REPUBLIC OF THE PHILIPPINES
CAGAYAN DE ORO CITY WATER DISTRICT
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PROCEDURES AND WORK INSTRUCTION MANUAL

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1.0 PURPOSE

The purpose of this document is to ensure the efficient design of a District Meter Area using such resources as the calibrated hydraulic model and the GIS database in the Cagayan de Oro City Water District.

2.0 SCOPE

Initial DMA design, verification using hydraulic model, field verification, finalization of design

3.0 RECORDS

Record the results of field verification on AR-DMD-mm-nnn

Record the completed design on AR-DMD-mm-nnn

4.0 ASSOCIATED DOCUMENTS

AR-DMD-mm-nnn – Accomplishment Report for the specific DMA design project

5.0 DEFINITIONS

DMA – District Meter Area, a smaller portion of the distribution system with only one inflow and completely isolated from the network by boundary valves

Calibrated Hydraulic Model – a model of the distribution system that shows the behavior of water flows, velocities and head losses among others that have been verified to approximate actual conditions in the system

GIS – Geographical Information System showing among others customer data, appurtenances data, etc.

6.0 RESPONSIBILITY

It is the responsibility of the Maintenance and NRW Department Manager to maintain this work instruction and introduce improvements that may be necessary. The Water Distribution Division Manager is responsible for training DMA design teams on the implementation of this work instruction. The DMA design team members are responsible for the implementation of

the instructions in this procedure.

7.0 TOOLS AND EQUIPMENTS

Calibrated Hydraulic Model

GIS Customer Database

Data Loggers

Computers

8.0 SAFETY REQUIREMENTS

Personal Protective Equipment during field verification

Traffic Cones and Barriers

9.0 INSTRUCTIONS

9.1 The Water Distribution Division Manager shall first select an area of the system that is ideal for DMA creation. This should be done in consultation with the Maintenance and NRW Department Manager.

9.2 The WD Division Manager and the DMA design team shall conduct an inspection of the area in order to have a better grasp of field conditions.

9.3 The WD Division Manager shall then select an initial DMA design using an assessment of natural boundaries such as roads, bridges, and others.

9.4 Using information on customers in the GIS database, the WD Division Manager shall refine the design such that the DMA will not cover a very low number of customers nor a very high number. Ideally the range would be from 1000 to 5000.

9.5 This refined design will then be investigated using the calibrated hydraulic model. The hydraulic modeler shall identify pipes near the boundaries of the refined design which have little hydraulic significance (i.e, flow and velocity are very low and pressures are relatively flat). These pipes when closed using existing valves should be able to completely isolate the DMA. (Note: It may be necessary to install additional boundary valves and these should be installed by the DMA design team.)

9.6 The boundary points (i.e. valves) of the DMA should, as much as possible be located near the hydraulic balance points.

9.7 The boundary valves are then verified by the WD Division Manager and the team in

the field and checked if they are functioning. Those which are not should be replaced.

9.8 The location of the inflow meter, its size and design including the design of a Pressure Regulating Valve should then be determined using the hydraulic model.

9.9 The final location of the inflow meter and chamber, as well as the monitoring of critical points in the proposed DMA, shall then be finalized after considering actual field conditions.

1.0 PURPOSE

The purpose of this document is to ensure the efficient creation and actual building of a District Meter Area using such resources as the calibrated hydraulic model and the GIS database in the Cagayan de Oro City Water District and the standard designs made by the USAID Be Secure Project.

2.0 SCOPE

Implementation of civil works construction through contracts, monitoring, testing of valves

3.0 RECORDS

Project Inspectors from the DMA design teams shall prepare daily inspector's reports and record all information gathered in the field regarding the construction

Record all the details of Inflow Assembly, Valves, Pressure Monitoring Points on the AR-DMC-mm-nnn

4.0 ASSOCIATED DOCUMENTS

Daily Inspectors Reports – daily reports by project inspectors

AR-DMC-mm-nnn – Accomplishment Report of the DMA construction project

5.0 DEFINITIONS

DMA – District Meter Area, a smaller portion of the distribution system with only one inflow and completely isolated from the network by boundary valves

Calibrated Hydraulic Model – a model of the distribution system that shows the behavior of water flows, velocities and head losses among others that have been verified to approximate actual conditions in the system

GIS – Geographical Information System showing among others customer data, appurtenances data, etc.

6.0 RESPONSIBILITY

It is the responsibility of the Maintenance and NRW Department Manager to maintain this work instruction and introduce improvements that may be necessary. The Water Distribution Division Manager is responsible for training DMA design teams on the implementation of this work instruction. The DMA design team members are responsible for the implementation of the instructions in this procedure.

