
- Prepare periodic financial reports and other reports required by management
- Responsible of the safekeeping of all book of accounts, financial records, and other financial instruments.
- Determine financial resources available to carry out water district programs
- Implement procedures and policies on cash management particularly on safekeeping, disbursements, and control of water district funds.
- Implement procedure and policies on collection of water bills, cash funds, income and deposit the same in authorized depository banks.
- Initiate financial planning on long-term basis.
- Ensure compliance to existing accounting rules and regulations issued by regulatory agencies such as COA and DBM.

Administrative Services Section:

- Implement procedures on procurement of adequate supply of materials, equipment and services.
- Implement procedures on warehousing and maintenance of materials, supplies, vehicles and equipment in accordance with the regulations, policies and pertinent provisions governing such matters as required by the Commission on Audit.
- Formulate, recommend for approval and implement policies related to security measures of building, grounds and people in the organization.
- Formulate and implement human resource programs, policies and procedures pursuant to Civil Service laws and rules.
- Formulate programs to assess and improve employee competencies.
- Responsible of the safekeeping of titles, loan documents, etc.
- Initiate programs for the protection and development of water resources and watershed.

3.1 Staff Training

Government agencies like the LWUA, DBM, COA, CSC, NWRB and even some local water districts and NGOs provide training and institutional development programs to assist water utilities. This is essential to ensure that the staff running and working the organization is adeptly equipped with the necessary skills for the position they are holding.

3.2 General Principles

Hinatuan Water District is guided by these principles in its day-to-day operations:

1. *Delivering Water Service 24/7*

   HWD aims to ensure reliable and continuous service even during emergencies. Pump Stations are provided with stand-by generator set to deliver water service to concessionaires despite power outage.

2. *Importance of Collection Efficiency*

   Cash inflows are essential to enable the water utility to operate in a reliable and predictable manner. Thus, tariff levels are generally set to cover normal operations and maintenance costs, as well as to provide surplus funds to cover emergency requirements. However, regardless of how well designed the tariff structure may be, if bills are not collected, or are not collected on time, the water district will experience cash shortages that could compromise service levels. To facilitate collection, the service area is divided into different zones and each zone is assigned with different due dates. Imposing surcharges is one of HWD's ways to discourage delayed payments.

3. *Preserving the Health of the Community*

   The sole product of the water district is water and it is imperative for this product to meet the specified standards of the PNSDW. As a minimum, the water district should have a sample tested in an accredited DOH laboratory for bacteriological presence at least once a month. Should a sample test positive for coli forms, a resampling should be done immediately, while the water district should simultaneously search for the possible source of contamination. A second positive test will subject to suspension of operations (or advise all concessionaire to boil their drinking water) until the problem is solved.

4. *Reducing Non-Revenue Water (NRW)*

   Non-revenue water (NRW) represents water that is produced but does not bring revenues for the water district. It is the sum of the water lost to physical leaks, illegal connections, unauthorized withdrawals, unmetered connections and metering errors.

   For a new system, the NRW should be kept to less than 10%. For older systems with NRW greater than 25%, the water district should bring the NRW down to 20% or below. However, the cost of the efforts to reduce NRW is limited and guided by the principle: "Not spending ₱2 in order to earn ₱1".

3.3 Audits

Audits can be performed on an in-house basis or by outside experts. It can address various aspects of a utility's operations. The results can serve as a guide for improvement strategies. The Commission on Audit (COA) performs annual financial audit of the local water district.

The common scope and purpose of audits for water utility are:

1. Technical Audit – a review of a water district's technical operations (water sources, treatment plants, pumping, storage, distribution, fire protection);
2. Financial Audit – a review of a water district's financial condition;
3. Management Audit – a review of utility management's practices (industrial practices, customer service, billing, metering, regulatory compliance);
4. Operations Audit – a comprehensive audit involving all operational aspects.

3.4 Business Planning

A 3 to 5-year Business Plan for the water district to meet present and future water demands or for water districts planning to expand its services. It serves to provide direction and track the progress of the undertaking. If the expansion program requires outside funding, a BOD approved business plan can be a requirement for loan application.

Business plans are prepared for different purposes. Typical uses and their specific requirements are as follows:

A. Borrowing

A summary page will have to be included detailing the specific request as well as the collaterals that can be offered. These can be in the form of assets, locked-in deposits and the likes. A feasibility study will likewise be required by the lender to determine project viability.

B. Budget Approval

After the Board has approved the 5-year plan, management must provide a detailed cash flow for the year in review. Attached to this will be the details or schedule for each account. If there are changes in the organizational structure or staffing requirements, the new organizational chart and related information must be provided for Board approval.

C. Tariff Adjustment Approval

For the required tariff approval from LWUA, some specific documents may be necessary to indicate compliance with legal requirements. Among these are the Proof of Posting and Minutes of the Public Hearing conducted for the purpose of any tariff adjustment.

3.4.1 Contents of Business Plan

Basically, the business plan for a water utility will address the following major issues:

A. How many more stand posts or private connections will the utility add over the planning period;
B. Where will it get its water supply?
C. What are the additional facilities required;
D. How much investments will be needed to support the expansion process;
E. How the undertaking will be funded;
F. What would be the projected operational cost; and
G. What would be the water tariff that would enable the water district to operate and at the same time recover the investments and or pay off any borrowings?

Annex A lists the basic contents of a business plan.

3.5 Responsibility of the Water Utility

The water utility has an awesome responsibility in its job of furnishing potable water to a trusting public. It has the power to prevent – or cause – sickness and death from water borne disease or poisonous pollutants.

A. Purity

Most people are unaware of, or unconcerned about the degree to which their well-being is in the hands of the employees of the water utility. It should not be forgotten, for even a moment, which the first responsibility of every employee of the water utility is to do his part to ensure that only SAFE POTABLE WATER will be provided to the public.

B. Reliability

There are many reasons for the importance of reliability of supply – mostly concerned with public relations – but the main one is related to water safety.

C. Water Costs

Most people expect water to be cheap; probably because it is so plentiful in nature. For that reason, the public will not usually tolerate high water rates. In general, consumers consider the water as a natural, God-given product, when in reality, the cost is based on service performed by the water utility wherein the water is *collected, treated* as necessary to guarantee potability, and *delivered* to the consumer's premises.

In any case, it is the responsibility of the utility to furnish water at the lowest cost possible without relaxing its standards of potability and reliability.

D. Planning for the Future

The utility management must anticipate population growth and changing water consumption habits, and make provisions for orderly expansion of its facilities in advance of critical needs. The long-range plan must be flexible enough to provide for unexpected development, yet as accurate as possible so that financing can be arranged in advance of need.

3.6 Population and Water Needs

All long-range plans for water supply expansion are based on estimates of future water needs. These, in turn, are dependent on estimates of future population growth. Also, the locations of planned future pipelines, reservoirs and pumping stations are based on expected *land use*, or how the cities/municipalities will spread out as population grows.

A. Population Growth

The usual approach in estimating future population is to plot a curve of past population figures; then extend the curve into the future.

B. Land Use

In long-range water supply planning, it is necessary not only to estimate future populations, but to try to foresee how land will be used. This land will determine the location of future pipelines, reservoirs and pump stations.

The usual approach to projecting land use begins with a map showing present land use patterns. The total number of hectares of each type of land use are calculated on the basis of population estimates; then outlined on a land use map.

C. Water Demands

The amount of water required each year by a person, a commercial establishment, a government office, or an industrial concern is fairly easy to estimate, given sufficient information on types of housing, daily habits of people (i.e., working hours, sleep, washing, shopping, etc.), and types of industries. The total of all water requirements for one year is known as Gross Annual Demand, or sometimes simply *Gross Demand.*

1. Demand Fluctuations

Unfortunately, Gross Demand is not evenly spread out during the year. Water uses fluctuates from day-to-day and hour-to-hour, depending on weather conditions, degree of industrialization, seasonal changes, water use habits, and other factors peculiar to the area and the system under consideration. In the Philippines, the maximum amount of water required in a single day (Maximum Day Demand) is about 125% of the average daily

demand, while the most required in a single hour (Peak Hour Demand) is about 200% of the average.

2. **Unaccounted-for-water**

   Every water distribution system supplies a quantity of water that cannot be accounted for through meter records. This includes water lost through leakage, evaporation from reservoir surfaces, firefighting, illegal connections, and the like.

   A distribution system that is in good condition, with no excessive operational waste (such as overflowing of reservoirs, open hydrants and the like) or "administrative losses" (illegal connections, accounting errors, etc.), will experience unaccounted-for-water demand amounting to no more than perhaps 10 percent of total water production. Poorly managed water systems often experience losses of up to 50 percent of production.

