# WATER QUALITY MONITORING

**Objective --**

This procedure defines the system for monitoring and reporting the quality of water provided to the customers of **CAGAYAN DE ORO CITY WATER DISTRICT**.

**Scope –**

This procedure applies to water sampling at designated sampling points, laboratory analysis for physical, chemical parameters such as Residual Chlorine, Turbidity, pH, Temperature and microbiological analysis of **CAGAYAN DE ORO CITY WATER DISTRICT**'s Quality Control in accordance to PNSDW Standards.

**Definition of Terms –**

Quality Control - Is a procedure or set of procedures intended to ensure that the product or performed service adheres to a defined set of quality criteria or meets the requirements of the client or customer.

PNSDW – Philippine National Standards for Drinking Water

PPM – Parts Per Million

LWUA – Local Water Utilities Administration

Gas Chlorine – a yellowish-green gas consisting of diatomic molecules of chlorine, which is highly reactive and toxic, and used as a chemical reagent and disinfectant

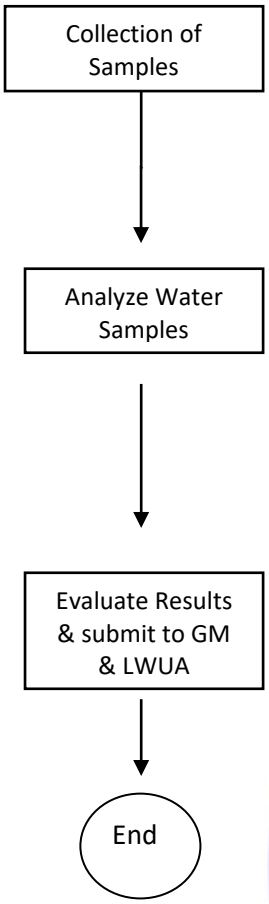
Chlorine Dioxide – a yellowish-green gas crystallizes as bright orange crystals, which is a potent and useful oxidizing agent used in water treatment and in bleaching substitute

Chlorine Residual – the level of chlorine detected in the product water. To maintain safety in the water, this is maintained at 0.3 to 1.5 PPM according to PNSDW.

| Process Flow | Detailed Description | Responsibility | Retained Documented Information |
|---|---|---|---|
| Start | | | |
| Establish designated sampling points | The Water Quality Control Assurance Section (WQCAS) shall establish Designated Sampling Points based on the guidelines of the Philippine National Standards for Drinking Water (PNSDW) to determine Sampling Locations wherein the Quality Control Personnel shall collect water sample for analysis. | Quality Control Personnel | Accomplishment Reports/ Summary Results |
| Establish sampling schedule | <u>For Periodic System Monitoring</u> –<br><br>The WQCAS shall provide Sampling Schedule for the whole month and shall follow the same schedule for monitoring of water samples for Water Quality Testing. | Quality Control Personnel | Sampling Schedule |

| Prepared By: | Approved By: |
|---|---|
| **Juvira Kris C. Cuyno**<br>Process Owner | Quality Management Representative |

# WATER QUALITY MONITORING




| | | |
|---|---|---|
| The WQCAS shall collect the Water Samples from the Designated Sampling Points following the Sampling Schedule. | Quality Control Personnel | |
| The WQCAS shall then analyze the samples taken.<br><br>The following parameters are used:<br>1. Micro-Bacteriological Analysis<br>a. Total Coliform<br>b. Fecal Coliform<br>c. Heterotrophic Plate Count<br><br>If result is Positive, continue sampling procedure until result shows Negative.<br><br>2. Physical and Chemical Analysis<br>a. pH<br>b. Turbidity,<br>c. Temperature,<br>d. Residual Chlorine | Quality Control Personnel | Logbook, Summary Report/Accomplishment Report |
| Analysis Reports will then be evaluated and recorded and will be submitted to the General Manager and LWUA. | Quality Control Personnel | Summary Report, LETTER |

**Reference Documents** –

1. Laboratory Work Instruction for Quality Control WI-PRD-01
2. Philippine National Standards for Drinking Water

**Records Generated –**

1. Schedule of Sample Collection FM-PRD-03
2. Monthly Summary & Evaluation Report of PWs Microbiological Analysis
3. Monthly Summary & Evaluation of Microbiological Analysis of COWD
4. Chlorine Monitoring FM-PRD-16
5. Water Quality Monitoring of COWD Water System Logbook
6. Letter
7. Accomplishment Report

# CUSTOMER COMPLAINTS AND REQUESTS ON WATER QUALITY

**Objective –**

This procedure defines the system for monitoring and reporting the water quality of water provided to the customers of the **CAGAYAN DE ORO CITY WATER DISTRICT**.