8.0 TOOLS AND EQUIPMENTS

Calibrated Hydraulic Model

GIS Customer Database

Data Loggers

Computers

9.0 SAFETY REQUIREMENTS

Personal Protective Equipment for project inspectors

Health and Safety Guidelines for project contractors

10.0 INSTRUCTIONS

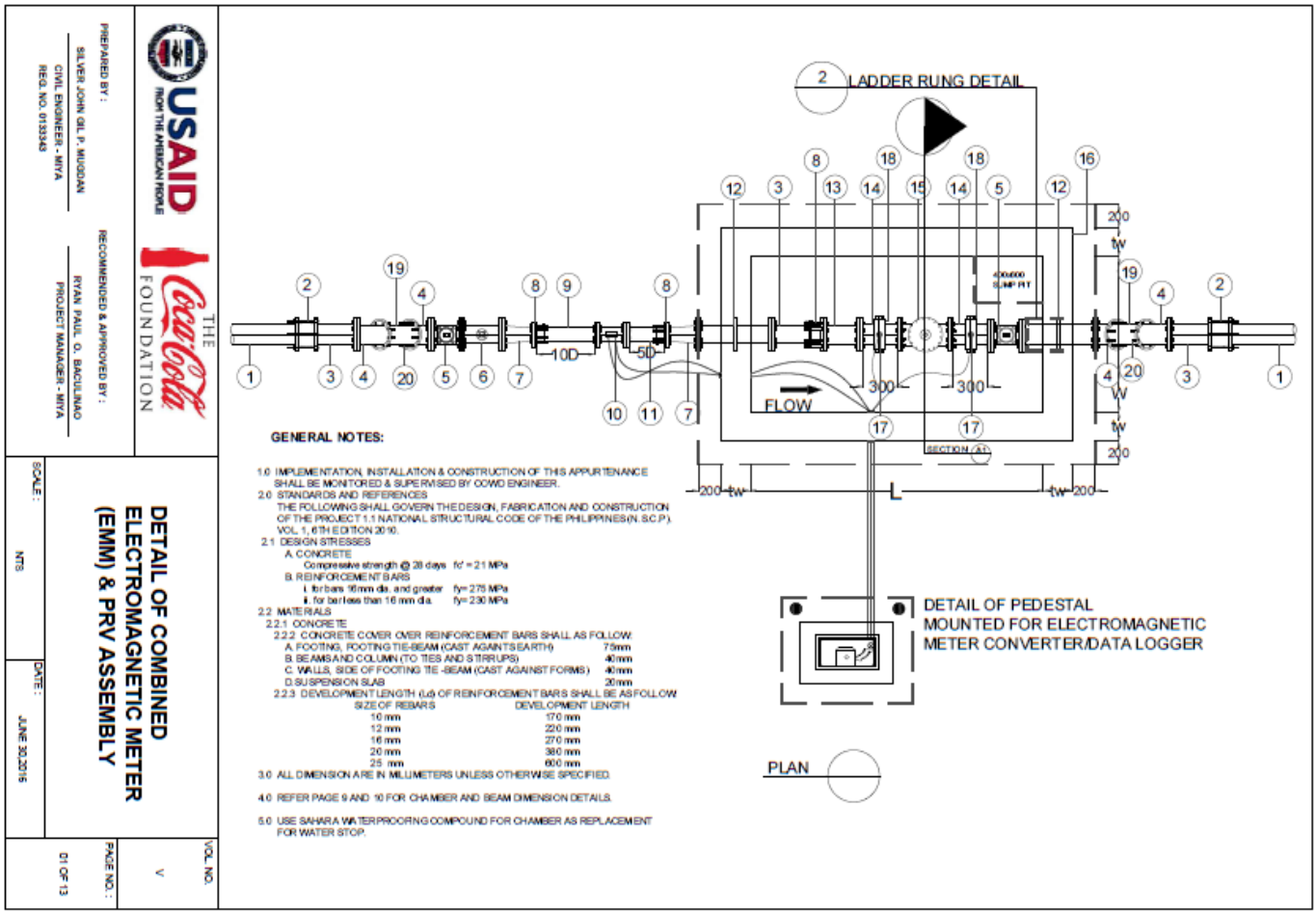
10.1 Install the Inflow Assembly for the DMA (by contract) using standard design (see below).

10.2 Install additional boundary valves and valves inside the DMA (by contract) using standard design (see below).

10.3 Install Pressure Monitoring Points (by contract) using standard design at the identified critical points in the DMA.

10.4 After the completion of the above installations, the WD Division Manager shall test all boundary valves and valves inside the DMA to check if they can be operated and shut-off or opened effectively.