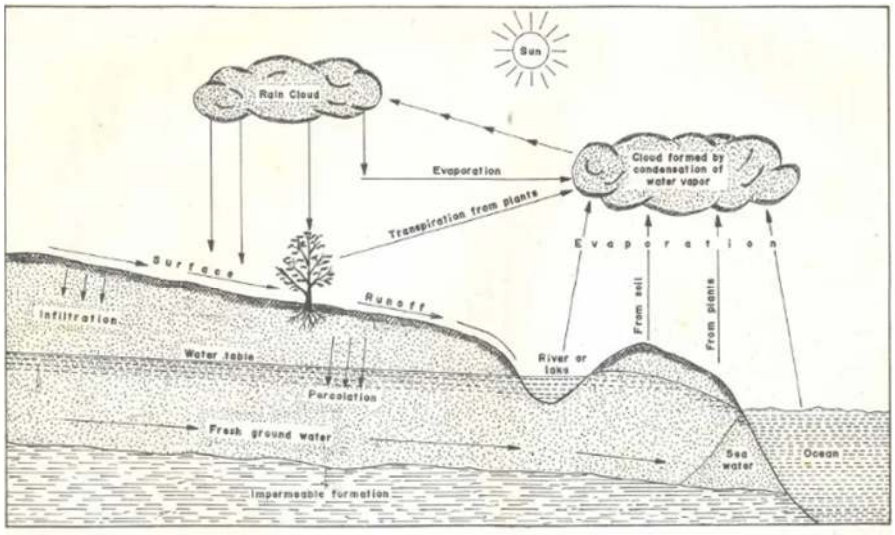
3. **Fire Flows**

   Excess capacity is often provided in pumps, reservoirs and pipelines to allow for firefighting. In addition, fire hydrants are installed at intervals on the distribution network.

   The spacing of hydrants and excess delivery capacity are determined partly by the value of building in the area. Also, the nature of demand fluctuations is an important factor.

3.7 Water Sources

The total amount of water in and around the earth is constant. Water is neither manufactured nor destroyed, but is constantly recycled by nature. The cycle that it endlessly goes through is called the hydrologic cycle.



THE HYDROLOGIC CYCLE

Water vapor is continually added to the atmosphere by evaporation from the seas, lakes, and other water surfaces. Vegetation draws water from the group, extracts nutrients from it, converts it to vapor and releases it to the atmosphere from leaf surfaces (*transpiration*). As water vapor moves upward to cooler levels in the atmosphere, it condenses to form clouds. Sooner or later, particles of dust in the atmosphere attract water vapor until they become too heavy to remain suspended in the air, and fall to earth as rain, snow, hail or sleet. As the rain fall through lower levels of atmosphere, a small amount evaporates before hitting the ground. Rain which falls on the earth, does one of three things: (1) soaks into the earth (*percolation*), (2) runs off into rivers, lakes or seas (*runoff)* or (3) evaporates from the earth's surface.

A. Ground Water

The term *ground water* refers to the water that is stored (or is moving) beneath the earth's surface. Most ground water is stored in underground layers of sand and gravel, or in the cracks and crevices of certain types of rocks (for example, limestone and sandstone). When an underground layer of sand or fractured rock contains water, that layer is called an *aquifer*.

Ground water may be *free* or *confined*. *Free* ground water refers to the condition where a layer of water bearing sand, or aquifer, extends downward from just below the topsoil. *Confined* ground water occurs when water bearing sand lies below an impervious layer of clay, shale or rock. When a well is drilled into a confined aquifer, the water level inside the well might be higher than the top of the aquifer, and may even flow over the top of the well casing (i.e., a *flowing well*).

Since ground water generally travels great distances through sand from the point where it falls on the ground as rain, until it is intercepted by a well, it is naturally filtered. In general, by the time water percolates downward for ten or fifteen meters below the ground surface, most *microbes* (bacteria, virus, etc.) are filtered out. For that reason, deep wells are usually constructed with the upper 15 meters sealed off to exclude shallow water and surface water,

B. Surface Water

Approximately ¾ of the world's population relies on surface water sources such as rivers, lakes and man-made impounding reservoirs to meet their water needs. Since surface water resources rely almost entirely on rainfall for replenishment, the amount of water available is sometimes at a minimum during hot, dry months, when public demand for water is greatest. For that reason, collection, treatment, storage and distribution facilities must be designed on the basis of dry weather conditions.

C. Other Sources

One source of water that may be become valuable in the future us de-salted sea water (*de-salinization*). This source is being used to a limited extent in some areas

where no other alternatives exist. Obtaining water by this method is extremely expensive (perhaps 50 times the cost of treating surface water).

The other potential source of water is *reclamation* of waste water. Although it is now possible to treat sewage to the extent that it would be entirely safe and undistinguishable in taste from other treated water, this is not generally accepted to the public. Nonetheless, reclaimed water is presently supplementing water supplies in many areas of the world in an indirect way. If reclaimed water is used in manufacturing and agriculture, the potable water that would be otherwise be used for these purposes is released for *domestic use.*

3.8 Metering of Water Production and Consumption

Usually, the water utility has only one source of funds: the revenues it collects from its customers as payment for water consumed. These revenues must be sufficient to pay all the utility's expenses, including:

- Annual payments on loans previously taken out to finance new construction.
- Costs of replacing worn out or damaged equipment.
- Costs of materials, tools and services required for operation and maintenance of the water system, such as electric power, fuels, spare parts, lubricant, etc.
- Administrative costs such as employee's salaries, rent, office supplies, outside services, and the like.

If the utility is to remain solvent financially, it must maintain accurate records of operating costs, water production and customer consumption, in order to ensure that water rates are always adequate to meet all costs.

Water meters enable the utility to precisely determine water production and consumption. Water production is monitored by *bulk metering* through main-line meters installed on the discharge piping of each well, spring, treatment plant, or pumping stations. Consumption is determined by adding up water used by all utility's customers, from records of monthly *service meter* readings.

Water meters on concessionaires are replaced after five (5) years of utilization and is tested for accuracy.

3.9 Record Keeping

With a good system of records and efficient operations, a water utility can:

- Anticipate replacement of facilities long in advance, allowing ample time for planning and budgeting.
- Ensure uniformity of service, operation and maintenance.
- Control unaccounted-for-water.
- Closely predict future needs of spare parts, fuels, lubricants, chemicals and the like, so that they can be budgeted in advance.

- Evaluate performance of equipment of various manufacturers or designs when undertaking purchase of replacements.
- Adjust operation and maintenance procedures and schedules based on observed realistic needs.
- Set water rates that are neither too high nor too low, based on trends in administrative, operational and maintenance costs.
- Provide, on short notice, any statistical information required by its governing board.

A. Accounting Records

Accounting Records should contain all information on revenues and costs, broken down in such detail that any operation of the utility can be quickly analyzed economically.

B. Water Consumption Records

Water Production Records, including daily water production quantities, electrical power used, fuel used, chemical quantities used, in-plant water used, if any, and water quantities delivered to distribution system, etc. are maintained by operators.

The operators also record comments concerning any out-of-ordinary operating conditions and the performance of periodically scheduled functions such as pump tests, measuring drawdown of wells, cleaning of basins and storage facilities, accidents, etc.

A daily, monthly, semi-annual, and annual summary taken from the operator's log is submitted by the Production Supervisor or Chief Operator and is filed as a part of the permanent records in the utility office.

Each month, total consumption is compiled from meter reader books, and shown on the Monthly Consumption Summary which is filed in its own folder in the utility office.

C. Operation and Maintenance Records

The operation should provide checklists of scheduled preventive maintenance measures. The operator should check off each item as it is performed on a given item of equipment. When completed, it should be placed in the utility's files where it will become part of the permanent O & M history of the equipment.

D. Water Quality Records

A utility must set up a program of systematically monitoring the chemical and biological quality of water served to other public. Reports should be prepared on each water sample analyzed, and these filed in their own file.

3.10 Water Quality and Public Health

The first and foremost responsibility of the water utility is to provide its customers with safe potable water. This means that the water must not contain anything that is harmful to the health of the public and must be free of any unpleasant taste, odor or color.

The extent to which a given water contains objectionable or harmful ingredients is known as *water quality*. For convenience, water quality is broken down into three categories:

1. Chemical Quality (minerals, gases, acidity)
2. Physical Quality (taste, odor, color, temperature)
3. Biological Quality (usually called Bacteriological quality even though it covers not only bacteria, but all types of microorganisms.

From a quality standpoint, water falls into the following classifications:

1. Pure – this is not normally found in nature. Due to the absence of normal dissolved material, this water would not be satisfying to drink.
2. Wholesome – this is the most desirable quality level.
3. Potable – this would be suitable for drinking even if there may be one or more aspects of the water that is undesirable.
4. Polluted – this water has received substances in sufficient quantities to render it objectionable for use, such as a taste or odor, or color, but it would not necessarily constitute a health hazard.
5. Contaminated – this water has been adulterated by the introduction of toxic substances, bacteria, or other harmful agents that make it hazardous and unfit for human consumption.