**Scope –**

This procedure applies to water sampling at designated sampling points, laboratory analysis for physical, chemical and microbiological quality of water of **CAGAYAN DE ORO CITY WATER DISTRICT**.

**Definition of Terms –**

Quality Control - Is a procedure or set of procedures intended to ensure that the product or performed service adheres to a defined set of quality criteria or meets the requirements of the client or costumer.

Dirty Water – refers to a color of water that is not physically clear.

Potable Water – water suitable (both health and acceptability considerations) for drinking and cooking purposes

Flushing – to cleanse (something) by causing large quantities of water to pass through it

| Process Flow | Detailed Description | Responsibility | Retained Documented Information |
|---|---|---|---|
| Start | | | |
| Determine Request Type | The Water Quality Control Assurance Section (WQCAS) will receive the Job Orders or Letter-Requests approved by the General Manager and will act upon the type of request from the Customer:<br>1. Dirty Water Complaints<br>2. Water Potability Testing | Quality Control Personnel | Job Order, Letter-Request, Water Quality Complaints Logbook |
| Inspection and Flushing | The WQCAS shall and shall conduct Inspection and implement Flushing as part of the quality assurance preventive maintenance. Refer to Work Instruction Manual for Flushing. | Quality Control Personnel | Accomplishment Report on Flushing |
| Collection and Analysis of Sample | The WQCAS shall then collect samples to be tested with the following parameters:<br>• Microbiological Analysis<br>• Physical and Chemical Analysis (pH, turbidity, temperature, residual chlorine) | Quality Control Personnel | Microbiological Results |

| Prepared By: | Approved By: |
|---|---|
| **Juvira Kris C. Cuyno**<br>Process Owner | Quality Management Representative |

# CUSTOMER COMPLAINTS AND REQUESTS ON WATER QUALITY

| | | | |
|---|---|---|---|
| Evaluation and Submission of Result<br>↓<br>End | Reports of the analysis will then be evaluated and recorded and will be submitted to the General Manager.<br><br>For Water Potability Testing, results will also be given to the Customer who requested the analysis. | | Letter, Microbiological Results |

**Reference Documents** –

1. Philippine National Standards for Drinking water (PNSDW)
2. Work Instruction Manual on Flushing

**Records Generated –**

1. Job Orders/Letter Request
2. Accomplishment Report on Flushing
3. Monthly Summary Report of Customer Complaints & Request on Water Quality
4. Monthly Summary of Dirty Water Complaints Positive Areas & Schedule Flushing Report

# PHY-CHEM WATER QUALITY MONITORING

**Objective –**

This procedure defines the system for monitoring and reporting the water quality of water provided to the customer of **CAGAYAN DE ORO CITY WATER DISTRICT**.

**Scope –**

This procedure applies to water sampling at designated sampling points, laboratory analysis for physical, and chemical analysis of water of **CAGAYAN DE ORO CITY WATER DISTRICT.**

**Definition of Terms –**

**LWUA** – Local Water Utilities Association

**Parameters** – a numerical or other measurable factor forming one of a set that defines a system or sets the conditions of its operation

**Color** – In natural water, color is due to the presence of humic acids, fulvic acids, metallic ions, suspended matter, plankton, weeds and industrial effluents. Color is removed to make water suitable for general and industrial applications and is determined by visual comparison of the sample with distilled water.

**Turbidity** – is an expression of optical property; wherein light is scattered by suspended particles present in water (Tyndall effect) and is measured using a nephelometer.

**pH**-It is one of the most important parameter in water chemistry and is defined as -log [H+], and measured as intensity of acidity or alkalinity on a scale ranging from 0-14.