10.5 The WD Division Manager shall record all actual details of the Inflow Assembly, Valves, and Pressure Monitoring Points in the AR-DMC-mm-nnn. These may be corrected later on when the As-Built Plans become available.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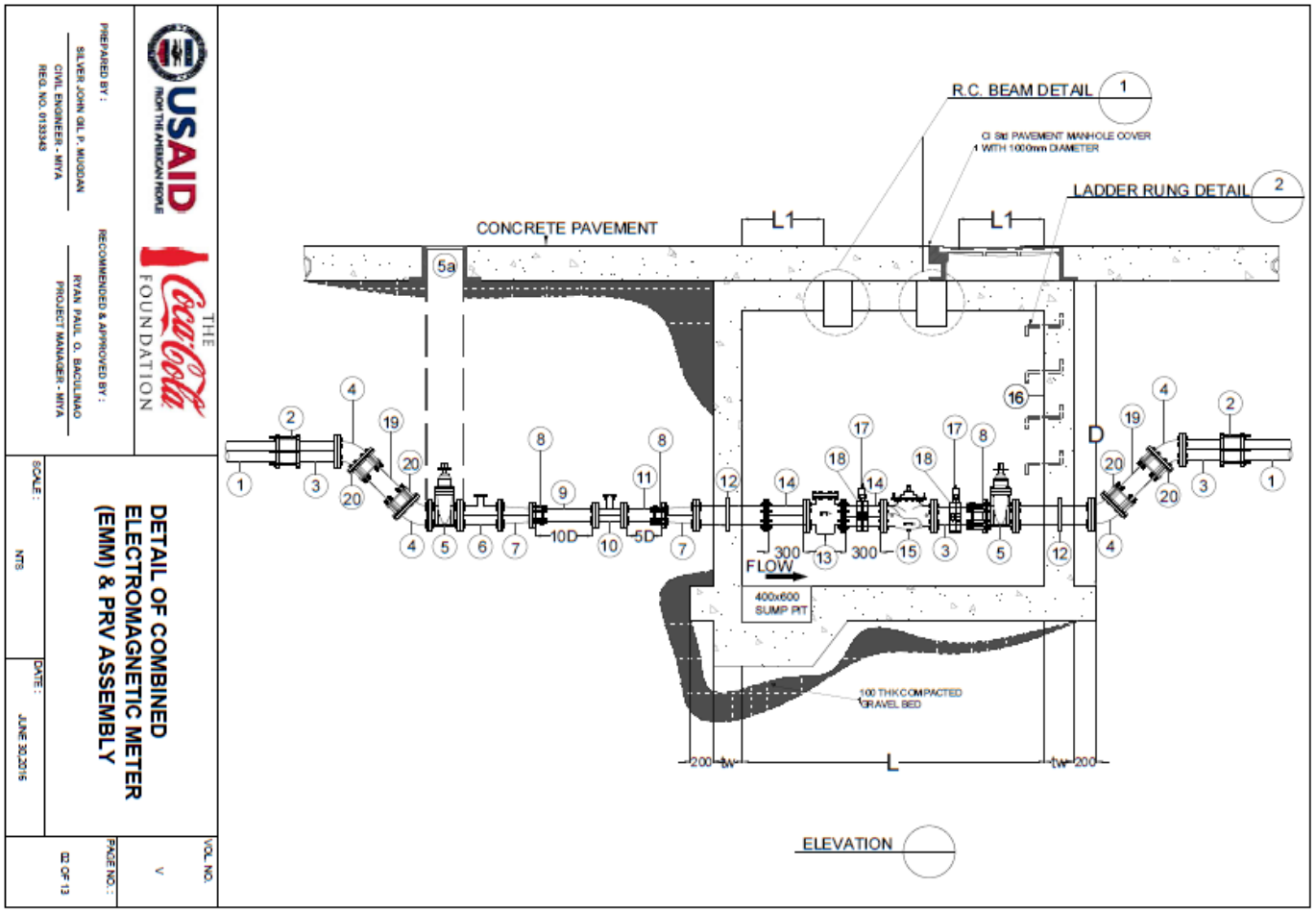
FROM THE AMERICAN PEOPLE
THE Coca-Cola FOUNDATION
DETAIL OF COMBINED ELECTROMAGNETIC METER (EMM) & PRV ASSEMBLY
SCALE : NTS
DATE : JUNE 30,2016
VOL. NO. V
PAGE NO. : 01 OF 13
2 LADDER RUNG DETAIL
10D
5D
FLOW
300
300
SECTION (A)
L
tw
200
DETAIL OF PEDESTAL MOUNTED FOR ELECTROMAGNETIC METER CONVERTER/DATA LOGGER
PLAN
GENERAL NOTES:
1.0 IMPLEMENTATION, INSTALLATION & CONSTRUCTION OF THIS APPURTENANCE SHALL BE MONITORED & SUPERVISED BY COWD ENGINEER.
2.0 STANDARDS AND REFERENCES
THE FOLLOWING SHALL GOVERN THE DESIGN, FABRICATION AND CONSTRUCTION OF THE PROJECT 1.1 NATIONAL STRUCTURAL CODE OF THE PHILIPPINES (N.S.C.P.), VOL. 1, 6TH EDITION 2010.
2.1 DESIGN STRESSES
A. CONCRETE
Compressive strength @ 28 days f'c' = 21 MPa
B. REINFORCEMENT BARS
i. for bars 16mm dia. and greater fy= 275 MPa
ii. for bar less than 16 mm dia. fy= 230 MPa
2.2 MATERIALS
2.2.1 CONCRETE
2.2.2 CONCRETE COVER OVER REINFORCEMENT BARS SHALL AS FOLLOW:
A. FOOTING, FOOTING TIE-BEAM (CAST AGAINTS EARTH) 75mm
B. BEAMS AND COLUMN (TO TIES AND STIRRUPS) 40mm
C. WALLS, SIDE OF FOOTING TIE -BEAM (CAST AGAINST FORMS) 40mm
D. SUSPENSION SLAB 20mm
2.2.3 DEVELOPMENT LENGTH (Ld) OF REINFORCEMENT BARS SHALL BE AS FOLLOW
SIZE OF REBARS DEVELOPMENT LENGTH
10 mm 170 mm
12 mm 220 mm
16 mm 270 mm
20 mm 380 mm
25 mm 600 mm
3.0 ALL DIMENSION ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.
4.0 REFER PAGE 9 AND 10 FOR CHAMBER AND BEAM DIMENSION DETAILS.
5.0 USE SAHARA WATERPROOFING COMPOUND FOR CHAMBER AS REPLACEMENT FOR WATER STOP.