3.10.1 Chemical and Physical Quality

Water may contain minerals that are poisonous to humans even when present in minute quantities, such as arsenic, lead, and chromium. Fortunately, these toxic minerals are rarely found in water in quantities great enough to be hazardous, except in the event of an industrial accident whereby large quantities of a toxic substance is "spilled" into a stream or lake which is used as a water supply. When larger than minute amounts are found, the source should be discovered and eliminated. If a given water supply cannot be protected and treated to maintain acceptable dissolved mineral concentrations as delineated by public health standards, it should be abandoned.

Other objectionable quality characteristics sometimes found in water include the following:

- Excessive iron and/or manganese (stains clothing, porcelain, equipment, etc., imparts a musty metallic taste to the water)
- Hydrogen Sulfide (rotten egg taste and odor)
- Alkalinity (scale deposits in piping and cooking utensils)
- Acidity (corrosive to metal)

- Hardness (excessive soap needed for washing and scale deposits in piping, and cooking utensils)
- Chlorides (salty taste)
- Magnesium (laxative effect)
- Nitrates (laxative effect)

Various ways of measuring chemical and physical characteristics have become widely used.

- *Minerals and Gases.* Where the constituents if water can be extracted and weighed, they are measured in milligrams per liter of water (mg/L) or parts per million parts of water by weight (ppm). These units are the same.
- *Turbidity.* Turbidity is measured by the degree to which the water scatters or diffuses light.
- *Color.* Color in water may result from the presence of natural metallic ions (iron and/or manganese, humus, and peat materials, plankton, weeds and industrial wastes). Color is determined by visual comparisons of the sample with known concentrations of colored solutions or standard color glass discs, which have been calibrated against a platinum-cobalt standard solution.
- *Odor.* Odor of water is measured in *Threshold Odor Units.* This is the number of times that a sample of water is repeatedly diluted with an equal amount of odor-free water before odor is no longer detectable.
- *Acidity and Alkalinity.* Water is classified as *acid, neutral,* or *alkaline* depending on its *pH number* on a scale of 0-14 (this is related to the concentration of hydrogen ions in the water). If the pH is about 7.0, the water is neutral; if below 7.0, it is acidic; if above 7.0, it is alkaline or basic. In addition, alkalinity is sometimes expressed as an equivalent concentration of calcium carbonate in mg/L.

3.10.2 Pollution and Contamination

The term pollution is used when any undesirable substance – not necessarily harmful – are added to water. *Contamination* is the introduction of harmful chemicals or microorganisms. Therefore, pollution of water can take place without contaminating it (though, in fact, that is almost never true).

There are many types of small organisms in water. Most of them are harmless and of no interest to the water utility operator., while other types indicate that water is polluted but are, in themselves are harmless; and some, a very few types, cause disease. Still others, while harmless, create operational problems or impart tastes, odors or color to water.

The following types of microbes are known, or strongly believed, to spread disease through contaminated water supplies:

A. Viruses
    - Poliomyelitis
    - Infectious Hepatitis

B. Bacteria
    - Typhoid Fever
    - Bacillary Dysentery
    - Gastroenteritis
    - Cholera
C. Protozoa
    - Amoebic Dysentery
    - Schistosomiasis

The following types of organisms are not known to cause disease but are a nuisance to the water quality.

- Algae (Tastes and Odors)
- Fungi (Tastes and Odors)
- Actinomycetes (Taste and Odors)
- Water worms (Harmless but cause customer complaints)
- Leptothrix and Crenothrix (Oxidize iron, manganese or aluminum; causing color, taste, odor and sometimes, clogging problems.

It is impossible to determine whether a given disease-causing organism exists in water because they are so few in number. However, it is possible to detect the presence of harmless bacteria (E. coli) known to live in the intestine of human and animals. Therefore, if these are present in water, it must be assumed that disease-causing organisms are also present.

If samples of water are collected and sent to a sanitary laboratory, it is possible to not only detect the presence of intestinal bacteria but also to estimate their numbers.

Obviously, the greater the number of intestinal bacteria in water, the greater the chance that they will include disease-causing organisms.

3.10.3 Cross Connections

The term cross connection describes a situation where pollutants may accidentally flow into a piped water system. The most dramatic – but fortunately rare – type of cross connection is the accidental connection of a water main to a pipeline carrying some other liquids (such as sewage, cooking gas or petroleum and other types of fluids). Most cross connections only function when the water main pressure is low. For example, if a water main is undersized and any large draft occurs (say, an open fire hydrant, a major pipeline break or high-water demand), pressure in the main drops enough to create a vacuum at or above ground level. Then, wherever a cross connection exists, polluted water will be sucked into water main.

A backflow prevention device should be installed on the service connection. Such devices usually consist of two check valves om series, with a vacuum breaker between them.

3.10.4 Water Quality Sampling

A water sample must be truly representative of the water to be tested. Therefore, the frequency and location of sampling is very important. Sample collecting techniques may vary, depending on the kind of test to be made. A carelessly collected sample can make the highest quality water, or the best of treatment processes appear bad.

In general, samples for analysis of chemical and physical quality are collected at the water source and immediately following any treatment facilities.

Samples for bacteriological testing are taken at widespread, scattered points in the distribution network and at reservoirs. It is also a good idea to collect samples at surface water sources in order to detect any massive new contamination upstream.

The Philippine National Standards for Drinking Water of 2017 (Administrative Order 2017-0010) include certain minimum standards for water quality, and frequently of water sampling of potable water supplies.

If a *Routine Sample* shows an excessive number of microorganisms, another sample (*Recheck Sample*) should be taken from the same location, after determining and correcting the cause if possible.

In addition to the routine and recheck samples, which are reported to LWUA, the utility may collect samples for its own use (*Information Sample*).

Sample bottle labels should clearly indicate the reason the sample is taken: “Routine”, “Recheck” or “Informational.” Process control samples should be collected and analyzed daily or more frequently if water is subject to rapid quality changes. Specific analysis to be made depend on treatment process being used.

It is suggested that informational samples for Chemical and Physical Quality testing be taken every three months at all surface water sources and immediately downstream of treatment facilities. Where no treatment is provided, as in the case of well supplies, samples should be collected annually at the pump discharge or spring collection works.

3.10.4.1 Sampling Techniques

A. Chemical and Physical Quality Sampling

   The bottles should have been cleaned in the laboratory with appropriate cleaning solutions and rinsed with distilled water. Only when a clean bottle is not available should rinsing on the field be necessary.

   The sample bottle should be completely filled when it is being collected for chemical and physical analysis. Send sample to laboratory within 24 hours.

B. Bacteriological Quality Sampling

Water samples for bacterial analysis should be collected only in the special sterilized bottles prepared and provided by the laboratory. Extreme care must be exercised to avoid contaminating the sample by any bacteria on the hands, clothing or tap. Chlorine residual must be determined.

Take sample to laboratory within 2 hours, if possible. In no case should a sample be more than 4 hours old when reaching the laboratory. If travel distance to the laboratory will not permit sample to be delivered in less than 4 hours, keep packed in ice until delivered to laboratory. Samples should be in laboratory within 24 hours under any circumstances.

3.10.5 Disinfection

Disinfection is necessary to ensure that drinking water is free from disease-causing microorganisms. Water disinfection means the removal, deactivation or killing of pathogenic microorganisms.

3.10.5.1 Chlorine Disinfection

Chlorination is the process of adding chlorine to water to make it safe for human consumption as drinking water. Chlorine (and its compounds) is the most widely used disinfectant for water systems because of its effectiveness, cheap cost and availability.

3.10.5.2 Determinants of Chlorine Effectiveness

1. *Contact Time (CT and Dosage)* – refers to period of time allowed for the disinfectant to react with the microorganism that may be in the water. Dosage refers to the amount of chlorine infused in relation to the volume of the water being treated.
2. *Type of Microorganism* – Chlorine is quite effective in destroying the most significant pathogenic organisms that are dangerous to humans and are commonly borne in water. Different pathogens and parasites, however, have different levels of resistance to it. Thus, the dosages, the CT, and other conditions of the water that intensify or inhibit the oxidizing action of chlorine such as temperature and pH (acidity or alkalinity) need to be considered in order to be sure that the harmful organisms and undesirable substances are eliminated.
3. *Characteristics of the Water Source* – The nature of the water that requires treatment influences the disinfection. Materials in the water like iron, manganese, hydrogen sulfide and nitrates often react with disinfectants, effectively increasing the chlorine demand. Turbidity of the water also reduces the effectiveness of disinfection. Usually, the tests on the water from a new source are the basis for prescribing the dosage and CT needed to eliminate the harmful and undesirable substances. Additional tests on the water at source need to be conducted when there are indications that the water source characteristics have changed. The possibility of contaminants (whether pathogens or

minerals that change its acidity or turbidity) in the path of water or reservoir need to be checked.