**Nitrate**- the most oxidized forms of nitrogen and the end product of the aerobic decomposition of organic nitrogenous matter. Nitrates may find their way into ground water through leaching from soil and at times by contamination.

**Sulfate**- found appreciably in all natural waters, particularly those with high salt content. Sulphate causes scaling in industrial water supplies, and odor and corrosion problems due to its reduction to hydrogen sulphide.

**Chloride**- the presence of chlorides in natural waters can mainly be attributed to dissolution of salt deposits in the form of ions (Cl-). It is the major form of inorganic anions in water for aquatic life.

**Total Dissolved Solids**- is the term applied to the material residue left in the vessel after evaporation of the sample and its subsequent drying in an oven at a temperature of 103-105oC

**Iron** - is an abundant element in the earth's crust, but exists generally in minor concentrations in natural water systems. Iron is found in the +2 (ferrous) and +3 (ferric) states depending on the oxidation-reduction potentials of the water.

**Manganese-** a mineral that naturally occurs in rocks and soil and may also be present due to underground pollution sources. High presence in water can cause toxicity.

**Arsenic -** Toxic metal (found in air and water due to industrial contamination) that can cause skin and lung cancer, peripheral vascular disease, and liver damage.

**Lead** - is relatively a minor element in the earth's crust but is widely distributed in low concentrations in uncontaminated soils and rocks. Lead concentration in freshwater is generally much higher.

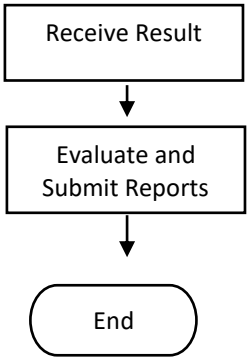
# PHY-CHEM WATER QUALITY MONITORING

**Cadmium** - largely found in nature in the form of sulphide, and as an impurity of zinc - lead ores. Cadmium may enter the surface waters as a consequence of mining, electroplating plants, pigment works, textile and chemical industries, and is toxic to man.

**Benzene -** a colorless, volatile, flammable, toxic, slightly water-soluble, liquid, aromatic compound, C 6 H 6, obtained chiefly from coal tar: used in the manufacture of commercial and medicinal chemicals, dyes, and as a solvent for resins, fats, or the like.

| Process Flow | Detailed Description | Responsibility | Retained Documented Information |
|---|---|---|---|
| Start | | | |
| Established Designated Sampling Point | The Water Quality Control Assurance Section (WQCAS) shall establish designated sampling point to be used as sampling locations for collection of water samples for annual physical-chemical analysis of water. | Quality Control Personnel | Accomplishment Reports/ Summary Results |
| Issue PR and schedule for Job Order | The WQCAS shall issue Purchase Request to be submitted to Property Division and shall wait for an approved Job Order to schedule for the collection of water samples. | | Purchase Request<br>Job Order |
| Sample Collection | The WQCAS shall collect the samples from all of COWDs PWs and selected transmission lines. | | |
| Send-out of Water Sample | The WQCAS shall forward the samples for outside testing for the testing of the following 13 parameters:<br><br><u>Physical</u><br>1. Color<br>2. Turbidity<br><br><u>Chemical</u><br>1. pH<br>2. Nitrate<br>3. Sulfate<br>4. Chloride<br>5. Total Dissolved Solids<br>6. Iron<br>7. Manganese<br>8. Arsenic<br>9. Lead<br>10. Cadmium<br>11. Benzene | | |

# PHY-CHEM WATER QUALITY MONITORING




| | | |
|---|---|---|
| Reports of the analysis will then be sent back to COWD Water Quality Assurance Section. | | |
| Results of analysis received will then be recorded, evaluated and submitted to LWUA through the General Manager. | | Letter,<br>Summary Report |

**Reference Documents** –

1. Philippine National Standards for Drinking Water

**Records Generated –**

1. Purchase Request
2. Job Orders
3. Letter
4. Annual Summary Report on Phy-Chem
5. Accomplishment Reports

# PUMPING EQUIPMENT & GENERATING SET MAINTENANCE

**Objective –**

This procedure shall ensure the availability of pump set and standby unit operation of the Production Facilities.

**Scope –**

This procedure is applicable to the maintenance of pump set and generating sets.