R.C. BEAM DETAIL 1
CI Std PAVEMENT MANHOLE COVER
WITH 1000mm DIAMETER
LADDER RUNG DETAIL 2
CONCRETE PAVEMENT
L1
L1
5a
D
10D
5D
300
300
FLOW
400x600
SUMP PIT
100 THK COMPACTED
GRAVEL BED
200
tw
L
tw
200
ELEVATION
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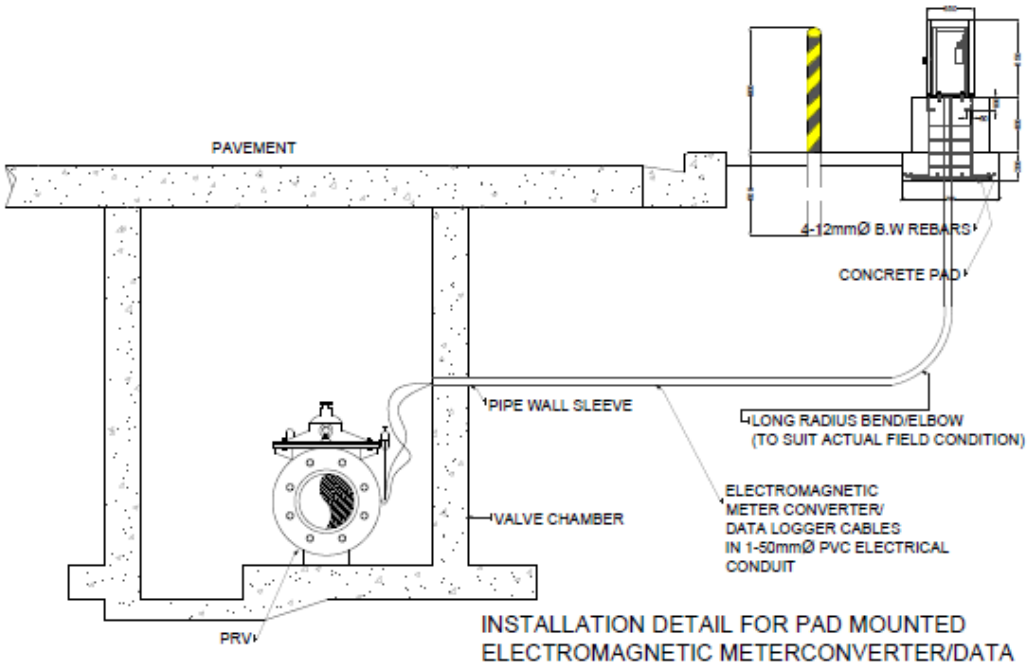

INSTALLATION DETAIL FOR PAD MOUNTED ELECTROMAGNETIC METERCONVERTER/DATA LOGGER ENCASEMENT (FRP)

NOTES:

1. ALL DIMENSION ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.
2. CONDUIT FOR ELECTROMAGNETIC METER CONVERTER/ DATA LOGGER CABLES SHALL BE 1-50 mmØ PVC ELECTRICAL CONDUIT.
3. ALL METALLIC NON-CURRENT CARRYING PARTS OF ELECTROMAGNETIC METER CONVERTER/DATA LOGGER SHALL BE PROPERLY GROUNDED TO PROTECT INSTRUMENT FROM ELECTRICAL & LIGHTING SURGES.
4. SEALING FITTINGS SHALL BE PROVIDED ON CONDUIT RUNS ENTERING FROM NON-CORROSIVE AREAS. SEALING COMPOUND SHALL NOT BE POURED IN PLACE UNTIL INSTALLATION HAS BEEN ACCEPTED.
5. THE CONTRACTOR TOGETHER WITH COWD SHALL DETERMINE AND MAKE ADJUSTMENT FOR THE LOCATION OF THE ELECTROMAGNETIC METER CONVERTER/DATA LOGGER ENCLOSURE THAT WILL SUIT FIELD CONDITIONS.
6. THE CONTRACTOR SHALL PROVIDE A PULL WIRE IN EACH OF THE PVC ELECTRICAL CONDUIT.
7. HAND HOLE AND/OR PULL WIRE SHALL BE PROVIDED WHENEVER NECESSARY TO FACILITATE HOSE/CABLE MAINTENANCE EVEN IF IT WERE NOT SHOWN IN THE PLANS NOR MENTIONED IN THE SPECIFICATIONS.
8. MAXIMUM ELECTROMAGNETIC METER CONVERTER/CABLE LENGTH/HORIZONTAL DISTANCE BETWEEN THE PRV & ELECTROMAGNETIC METER CONVERTER SHALL BE 10 METERS, WITH A VERTICAL DISTANCE NOT MORE THAN 2.5 METERS.
9. ADJUSTABLE HOOK & SLOOT SHALL BE BOLTED DIRECTLY TO FRP HOUSING.