4. *Temperature of Water* – Higher temperatures usually increase the speed of reactions and of disinfection.

3.10.5.3 Compounds Used in Disinfection

1. *Chlorine* – is a poisonous yellow-green gas with a penetrating pungent odor. It is extracted from chlorides through oxidation and electrolysis. In water, chloride (chlorine compounds) hydrolyzes to form hypochlorous acid and the hypochlorite ion (free available residual chlorine), which is toxic to bacteria.
2. *Bleaching Powder or Chloride of Lime* – bleaching powder or calcium hypochlorite is a yellow white solid which has a strong smell of chlorine. It is not highly soluble in water, and is preferably used in soft to medium-hard water. Bleaching powder loses strength rapidly whenever it is exposed to moist air so that it should be kept in closed containers.
3. *High Test Hypochlorite (HTH)* – It is a more stable and stronger compound than bleaching powder.
4. *Sodium Hypochlorite (NaOCl)* – This is highly corrosive, slightly yellow liquid. It is used extensively in many industries as a disinfectant, deodorizer, bleach, and to neutralize certain undesirable chemicals and compounds used or formed in production processes. For households, it is supplied as the common household bleach.

HWD uses hypochlorination or injecting of chlorine solution into the water by using Gas Chlorine and Chlorine Dioxide.

3.10.5.4 Chlorine Dosage and Demand

There are two (2) ways of determining the chlorine dosage:

Method 1:

1. Dose the water supply with an arbitrary amount, say 1 mg/L.
2. Wait for 30 minutes and measure the chlorine residual.
3. If residual is zero or less than 0.2 mg/L, increase the dosage until the right residual is obtained.
4. If residual is more than 0.5 mg/L, then the dosage can be reduced.

Method 2:

1. Prepare a 1% chlorine solution (10 grams active chlorine per liter of water). The quantity depends upon type of chlorine using the table below:

Material	Available Chlorine	Quantity to Make 1 Liter of Solution
Chlorine Gas	100%	-
Calcium Hypochlorite	70-74%	14 grams

Bleaching Powder	34-37%	30 grams
Sodium Hypochlorite (HTH)	12-15%	80 grams

2. Take 3 or 4 non-metallic containers of known volume (e.g., 20 liters bucket).
3. Fill the containers with some of the water to be treated and check the pH of the water.
4. Add to each bucket a progressively greater dose of 1% solution with a measuring device.
    - 1st container: 1 ml
    - 2nd container: 1.5 ml
    - 3rd container: 2 ml
    - 4th container: 2.5 ml
5. Wait 30 minutes. (This is essential as this is the minimum contact time for the chlorine to react. If the pH of the water is high, this minimum time will increase).
6. Measure the free chlorine residual in each bucket.
7. Choose the sample which shows a free residual chlorine level between 0.2 mg/L and 0.5 mg/L.
8. Extrapolate the 1% dose to the volume of water to be treated.
9. Check chlorine demand at several water distribution points and adjust if required.

3.10.5.4.1 Chlorine Dosages

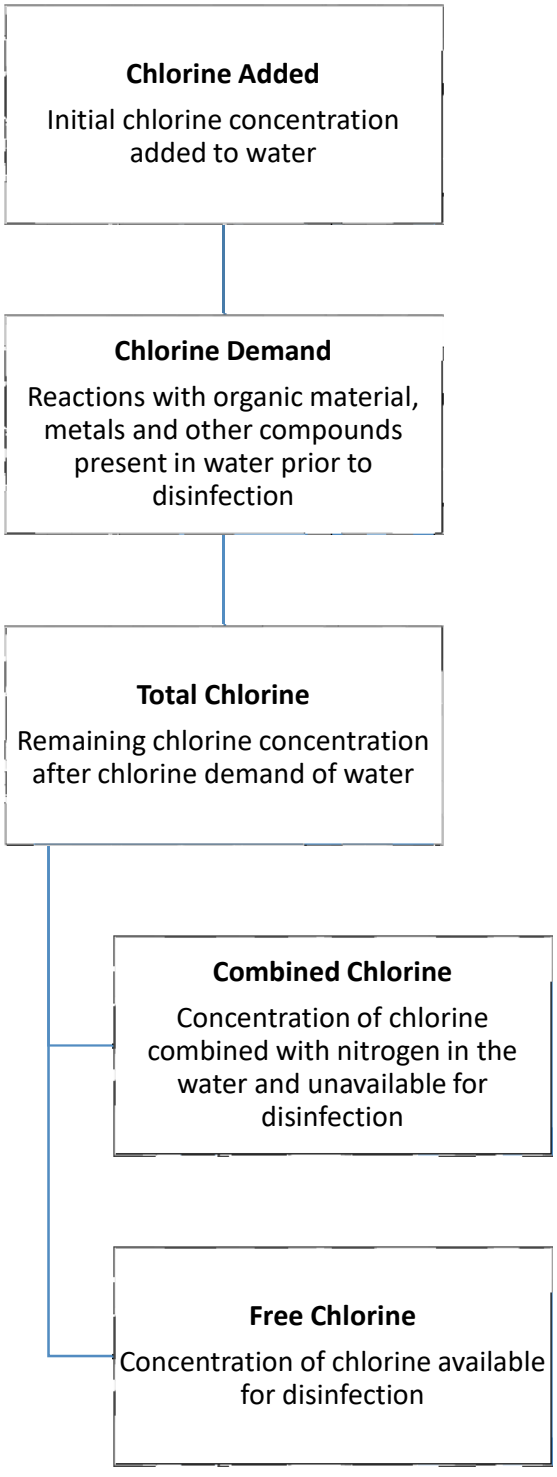
The commonly used dosages for various disinfection requirements are as follows:

1. For disinfection of water supplies:
    - Dosage: 0.5 - 2.0 mg/L
    - Contact Time: 20 - 30 minutes
2. For disinfection of newly constructed/repaired wells, storage tanks, pipelines, spring box, etc.:
    - Dosage: 50 mg/L
    - Contact Time: 24 hours

      or,
    - Dosage: 300 mg/L

   Contact Time: 1 hour

3.10.5.5 Chlorine Addition Flow Chart



3.10.5.6 Chlorination Guidelines

1. Chlorine solutions lose strength while standing or when exposed to air or sunlight. Make fresh solutions frequently to maintain the necessary.
2. Maintain a free chlorine residual of 0.3 mg/L (minimum) to 1.5 mg/L (maximum) for Chlorine; 0.2 mg/L (minimum) to 0.4 mg/L (maximum) for Chlorine Dioxide. Residual chlorine should be measured every day.
3. Once the chlorine dosage is increased to meet greater demand, do not decrease it unless the raw water quality improves.
4. When there is a risk of cholera or an outbreak has already occurred, maintain the chlorine residual as follows:
    - Distribution systems: 0.5 mg/L

3.10.6 Chlorine Residual

The word residual means "remainder" or that which is left. Chlorine Residual Test is used to measure the amount of chlorine remaining in the water at a certain point of time when the test is made.

Chlorine Residual has three forms in water treatment:

- *Free Residual Chlorine* composed of dissolved hypochlorite ions, hypochlorous acid and chlorine gas.
- *Combined Residual Chlorine* composed of chloramines that can kill bacteria and oxidize organic matter.
- *Total Residual Chlorine* is the sum of free and combined residual chlorine.

When chlorine is added to water, some of the chlorine reacts first with organic materials and metals in the water and is not available for disinfection (this is called the chlorine demand of the water). The remaining chlorine concentration after the chlorine demand is accounted for is called total chlorine. Total chlorine is further divided into: 1) the amount of chlorine that has reacted with nitrates and is unavailable for disinfection which is called combined chlorine and, 2) the free chlorine, which is the chlorine available to inactivate disease-causing organisms, and thus a measure to determine the potability of water.

For example, if using completing clean water the chlorine demand will be zero, and there will be no nitrates present, so no combined chlorine will be present. Thus, the free chlorine concentration will be equal to the concentration of chlorine initially added. In natural waters, especially surface water supplies such as rivers, organic material will exert a chlorine demand, and nitrates will form combined chlorine. Thus, the free chlorine concentration will be less than the concentration of chlorine initially added.

3.11 Wells

There are many ways of constructing water wells. The method used usually depends on the depth of the well. The two methods of drilling a well are:

1. *Percussion (Cable Tool) Method*. A cutting tool suspended by a cable is repeatedly raised and dropped, breaking up subsurface materials, which are then removed from the hole at frequent intervals as the depth increases. Usually, a steel liner, or *casing*, is driven downward inside the hole as drilling progress.