**Definition of Terms –**

PMS refers to the Preventive Maintenance Schedule

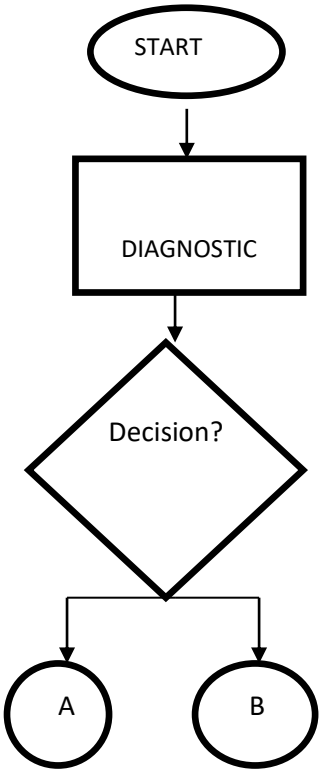
Pump set refers to Turbine, Modular, in booster and submersible pumps

PR – Purchase Request

BUS – Budget Utilization Slip

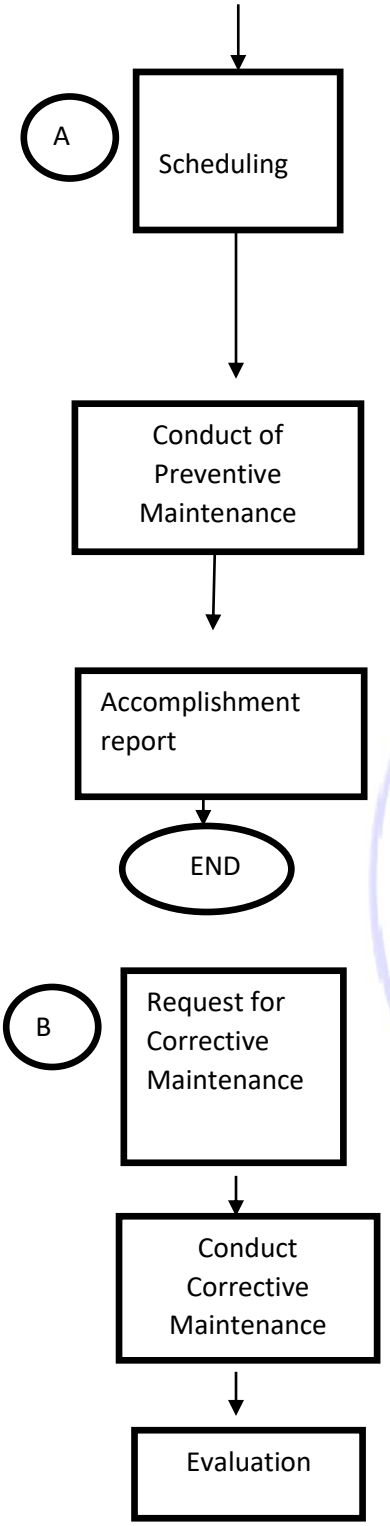
PC – Petty Cash

BAR – Budget Appropriation Request

| Process Flow | Detailed Description | Responsibility | Retained Documented Information |
|---|---|---|---|
|  | <u>FOR PUMPS</u><br>a. Conduct Pump Efficiency Test<br>b. Monitoring of Preventive Maintenance Check<br>c. Monitoring of Operators<br><br><u>FOR GENERATING SETS</u><br>a. Monitoring of Preventive Maintenance Checks<br>b. Monitoring of Operators | Preventive Maintenance Personnel<br>Operators | Pump Test Result, Monthly Monitoring Report<br>Operators Logbook |
| | Submit report of the findings and recommendations to the Department Manager. | Section Head | Report |
| | A. Decision for Preventive Maintenance<br>B. Decision for Corrective Maintenance | Department Manager | |