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STANDARD DETAILS FOR PEDESTAL MOUNTED INSTRUMENTATION BOX / PRESSURE MONITORING POINT

VOL. NO. II

PAGE NO. : 02 OF 06

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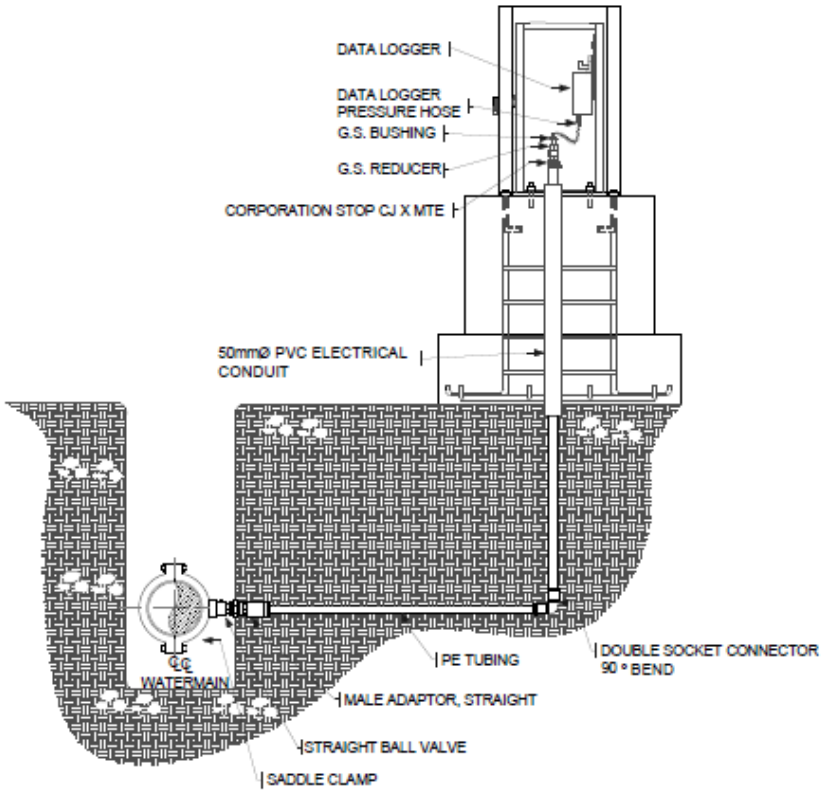

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STANDARD DETAILS FOR PEDESTAL MOUNTED INSTRUMENTATION BOX / PRESSURE MONITORING POINT

VOL. NO. II

PAGE NO. : 06 OF 06

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SCALE : NTS

DATE : JUNE 30,2016

1.0 PURPOSE

The purpose of this document if to ensure the proper maintenance and servicing of Metering Points including strainers installed at the Meter Point of a DMA.

2.0 SCOPE

Opening/closing of bypass valves, monitoring benchmark pressure, closing/opening of isolation valves, servicing of flowmeter and strainer.

2.0 RECORDS

Record accomplishment of DMA Maintenance on AR DMM-mm-nnn

Record all activities don on AR DMM-mm-nnn

3.0 ASSOCIATED DOCUMENTS

AR DMP-mm-nnn – Accomplishment Report on DMA Maintenance for the specific work

5.0 DEFINITIONS

Meter Point Installation – also called the inflow assembly into the DMA, usually equipped with isolation valves, bypass and PRV

Pressure Reducing Valve – an equipment used in the water distribution system to reduce pressure to a desired level.

6.0 RESPONSIBILITY

It is the responsibility of the Maintenance and NRW Department Manager to maintain this work instruction and introduce improvements that may be necessary. The Water Distribution Division Manager is responsible for training the Distribution Operation teams on the implementation of this work instruction. The Distribution Operation team members are responsible for the implementation of the instructions in this procedure.

7.0 TOOLS AND EQUIPMENTS

Appropriate Hand Tools

Valve T-Wrench

Portable Lighting Equipment

Portable Generator

Dewatering Pump and Hose

8.0 SAFETY REQUIREMENTS

Personal Protective Equipment

Traffic Cones and Barriers

Portable Warning Lights

9.0 INSTRUCTIONS

9.1 The Water Distribution Division Manager shall check the latest logged data to confirm that both pressure and flow are being recorded correctly at the Meter Point.

9.2 The Water Distribution Division Manager or the team supervisor shall select a point downstream of the bypass where pressure can be measured constantly over the period during which the maintenance is carried out. The pressure reading taken initially shall be used as the pressure benchmark level.

9.3 A competent team member shall slowly open the bypass valve, just enough to sustain the DMA at the benchmark pressure level. The meter dial should slow down or even stop as the bypass valve is opened. It is now important to monitor the pressure and maintain the benchmark level. The level can be sustained by "throttling" the bypass valve.

9.4 Once the pressure inside of the DMA has stabilized the Meter Point (MP) inlet and outlet valves can be closed by a competent team member to take the installation off line. If there is a pressure monitoring point between the inlet and outlet valves, then this should be opened to depressurized the meter point set up.