   This method is normally used where the required depth of the well is less than about 250 meters.

2. *Rotary Method.* A rotating *bit* mounted on the end of a "string" of *drill pipe* chews up the formation as drilling progresses.

A well may be considered as consisting of two main parts. The *cased section* serves as housing for the pumping equipment, while the *intake section* is where the water from the aquifer enters the well casing. The intake section is actually a screen or perforated part of the casing located in the water bearing formation.

A *sanitary seal* is constructed at the top 12-15 meters of the well on the space between the casings and bore hole with cement slurry. It seals against contaminated surface water or sub-surface water that might otherwise percolate down the well between the casing pipe and the bore hole.

After the well is drilled, cased and developed, a large block of concrete is cast around the top of the well casing known as the *pump base.*

A *gravel chute* allows gravel to be added as the gravel pack settles. The *sounding tube* permits measurement of well depth and pumping levels with the pump in place.

The performance of a new well should be checked at least once each day for the first several days, then if the performance seems stable, it should be checked once each month for the first year. After the first year, and as long as the performance remains stable, it should be checked at least every six months.

A well performance check consists of the following steps:

1. *Static Level.* Before starting the pump, carefully measure the static level and record. The pump should have been stopped for at least 12 hours before doing this.
2. *Flow Drawdown.* The pump is operated for several hours at a steady rate; then the *pump discharge* and *pumping level* are carefully checked and recorded. A *drawdown* is computed by subtracting the static level from the pumping level.
3. *Specific Capacity.* The pump discharge is divided by the drawdown to compute the specific capacity (in liters/sec per meter).

4. *Well Recovery.* A well recovery test is carried out when the pump is stopped.
5. *Well Depth.* The depth of the bottom of the well will reveal build-up of sand in the bottom.

Routine maintenance of the well observes the following:

1. *Add make up gravel.* During the first year of operation of new well, the gravel pack may settle. The gravel chute cap should be removed, and with the pump running, add gravel slowly as necessary. A sudden drop in the gravel may indicate a hole in the casing. In that case, remove pump and consult a well drilling contractor.
2. *Periodic Chlorination.* Once each six months, the well should be chlorinated to help prevent the build-up of encrustation.
   This is most easily accomplished as follows:
   a. Dump 10 kg of 70% powdered chlorine down to well, and let sit for 20-30 minutes to dissolve.
   b. Run pump (discharging to waste) until an odor of chlorine is detectable at the pump discharge. The odor should be detectable in a very short time.
   c. Shut the pump down and let sit for several hours, preferably overnight.
   d. Before putting pump back in service, operate (again discharging to waste) until chlorine odor is no longer detectable at the outlet.
   e. If there is no odor of chlorine, or chlorine residual, during this final pumping, it is necessary to re-chlorinate, because the well has been contaminated and has a high chlorine demand. In other words, a good job of chlorinating the well has not been accomplished.

Annex B contains the procedures for pump testing of wells.

3.12 Storage Facilities

Reservoir, as used in this section applies to storage of water for any use. Reservoirs used for storage of water supplies for later consumption fall into three general types: (1) Regulating (2) Pure Storage (3) Regulating/Storage.

Regulating Reservoirs serve the following general purposes:

- To even out demands during the day; filling when demand is low, and emptying when demand is high.
- To maintain desired pressure in a distribution system
- To provide a limited emergency reserve for fire fighting
- To prevent interruption of supply during pump outages because of electric power failure, mechanical breakdown, etc.
- To permit routine scheduling of pump operation

Pure Storage Reservoirs are used to store water as it becomes available; releasing it when water supply sources are not adequate to meet all daily needs.

Regulating/Storage Reservoirs serves both purposes: regulation and storage. It also serves two important secondary purposes: (1) providing chlorine contact time to ensure that all micro-organisms are killed before water is released to the public, and (2) in the case where wells pump into the reservoir allowing time for sand to settle out.

3.13 Distribution Facilities

3.13.1 Leakage Control and Repairs

Occasionally, a pipeline that has been in service for years will suddenly break, often completely disrupting the distribution system hydraulics and causing localized flooding or washing out of streets, with widespread disruption of water service. Such major outages generally involve a broken pipe, or parting of joints due to movement of a fitting.

- Broken Pipe

    a. Isolate the section of main by closing the nearest isolating valves.
    b. Excavate around the broken pipe, carrying the excavation beyond the joints on either side of the break, and thoroughly dewater the excavation.
    c. Install two short lengths of pipe of the same type and size, with a flexible coupling. (Note: For a clean break with no longitudinal cracks, a full circle repair clamp may be used)
    d. After repair, flush and chlorinate the pipeline as previously described for new pipe. Hydrostatic testing is not required, however, the normal working pressure should be applied to the line before backfilling.

- Movement of Fitting

    a. Isolate the section of main by closing the nearest isolating valves
    b. Excavate around the fitting and dewater the excavation
    c. Break out and remove the concrete thrust block
    d. Maneuver the fitting back into the proper position after making sure that pipe ends have not been damaged. Ensure that the joint is properly made, with rubber rings, if any, properly seated in the joint grooves.
    e. If movement was apparently caused by under mining of a thrust block due to nearby excavation, it may be necessary to uncover several lengths of pipe on both sides of the fitting and install joint restraints.
    f. If the cause of movement is not apparent, excavate behind the fitting, break out the existing thrust block and install a larger one against *undisturbed earth.*
    g. After the repair is completed, flush and disinfect the entire pipeline as previously described for new mains.

3.13.1.1 Locating Leaks

Most leaks are discovered by alert utility employees who observe and report all visible leaks, or clues to buried leaks, in the course of their regular daily duties. When a buried leak is suspected, a leak detector may be used to pinpoint its exact location.

3.13.1.2 Repairing Leaks

Small leaks are usually repaired without interruption of service. If shutting down the main is necessary, it should be done only in the presence of the supervisor in charge of maintenance.

When repairing leaking joints of pipes or fittings, observe the following rules:

- Have all required equipment and materials available at the site before starting to work
- Excavate around the leak
- Close the nearest isolating valves as directed by the supervisor
- Open a hydrant or tap to relieve line pressure
- After completion of repairs, flush and chlorinate, if repair procedure require opening the pipe

3.13.2 Flushing Mains

Every main with a dead end should be thoroughly flushed at least *twice each year* to dispose of accumulated silt and stagnant water. This is accomplished by opening a hydrant or blow-off at the end of the main and allowing water to flow to waste.

3.13.3 Fire Hydrants

Establish a routine maintenance schedule so that every hydrant is operated and inspected *at least once every six months.*

- Check for leaks below ground with a sounding bar
- Open and close, noting any difficulty operation and checking for water tight closure
- Check condition of turning nut, cap, chain and outlet threads. Repair or replace as required.
- If paint is maintained by the utility, touch up or repaint (this is sometimes the responsibility of the fire department)
- Clear off any weeds or high grass around the hydrant, that may hide it when there is a fire
- Note the date of inspection and repairs, if any

OPERATING PROCEDURES

4.1 New Service Connection Application

Step No.	Applicant/Client	Duration of Activity	In-Charge
01	Proceed to customer service for water service application form to be filled up. Present one (1) photocopy of any Valid ID and Barangay Clearance/Certification.	2 minutes	Commercial Section
02	Proceed to technical section for the on-site inspection where the service connection will be installed.	30 minutes	Technical Section
03	Proceed to commercial section for the verification whether applicant has the existing water service connection or it has previous unpaid balance after which prepare the necessary charges.	15 minutes	Commercial Section
04	Proceed to the cashier for the payment and issues of official receipt to applicant.	2 minutes	Finance Section
05	General Manager D will sign and approved the installation of new water service connection.	5 minutes	Administrative Section
06	Proceed to the technical section and present the approved application form with the official receipt for installation of new water service connection.	30 minutes	Technical Section
07	Acceptance and acknowledgement of water meter and materials installed.	5 minutes	Technical Section

4.2 Payment of Water and Non-Water Bill

Step No.	Applicant/Client	Duration of Activity	In-Charge
01	Present Statement of Account (SOA)/Billing Statement	2 minutes	Finance Section
02	Verify SOA with Billing Clerk	2 minutes	Finance Section
03	Concessionaire pays the water/non-water bill	2 minutes	Finance Section
04	Cashier accepts payment and issue Official Receipt	2 minutes	Finance Section

4.3 Billing and Collection

Step No.	Applicant/Client	Duration of Activity	In-Charge
01	Meter Reader reads consumption of each consumer by zone (1 zone per day starting on the first day of the month), prints billing statements and distribute to the consumer	Within the day	Commercial Section
02	Concessionaire present Statement of Account (SOA)/Billing Statement	2 minutes	Finance Section
03	Verify SOA with Billing Clerk	2 minutes	Finance Section
04	Concessionaire pays the water bill	2 minutes	Finance Section
05	Cashier accepts payment and issue Official Receipt	2 minutes	Finance Section