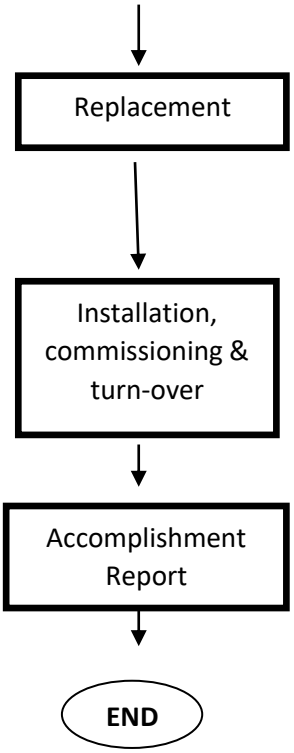
| Prepared By: | Approved By: |
|---|---|
| **Raymond R. Roa**<br>Process Owner | Quality Management Representative |

# PUMPING EQUIPMENT & GENERATING SET MAINTENANCE




| | | |
|---|---|---|
| FOR A<br>1. Prepare Job Order and procurement requirement/s for Preventive Maintenance with Materials.<br>2. Schedule<br>3. Assigned personnel | Section Leadman and Supervisor | Job Order, PR, PC, BUS, BAR, PC Voucher, Verification |
| For Motor Controllers<br>a. Clean and checkup parts<br>b. Tightening of bolts and contacts<br><br>For Standby Units<br>a. Change oil and filters<br>b. Clean Standby units and accessories<br>c. Tightening of bolts<br>d. Tune up intake and exhaust valves | Preventive Maintenance Personnel | |
| Submit Accomplishment Reports with the following information: materials used, outside job works, personnel who conducted the job, date started and finished. | Section Head | Accomplishment Report |
| **B**<br>Prepared Job Order and procurement requirement/s for Pull-Out or Disassemble of Generating Set for the Corrective Maintenance with Materials, Schedule and Assigned Personnel. | Section Leadman and Supervisor | Job Order, PR, PC, BUS, BAR, PC Voucher, Verification |
| For Pump Set<br>a. Pull out Pump set<br>b. Disassemble pump<br><br>For Generating Set<br>a. Disassemble Generator | Production Facilities Repair and Preventive Maintenance Personnel | |
| Check damage Parts.<br><br>Prepare Job Order and procurement requirement/s for the Installation and Assembling of Pump Set and Generating Set which include:<br>a. Request for Replacement of Materials Damage<br>b. Request Outside Job for Machining Works | Section Leadman | Job Order, PR, PC, BUS, BAR, PC voucher, Verification |

# PUMPING EQUIPMENT & GENERATING SET MAINTENANCE




| | | |
|---|---|---|
| For Pump Set<br>a. Splicing of motor cables<br>b. Assembling of pump set<br>c. Installation of pump set at well<br><br>For Generating Set<br>a. Assembling of Generating set | Production Facilities Repair and Preventive Maintenance Personnel | Accomplishment Report |
| Installation, Commissioning and Turn Over for Operation | Production Facilities Repair / Preventive Maintenance and Production Operators | Turn-Over Report |
| Submit Accomplishment Reports with attached materials used, outside job works, personnel who conducted job, and date started and finished. | Section Head | Accomplishment Report |

**Reference Documents** –

1. Local Water Utilities Administration (LWUA) Standards on Pumps and Motor Controls
2. Preventive Maintenance Checklist

**Records Generated –**

1. Accomplishment Report
2. Turn-over Report
3. Pump Test Result
4. Monthly Monitoring Report
5. Operators Logbook

# MAINTENANCE& CALIBRATION

**Objective –**

This procedure defines the system to ensure that all facilities and equipment needed for the effective and efficient operation of **CAGAYAN DE ORO CITY WATER DISTRICT** are functional and in good condition to minimize the variation during operations.

**Scope –**

This procedure covers all facilities and equipment utilized for the operation of **CAGAYAN DE ORO CITY WATER DISTRICT.** The maintenance of production wells and pumping facilities and calibration of laboratory equipment are handled mainly by the Production Department. However, there are other departments that also conduct maintenance and calibration such as the Computer Software and Development Section for preventive and corrective maintenance of Information Technology (IT) Equipment; Administrative Department for preventive and corrective maintenance of vehicles and air-conditioning units; Maintenance and NRW Management Department for calibration of water meters, maintenance of pipes and calibration of Hydraulic Model.

**Definition of Terms –**

*Preventive Maintenance* – maintenance that is regularly performed on equipment such as pipes, vehicles, pumps, pumping facilities, etc. to lessen the likelihood of failing.