9.5 The cover of the strainer should then be removed taking great care not to damage the mating surfaces of the strainer body or the seal ring. Damage to either will result in leakage from the joint.

9.6 Carefully remove the basket trying not to leave any loose material behind.

Photograph the contents for record purposes and if necessary bag and tag the contents for further analysis.

9.7 Slowly open the inlet valve so that enough water passes through to flush out any remaining small particles. The flushed out water must never be allowed to rise above the level of the strainer cover as this increases the chances of contamination.

9.8 The PRV, can also be serviced at the same time. Please refer to WI PRV-01.

9.9 Once the servicing has been completed, slowly open the MP outlet valve and check for leaks. The installation is now under mains pressure. Slowly open the MP inlet valve, check that the pressure is still at the benchmark level and finally slowly close the bypass valve. The meter should now be running as the water is directed through the installation. Confirm that the system is recharging by verifying the reading of the flowmeter.

1.0 PURPOSE

The purpose of this document if to ensure the proper updating of all information in the DMA, from new pipelines, customer changes and changes in the critical points.

2.0 SCOPE

Monitoring of critical points, updating of customer database in the GIS, updating of new pipelines in the DMA, updating of changes in the network within the DMA

3.0 RECORDS

Record accomplishment of DMA Maintenance on AR DMM-mm-nnn

Record all activities don on AR DMM-mm-nnn

4.0 ASSOCIATED DOCUMENTS

AR DMP-mm-nnn – Accomplishment Report on DMA Maintenance for the specific work

5.0 DEFINITIONS

Meter Point Installation – also called the inflow assembly into the DMA, usually equipped with isolation valves, bypass and PRV

Pressure Reducing Valve – an equipment used in the water distribution system to reduce pressure to a desired level.

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It is the responsibility of the Maintenance and NRW Department Manager to maintain this work instruction and introduce improvements that may be necessary. The Water Distribution Division Manager is responsible for training the Distribution Operation teams on the implementation of this work instruction. The Distribution Operation team members are responsible for the implementation of the instructions in this procedure.

7.0 TOOLS AND EQUIPMENTS

GIS Positioning Devices

Pressure Gauges

8.0 SAFETY REQUIREMENTS

Personal Protective Equipment

Traffic Cones and Barriers

9.0 INSTRUCTIONS

9.1 The Water Distribution Division Manager shall see to it that all new pipelines installed in the DMA are reflected properly in the GIS Map of the DMA.

9.2 Team supervisors can make their own records of any works done and have this recorded in the GIS. These can then later on be corrected, if necessary, when the As-Built Plans become available.

9.3 The Water Distribution Division Manager shall also see to it that changes in the customer database in the DMA are reflected in the GIS.

9.4 The team supervisor shall from time to time verify if the Critical Points in the DMA previously identified and monitored remain critical points. Changes in the usage, for example a new tall building built within the DMA may become a new Critical Point.

1.0 PURPOSE

The purpose of this document is to ensure the efficient continuation of GIS Data gathering and field survey for areas in Cagayan de Oro City not covered by the USAID Be Secure Project on NRW Reduction. This project will be finished in the first half of 2017 and this document seeks to set the roadmap for the continuation of GIS mapping and data acquisition for areas outside the focus areas now.

2.0 SCOPE

Prioritization of service area, planning, scheduling

3.0 RECORDS

Team supervisor to disseminate daily work schedules to team members.

4.0 ASSOCIATED DOCUMENTS

CSF mm-nnn – field data sheet or Customer Survey Form for the specific work

NSF mm-nnn – field data sheet or Network Asset Survey Form for the specific work

5.0 DEFINITIONS

DMA – District Meter Area, a smaller portion of the distribution system with only one inflow and completely isolated from the network by boundary valves

GIS – Geographical Information System showing among others customer data, appurtenances data, etc.

6.0 RESPONSIBILITY

It is the responsibility of the GIS Division Manager to maintain this work instruction and introduce improvements that may be necessary. The GIS Division Manager and team supervisor is responsible for training the GIS team members (survey teams, encoders, and digitizers) on the implementation of this work instruction. The GIS team members are responsible for the implementation of the instructions in this procedure.

7.0 TOOLS AND EQUIPMENTS

Customer Billing Databases

GIS Maps and Database

As-Built Plans

8.0 SAFETY REQUIREMENTS

Not applicable yet.

9.0 INSTRUCTIONS

9.1 The GIS Division Manager in consultation with the Maintenance and NRW Management Department Manager shall map out the priority areas for continuation of the NRW Reduction Project.

9.2 The areas are then listed and summarized with corresponding number of existing customers.

9.3 The GIS Division Manager shall then gather all As-Built Records of the different ares as the project goes along.

9.4 The GIS Division Manager shall then gather customer information and meter locations from the Customer Billing Database and from the meter readers

9.5 The GIS Division Manager shall then plan out areas for customer survey as well as network asset field survey on a monthly basis as much as possible.