4.4 Transfer Old/New Water Service Connection

Step No.	Applicant/Client	Duration of Activity	In-Charge
01	Proceed to commercial section to fill up the form for transfer of water service connection.	2 minutes	Commercial Section
02	Proceed to cashier for payment and issues of official receipt to old/new concessionaire.	5 minutes	Finance Section
03	Proceed to technical section for on-site inspection where the service connection installed.	30 minutes	Commercial Section
04	Acceptance and acknowledgement of water meter and materials installed.	5 minutes	Technical Section
05	Billing Clerk updates concessionaire ledger	10 minutes	Commercial Section

4.5 Disconnection of Service Connection

Step No.	Applicant/Client	Duration of Activity	In-Charge
01	Billing Clerk prepares listing of delinquent accounts and accounts with voluntary disconnection application	10 minutes	Commercial Section
02	Meter Reader downloads and prints the listing of accounts to be disconnected	1 hour	Commercial Section
03	Meter Reader will conduct disconnection of accounts thereafter grace period of disconnection date	2 hours (depending on the no. of accounts)	Commercial Section
04	Meter Reader retrieves the disconnected water meters and store in inventory	1 hour	Commercial Section
05	Billing Clerk updates concessionaire ledger	10 minutes	Commercial Section

4.6 Request for Voluntary Disconnection

Step No.	Applicant/Client	Duration of Activity	In-Charge
01	Concessionaire will request and fill-up Voluntary Disconnection Form	5 minutes	Commercial Section
02	Concessionaire proceed to the cashier and pays the water bill balance	2 minutes	Finance Section
03	Cashier accepts payment and issue Official Receipt	2 minutes	Finance Section
04	Meter Reader will conduct disconnection of accounts of the account	2 hours (depending on the no. of accounts)	Commercial Section
05	Meter Reader retrieves the disconnected water meters and store in inventory	1 hour	Commercial Section
06	Billing Clerk updates concessionaire ledger	10 minutes	Commercial Section

4.7 Reconnection of Disconnected Service Connection

Step No.	Applicant/Client	Duration of Activity	In-Charge
01	Concessionaire will request and fill-up Reconnection Form	10 minutes	Commercial Section
02	Billing Clerk will assess unpaid bills	10 minutes	Commercial Section
03	Cashier accepts payment and issue Official Receipt	10 minutes	Finance Section
04	Plumber/Meter Reader reconnects the service connection water meter	Within the day (Every Wednesday and Friday only)	Commercial Section
05	Billing Clerk updates concessionaire ledger	10 minutes	Commercial Section

4.8 Complaints on Leaks (Service Connection)

Step No.	Applicant/Client	Duration of Activity	In-Charge
01	Receive information thru hotline number, email or physical complaint	5 minutes	Commercial Section
02	Plumber conducts on-site inspection	2 hours (depends upon the service area)	Commercial/ Technical Section
03	Plumber fills-up the Job Order and conducts necessary repairs	1 hour	Commercial/ Technical Section

4.9 Complaints on Low Pressure/High Consumption

Step No.	Applicant/Client	Duration of Activity	In-Charge
01	Receive information thru hotline number, email or physical complaint	5 minutes	Commercial Section
02	Plumber conducts investigation/assessment on the area	1 hour (depends upon the service area)	Commercial/ Technical Section
03	Billing Clerk provides remedial measures	Within the day	Commercial Section/ Technical Section

4.10 Transfer/Relocation of Water Meter

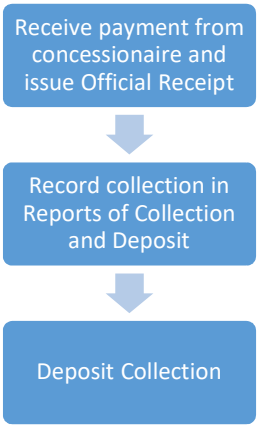
Step No.	Applicant/Client	Duration of Activity	In-Charge
01	Receive information and prepare Service Request Form	5 minutes	Commercial Section
02	Plumber conducts investigation/assessment on the area	1 hour (depends upon the service area)	Commercial/ Technical Section
03	Plumber transfer water meter	1 day	Commercial Section/ Technical Section
04	Billing Clerk updates concessionaire ledger	10 minutes	Commercial Section

4.11 Water Meter Calibration

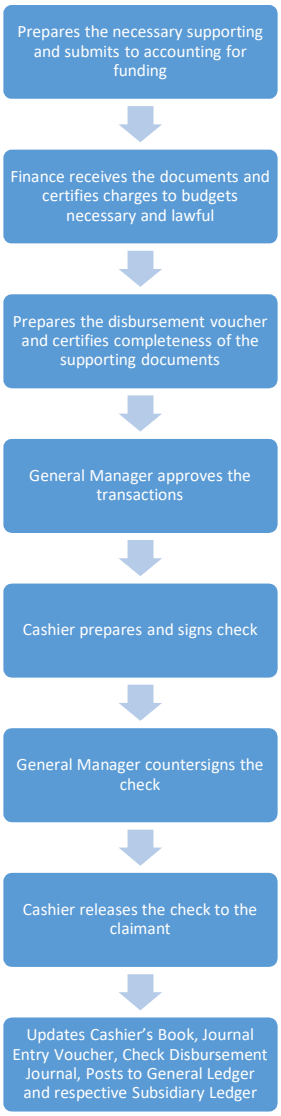
Step No.	Applicant/Client	Duration of Activity	In-Charge
01	Proceed to commercial section to fill up the form for water meter calibration	2 minutes	Commercial Section
02	Proceed to cashier for payment and issues of official receipt to old/new concessionaire.	5 minutes	Finance Section
03	Proceed to maintenance section and present the issued official receipt for the calibration of water meter and advice the concessionaire to follow-up after 2 days.	5 minutes	Technical Section
04	Acceptance and acknowledgement of water meter calibration after calibrated.	2 days	Technical Section

4.12 Finance Section

Accounting Workflow



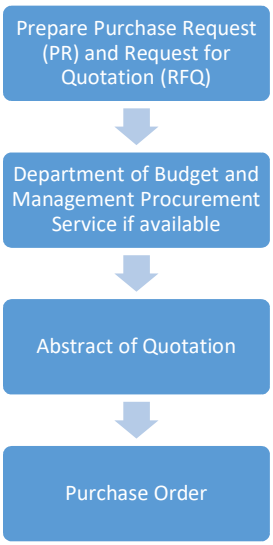
Disbursement Process



4.13 Admin Section

Procurement Process

Office Supplies



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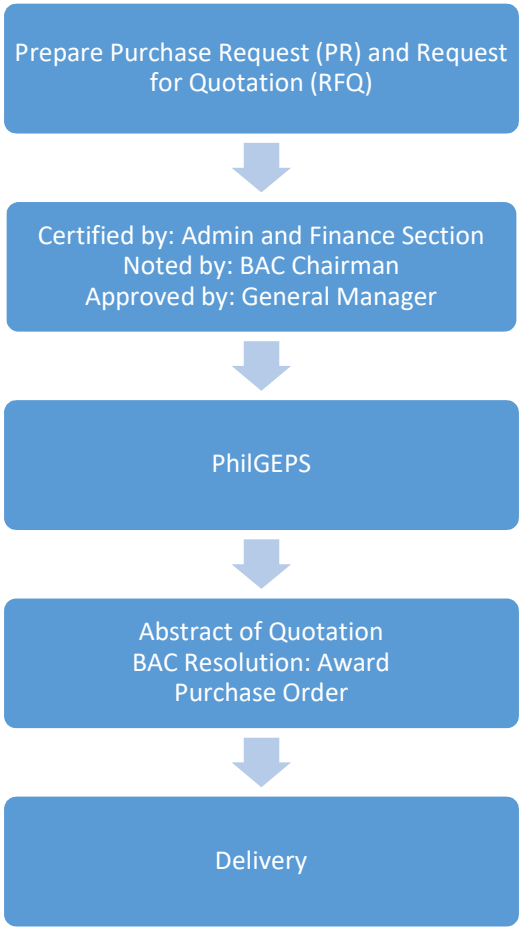
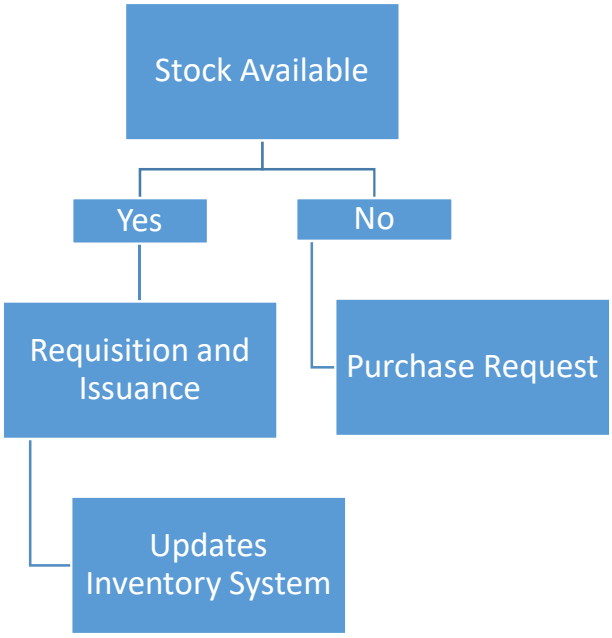