*Corrective Maintenance* - refers to maintenance task performed to identify, isolate, and rectify a fault so that the failed equipment, machine, or asset can be restored to an operational condition within the tolerances or limits established for in-service operations.

*Calibration* - is a process of configuring an instrument such as water meters, laboratory equipment and Hydraulic Model to maintain its accuracy.

| Process Flow | Detailed Description | Responsibility | Retained Documented Information |
|---|---|---|---|
| Start | | | |
| Identify Facilities / Equipment | Maintenance Officer shall identify and review all facilities and equipment needed for the effective operation of the organization's processes and activities. He shall update Annual Preventive Maintenance Plan with the identified facilities and equipment/vehicle indicating the following information:<br>• Facility/Equipment No. (unique identification of each equipment)<br>• Facility/Equipment Type<br>• Model Name/Number (If necessary)<br>• Year of Acquisition<br>• Area Assignment<br>• Status (Working Condition / Under Repair) | Maintenance Officer | Facilities and Equipment Master List |

| Prepared By: | Approved By: |
|---|---|
| **Raymond R. Roa**<br>Process Owner | Quality Management Representative |

# MAINTENANCE & CALIBRATION

| | | | |
|---|---|---|---|
| | Update Annual Preventive Maintenance Plan semi-annually for any additional and/or changes or as necessary. | | |
| Plan Maintenance Schedules | Identify recommended frequency of maintenance and or calibration for each facility or equipment based on the supplier/manufacturer recommendation or on the equipment's/facility manual.<br><br>Plan out Preventive Maintenance Schedules for all the identified facilities and equipment for the entire year using the Annual Preventive Maintenance Plan and based on the established frequencies. | Maintenance Officer | Annual Preventive Maintenance/Calibration Plan |
| Execute Maintenance Schedule | *For Preventive Maintenance*<br>Performs regular and systematic application of engineering knowledge and maintenance attention to equipment and facilities in order to ensure facility/ equipment functionality and to reduce the rate of deterioration.<br><br>The Maintenance Officer shall conduct regular inspection through Preventive Maintenance Checklist and planned schedule. The Mechanic or Technician who conducted the maintenance with confirmation of the Leadman shall ensure that the scheduled preventive maintenance for each facility or equipment has been conducted and signs the confirmation portion of the checklist.<br><br>*For Corrective Maintenance*<br>If a fault or problem emerges in the facilities and equipment, the Maintenance Officer shall investigate and fills up a Facility/Equipment Investigation Report which indicates the problem causes and actions to be taken. A Facility/Equipment Evaluation Report shall then be submitted to the Department Manager.<br><br>*For Calibration of laboratory equipments*<br>A Certificate of re-calibration will be required from the Calibrating Agency as proof of calibration.<br><br>*For calibration of water meters*<br>A Water Meter Accuracy Report is submitted for all water meters calibrated/tested.<br><br>*For calibration of Hydraulic Model*<br>A Hydraulic Model Calibration Report of the COWD is submitted to the General Manager to show that pressure and flow in the Hydraulic Model coincides with actual field conditions. | Maintenance Officer, Mechanic, Technician, Leadman | Preventive Maintenance Checklist<br><br>Facility/EquipmentInvestigation Report/ Facility/EquipmentEvaluation Report<br><br>Certificate<br><br>Accomplishment Report on Water Meter Accuracy<br><br>Hydraulic Model Calibration Report |
| Report Results | | | |

| | | | |
|---|---|---|---|
| End | Summarize performance and results of maintenance; calibration and repair activities, analyze trends and take actions to address any discrepancy or problems identified. Refer to Corrective Action Procedure. | | |

**Reference Documents** –

1. Corrective Action Procedure PM-CAR-01

**Records Generated –**

1. Facilities and Equipment Master List FM-PRD-12
2. Annual Preventive Maintenance/Calibration Plan FM-PRD-11
3. Calibration History Record FM-PRD-10
4. Preventive Maintenance Checklist FM-PRD-21
5. Facility/Equipment Investigation Report
6. Facility/Equipment Evaluation Report
7. Accomplishment Report on Water Meter Accuracy
8. Hydraulic Model Calibration Report
9. Certificate
10. Calibration Form (NRW) FM-PRD-23