9.6 The GIS Division Manager shall then plan out weekly schedules for customer survey and network asset field survey.

9.7 The GIS team leaders shall then implement the weekly schedules and fan these out to their team members.

1.0 PURPOSE

The purpose of this document is to ensure the efficient continuation of GIS Data gathering and field survey for areas in Cagayan de Oro City not covered by the USAID Be Secure Project on NRW Reduction. This project will be finished in the first half of 2017 and this document seeks to set the roadmap for the continuation of GIS mapping and data acquisition for areas outside the focus areas now.

2.0 SCOPE

Customer survey, network asset survey, encoding, digitizing, quality assurance

3.0 RECORDS

Record all customer and meter information details on CSF mm-nnn

Record all appurtenances information details on NSF mm-nnn

4.0 ASSOCIATED DOCUMENTS

CSF mm-nnn – field data sheet or Customer Survey Form for the specific work

NSF mm-nnn – field data sheet or Network Asset Survey Form for the specific work

5.0 DEFINITIONS

DMA – District Meter Area, a smaller portion of the distribution system with only one inflow and completely isolated from the network by boundary valves

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It is the responsibility of the GIS Division Manager to maintain this work instruction and introduce improvements that may be necessary. The GIS Division Manager and team supervisor is responsible for training the GIS team members (survey teams, encoders, and digitizers) on the implementation of this work instruction. The GIS team members are responsible for the

implementation of the instructions in this procedure.

7.0 TOOLS AND EQUIPMENTS

Field Data Sheet

Measuring Tape

Measuring Rollers

Survey Grade GPS Device

Markers

Camera

As-Built Records

Hand Tools

8.0 SAFETY REQUIREMENTS

Personal Protective Equipment

Traffic Cones

9.0 INSTRUCTIONS

Customer Survey

9.1 The GIS team supervisor shall conduct orientation of field survey team members

9.2 The field survey team members shall plan their route and approach

9.3 The field survey team members shall conduct detailed field survey of all customers and meter installations in the area selected

9.4 The quality assurance team shall ensure that all information are complete in each survey form, otherwise these are returned to the survey team

9.5 The census data is then encoded by the GIS encoders in the database

9.6 The customer and customer meter locations are then digitized by the GIS digitizers using Manifold

9.7 The quality assurance team shall check the encoded and digitized data for accuracy and completeness, otherwise these are returned and verified in the field again.

Network Asset Data Collection

9.8 The field survey teams shall gather information on every network asset such as valves, fire hydrants, blow-off valves, etc.

9.9 Using survey grade GPS devices, location of these assets are also determined.

9.10 The location of these assets are then plotted in the GIS by the GIS digitizers and the attributes are encoded in the database

9.11 A photo library of these assets are maintained and are made accessible in the GIS database by the digitizers.

1.0 PURPOSE

The purpose of this document is to ensure the proper preparations for the conduct of a Zero Pressure Test (ZPT) in the DMA. This will ensure that the actual test will proceed smoothly

2.0 SCOPE

Installation of data loggers, programming of data loggers, operation of valves, analysis of results

3.0 RECORDS

Record the mobilization date and time for the preparation of Zero Pressure Test on JO ZPT-mm-nnn

Record all details of boundary valve locations, meter point, pressure monitoring points on MAP ZPT-mm-nnn

4.0 ASSOCIATED DOCUMENTS

JO ZPT-mm-nnn – Job Order for the specific zero pressure test activity

AR ZPT-mm-nnn – Accomplishment Report for the zero pressure test activity

MAP ZPT-mm-nnn – map of the DMA showing all details for the zero pressure test activity

5.0 DEFINITIONS

DMA – District Meter Area, a smaller portion of the distribution system with only one inflow and completely isolated from the network by boundary valves

Calibrated Hydraulic Model – a model of the distribution system that shows the behavior of water flows, velocities and head losses among others that have been verified to approximate actual conditions in the system

GIS – Geographical Information System showing among others customer data, appurtenances data, etc.

Zero Pressure Test – a procedure done to reduce pressure in the DMA to zero by closing a valve

at the Meter Point. This will ensure that a DMA is completely isolated by the boundary valves.

6.0 RESPONSIBILITY

It is the responsibility of the Maintenance and NRW Department Manager to maintain this work instruction and introduce improvements that may be necessary. The Water Distribution Division Manager is responsible for training DMA design teams on the implementation of this work instruction. The DMA design team members are responsible for the implementation of the instructions in this procedure.

7.0 TOOLS AND EQUIPMENTS

Data Loggers

Hand Tools

Listening Sticks

8.0 SAFETY REQUIREMENTS

Personal Protective Equipment

Traffic Signs and Barriers

9.0 INSTRUCTIONS

9.1 The DMA design team shall install a data logger to record flow and pressure, in 15-minute intervals, at the DMA metering point (MP). This shall be done at least three (3) days before the actual conduct of the Zero Pressure Test (ZPT).

9.2 The team shall confirm that all boundary valves and inlet valves including the metering point are accessible and operational.

9.3 The team supervisor shall select suitable locations for checking pressure (PMP) inside and outside the DMA, these are ideally at the boundary valves. (Note: It may be necessary to ask customers if T-connections can be put on their meter stands to enable secure placement of loggers inside property boundaries.)

9.4 Retrieve the information from the data logger at the metering point. The team supervisor shall analyze the data in order to schedule the date and time of the actual ZPT. (Note: This is usually done during the period of Minimum Night Flow, in most

cases between 1:30AM and 4:00AM.)