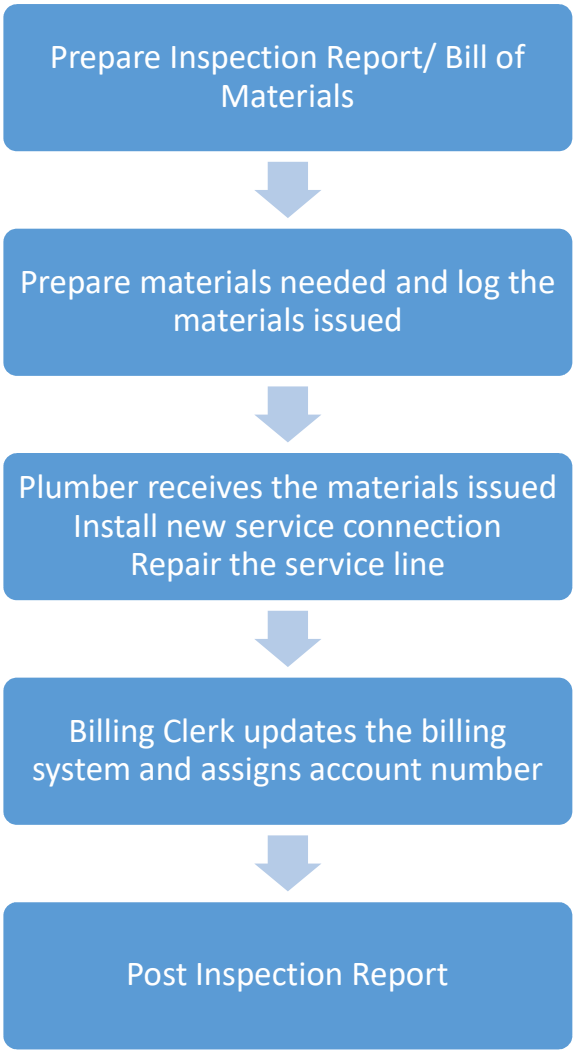
Receipt of Deliveries of Inventory

Issuance of Office Supplies



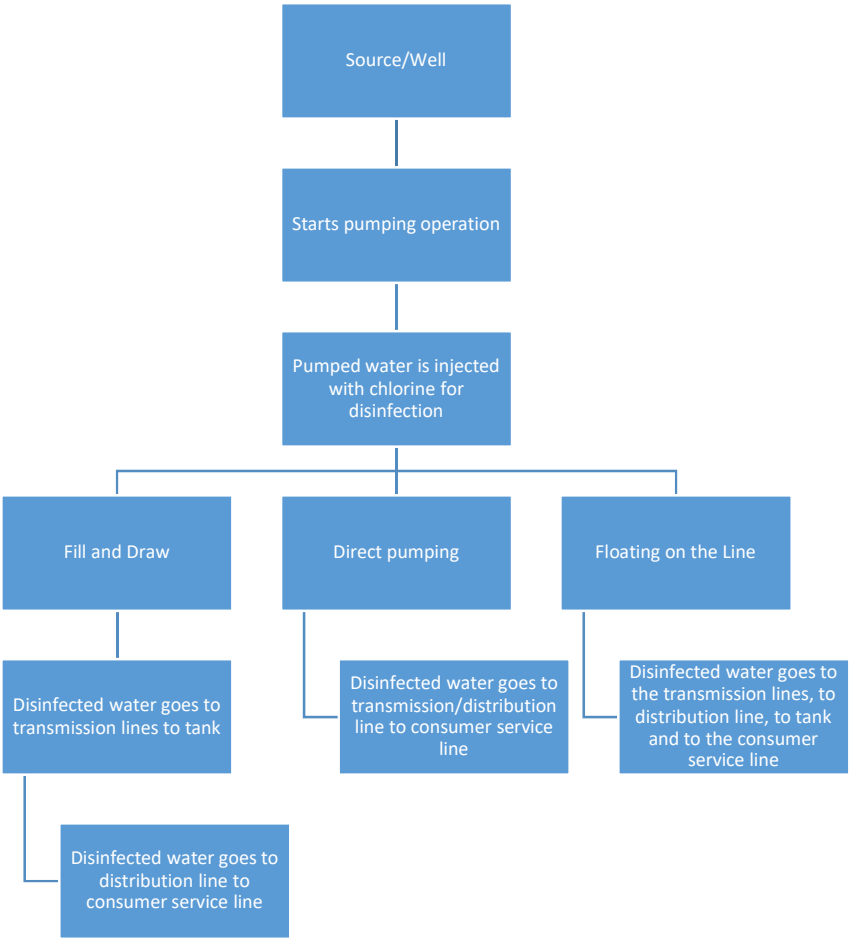
4.14 Commercial Section

Issuance of New Service Connection Materials and Repairs

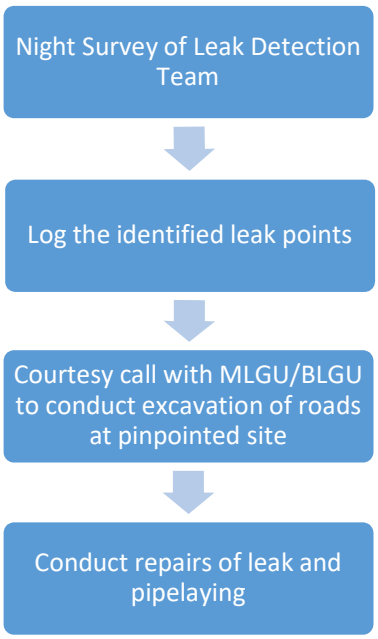


4.15 Technical Section

Production



Maintenance and Construction



Annex A

Business Plan Contents

I. Utility Profile

1. *General Information* – is used to give some information on the utility to the reader.
2. *Asset Register* – is a list of assets currently owned by the utility.

II. Business Plan Details

1. *Target Service Levels* – to present the existing service levels of the utility and the performance targets or planned service targets within the five year period. Service levels pertains to area coverage, water quality, continuity of supply, pressure and sewerage services, if any.
2. *Demand/Supply Projections* – contains an estimate of the projected demand as well as how the utility will be able to meet such demand. Any project needed to meet the demand and distribution requirements should either be presented in the list of projects or in the capex account in the cash flow.
3. *Capital Projects* – lists the major projects of the utility and the funding source for each project. In case of presenting such project/s to a proposed funder, the feasibility study for the project may be attached for reference.

III. Cash Flow

1. *Proposed Tariff Structure* – there should be calculations showing how the proposed tariff structure was derived.
2. *Project Key Performance Indicators* – gives the utility targets as well as providing a monitoring tool or benchmark for the utility to determine its progress or performance.
3. *Projected Financial Statements* – This pertains to the projected Income Statement and Balance Sheets.

Annex B

24-HR CONSTANT RATE PUMPING TEST PROCEDURE

A pump test consists of pumping a well at a certain rate and recording the drawdown decline of water level in the pumping well and in nearby observation wells over a certain time period. The responses of the water levels at and near the pumping well reflect the aquifer's ability to transmit water to the well. The response allows hydro geologists to determine the aquifer's characteristics. Water levels will drop less in more permeable aquifers than in aquifers of low permeability. Ideally, water levels should be measured at predetermined time intervals at the pumping well and nearby observations wells.

I. Required Tools and Equipment

- Pumping Unit (submersible pump with a capacity greater than the yield requirement by at least 20%)
- Water Level Indicator
- Stopwatch
- Containers for volumetric measurements of discharge

II. Terminologies

Static Water Level – The vertical distance from ground level or measuring point to the water surface in the well when there is no pumping activity.

Pumping Water Level – The vertical distance from ground level or measuring point to the water surface in the well during pumping activity.

Drawdown – The difference between the pumping water level and the static water level.

Well Yield – The volume of water per unit time that could be pumped from the well as determined by the pumping test.

III. Discharge Measurements

Discharge measurements are usually measured by a flow meter. If there is no device to measure the flow, then volumetric measurements will be resorted to.

The volumetric method consists of noting down the time required to fill a container bucket or a drum. Better results are obtained with a larger container. For more accurate results, several trial measurements should be done and the average of these trials taken.

IV. Procedure

1. Prior to starting the pump, measure and record the static water level.

2. After starting the pump, measure the corresponding water levels. Discharge should be greater than the required yield and should be maintained at a constant rate during the entire duration of the test for hours. Measurement intervals should be as follows:

Time from start of pumping (min)	Time intervals between measurements (min)
0 – 10	0.5 – 1
10 – 15	1
15 – 60	5
60 – 300	30
300 – 1440	60

3. Simultaneous with the water level measurements, take measurements of discharge.
4. Monitor nearby wells to determine effects during pumping.
5. Right after the end of the pumping test, measure the water level recovery.
6. Plot data obtained from the test on a semi-logarithmic paper showing the time in the abscissa x axis and the drawdown in the ordinate axis y axis.

HWD Service Application Form

Page 1

HINATUAN WATER DISTRICT
Service Application and Construction

Applicant: _____ Date: _____
Address: _____
Name of Spouse: _____ CP. No.: _____
Service Location: _____ Distribution line size: _____
Homeownership: Owner _____ Rented _____ Tenant _____ Contractor

APPLICATION STATUS

CUSTOMER CLASSIFICATION:

_____ Residential	_____ Commercial B	_____ New
_____ Government	_____ Commercial 1	_____ Separation
_____ Comm'l/Industrial	_____ Gov't/Comm'l. A	_____ Reconstruction
_____ Commercial A	_____ Gov't/Comm'l. 1	_____ Transfer

I HEREBY apply for a water service connection, meter size _____ located at _____.
I understand the connection will not be made until is approved and all charges are paid. Assume responsibility for the water meter and all that passes through the connection. I will condenm the *Rules & Regulations of the HINATUAN WATER DISTRICT.*

_____ Signature of Applicant

_____ Signature of Spouse

For SUB-CONNECTION

Signature of Lot Owner
The road right of way
Landlord

Authorized to Tap/attached from the existing service line.

_____
_____
_____
_____

Pls. provide a sketch of your house location at the back of this paper)

System is: Adequate ( )
Not Adequate ( )

Total length _____ Excess _____
Total amount to be paid for excess materials _____
excess labor _____

Inspector's Investigator's Remarks: _____

_____ Signature

AMOUNT OF CHARGES DUE:

	AMOUNT	O.R NO.	DATE PAID
1. Application & Installation Fee			
2. Material cost			
3. Excess materials fee			
4. Labor excavation fee			
TOTAL AMOUNT			
Partial			
BALANCE			

_____ Collector

APPROVED FOR CONSTRUCTION/INSTALLATION:

Installed by:

_____ Plumber

SERVICE CONNECTION RECORDS:

Date Installed _____ Meter Receipt No. _____
Service Connection No. _____ Account No. _____
Meter No. _____ Brand _____ Size _____
Classification _____ Initial Reading _____

WATER SERVICE CONNECTION CONTRACT

This SERVICE CONNECTION CONTRACT made and entered into by and between:

HINATUAN WATER DISTRICT, a Government Owned and Controlled Corporation organized and existing under and by virtue of the laws of the Philippines and having its affix address duly Sto. Nino, Hinatuan, Surigao del Sur, as represented by its manager JOSE HILARIO V. PANDILI, JR., of legal age, married, Filipino, and resident of Maharlika, Hinatuan, Surigao del Sur.

-and-

CONCESSIONAIRE, _____ **of legal age,** married/single, Filipino, and resident of _____, **Hinatuan, Surigao del Sur.**

WITNESSETH:

WHEREAS, the HWD owns and controls water services within the district of Hinatuan, Surigao del Sur whose primary purpose is to serve, furnish, and install water service to the concessionaire;

WHEREAS, the CONCESSIONAIRE wants to avail and install water service connection from the HWD;

WHEREAS, the parties mutually agreed in the following terms and conditions, to wit:

HINATUAN WATER DISTRICT

A. **Rights and Obligations**

A.1 The HWD shall install water service to the concessionaire at the address indicated in the contract and in the applicant's service application and construction order as hereto attached and made as an integral part of this contract.

A.2 The water meter shall be installed in such a way that it would be accessible for HWD employees to read, repairs, and disconnect.

A.3 The water meter is the property of HWD and can be pulled out from the customer by the authorized personnel only of HWD.

A.4 The HWD reserves the right to cut-off the supply or disconnect water service in any day for the following reasons:

a. For repair
b. For non-payment of bills
c. For fraudulent practices and illegal selling of water

A.5 The HWD shall not be responsible for the interruption of the service for cause beyond its control, nor liable to the concessionaires for damages caused by defective in-house connection not installed by HWD.

A.6 Representative of HWD. Shall have access to the premises at all times for the purpose of inspection, testing, repair and connection and that no one shall be permitted to remove, change or tamper with the installation unless authorized by the HWD.

CONCESSIONAIRES

B. **Rights and Obligations:**

B.1 The CONCESSIONAIRE shall conform and abide with the resolutions and policies appertaining to water services of HWD.

B.2 The Concessionaire shall pay an Application Fee and other fees pertinent his/her application for water service connection to the district.

B.3 The concessionaire shall be responsible for the cost of materials for the in-house connection.

B.4 The concessionaire shall be immediately billed after the reading and shall pay his/her water bill monthly to the HWD office on or before due date indicated in the water bill. Unpaid water bills after due date shall be considered delinquent and subject to ten percent (10%) penalty. Five (5) days from due date, if the concessionaire fails to pay his/her water bill, disconnection notice shall be served. Five (5) days from due date indicated in the notice, disconnection of water service follows without further notification.

B.5 The concessionaire shall make no changes in his/her approved connection without previously signing a revision on contract for that purpose in the office of the HWD. He/She shall notify the District in case of transfer of ownership when tenants leave the premises.

B.6 The concessionaire shall maintain the installation in proper condition while it is connected with the distribution line of HWD and guarantee that no tapping will be made on the service pipes.

B.7 In case of request for calibration, the concessionaire shall deposit FIFTY PESOS (P50.00) as calibration fee. Once the meter is found defective, the amount shall be refunded.

IN WITNESS WHEREOF, the parties have hereunto set their hands and signatures this _____ day _____, 20___ at Hinatuan, Surigao del Sur, Philippines.

_____
Concessionaire

HINATUAN WATER DISTRICT
By:

Signed in the presence of:

_____
Witness

ENGR. JOSE HILARIO V. PANDILI, JR.
General Manager

_____
Witness

ACKNOWLDEGMENT

REPUBLIC OF THE PHILIPPINES)
PROVINCE OF SURIGAO DEL SUR)
)

BEFORE ME, a Notary Public this _____ day of _____, 20____ at _____, personally appeared with their witnesses the above-named parties,

NAME	CTC. NO.	DATE PLACE ISSUED
Jose Hilario V. Pandili, Jr.	_____	_____

Known to me to be the same persons who executed the foregoing instrument and they acknowledged to the same is their free act and deed.

Doc. No. _____;
Page No. _____;
Book No. _____;
Series of 2005

Annex D

CONTACT INFORMATION

Office of the Board of Directors

Chairperson:

LILY V. BALBUENA
Contact No.: 0907-953-6710

Vice-Chairperson:

MARILYN S. ORTEGA
Contact No.: 0938-728-4473

Secretary:

JANELLE P. NAZARENO
Contact No.: 0951-091-2788

Members:

ARLITA L. BALBUENA
Contact No.: 0948-120-8259

ALEXIS M. MATITO
Contact No.: 0932-156-2008

Top Management

General Manager:

ENGR. JOSE HILARIO V. PANDILI JR.
Contact No.: 0919-560-6693

Administrative Section Head:

ENGR. AUGUSTUS ABRIL U. TURIN
Contact No.: 0928-840-6145

Commercial Section Head:

ZENITH V. BARRAMEDA
Contact No.: 0910-894-4298

Finance Section Head:

MENCHIE I. BAUTISTA
Contact No.: 0909-612-6719

Technical Section Head:

ENGR. CHRISTIAN M. BULASO
Contact No.: 0930-091-2858

Agency Information

Name of Office:	Hinatuan Water District (HWD)
Address:	Viola St., Sto. Niño, Hinatuan, Surigao del Sur
Cell./Tel. Nos:	SMART/TNT – 0948-442-0691
	GLOBE – 0936-910-0604
	(086) 628-0163
Website:	www.waterdistricthinatuan.com
E-mail:	water_hwd_1980@yahoo.com
	Water.hwd.1980@gmail.com