9.5 The team supervisor shall prepare a map of the DMA, including surrounding areas. Each PMP, boundary valves, hydrants, MP, shall be reflected in the map and referenced to landmarks in the field. Each PMP shall be identified by a unique identification number.

1.0 PURPOSE

The purpose of this document is to ensure the effective conduct of a Zero Pressure Test (ZPT) in the DMA.

2.0 SCOPE

Installation of data loggers, programming of data loggers, operation of valves, analysis of results

3.0 RECORDS

Record the mobilization date and time for the conduct of Zero Pressure Test on JO ZPT-mm-nnn

Record the completion date and time for the completion of the Zero Pressure Test on AR ZPT-mm-nnn

4.0 ASSOCIATED DOCUMENTS

JO ZPT-mm-nnn – Job Order for the specific zero pressure test activity

AR ZPT-mm-nnn – Accomplishment Report for the zero pressure test activity

MAP ZPT-mm-nnn – map of the DMA showing all details for the zero pressure test activity

5.0 DEFINITIONS

DMA – District Meter Area, a smaller portion of the distribution system with only one inflow and completely isolated from the network by boundary valves

Calibrated Hydraulic Model – a model of the distribution system that shows the behavior of water flows, velocities and head losses among others that have been verified to approximate actual conditions in the system

GIS – Geographical Information System showing among others customer data, appurtenances data, etc.

Zero Pressure Test – a procedure done to reduce pressure in the DMA to zero by closing a valve at the Meter Point. This will ensure that a DMA is completely isolated by the boundary valves.

6.0 RESPONSIBILITY

It is the responsibility of the Maintenance and NRW Department Manager to maintain this work instruction and introduce improvements that may be necessary. The Water Distribution Division Manager is responsible for training DMA design teams on the implementation of this work instruction. The DMA design team members are responsible for the implementation of the instructions in this procedure.

7.0 TOOLS AND EQUIPMENTS

Data Loggers

Hand Tools

Listening Sticks

8.0 SAFETY REQUIREMENTS

Personal Protective Equipment

Traffic Signs and Barriers

9.0 INSTRUCTIONS

9.1 In the afternoon of the day of the conduct of the Zero Pressure Test, the team shall install data loggers at all previously identified PMPs both inside and outside the DMA. Each logger shall be programmed to record pressure at one-minute intervals.

9.2 A competent team member shall reprogram the logger at the MP to record data at one-minute intervals (for this, use the second memory of the logger if available).

9.3 The team supervisor shall confirm that there is water supply in the DMA by taking pressure readings inside the DMA.

9.4 Competent team members shall operate the boundary valves and sound these using a listening stick to ensure that they are closed. (Note: This is a very important step and must be done thoroughly and carefully.)

9.5 The outlet valve at the MP shall be closed slowly by a competent team member. The closure should be confirmed by sounding the valve using a measuring stick. It should not be presumed that flow was stopped simply by looking at the flowmeter.

9.6 After five minutes the team supervisor shall check the pressure inside the DMA, which by this time should be dropping down to zero. (Note: In order to facilitate the

attainment of zero pressure, hydrants in the DMA may be opened to release water.)

9.7 The Zero Pressure Test shall end when zero pressure is attained inside the DMA and the activity ends.

9.8 The following day, data from the data loggers are analyzed bty the team supervisor to have a confirmation that zero pressure inside the DMA was attained while pressure outside the DMA was maintained.

1.0 PURPOSE

The purpose of this document is to ensure the efficient conduct of Minimum Night Consumption Calculation using logged data at the Meter Point of a DMA. The successful conduct of this activity can possibly lead to identifying possible water loss due to leakage and pilferage in the DMA.

2.0 SCOPE

Analysis of logged flow and pressure, random selection of customer meters, tagging of meters, meter reading, analysis of results

3.0 RECORDS

Record the location of the tagged meters in the MAP MNC-mm-nnn

Record the date and time of accomplishment of the activity on AR-MNC-mm-nnn

Collate all tables and analysis done and attach to AR MNC-mm-nnn

4.0 ASSOCIATED DOCUMENTS

MAP MNC-mm-nnn – a map of the DMA showing the locations of the Meter Point and the tagged meters.

5.0 DEFINITIONS

DMA – District Meter Area, a smaller portion of the distribution system with only one inflow and completely isolated from the network by boundary valves

Calibrated Hydraulic Model – a model of the distribution system that shows the behavior of water flows, velocities and head losses among others that have been verified to approximate actual conditions in the system

GIS – Geographical Information System showing among others customer data, appurtenances data, etc.

Minimum Night Consumption Calculation – a method of calculating the consumption of

customers at night. This can then be used for estimating possible leakage in the DMA

6.0 RESPONSIBILITY

It is the responsibility of the Maintenance and NRW Department Manager to maintain this work instruction and introduce improvements that may be necessary. The Water Distribution Division Manager is responsible for training DMA design teams on the implementation of this work instruction. The DMA design team members are responsible for the implementation of the instructions in this procedure.

7.0 TOOLS AND EQUIPMENTS

Vehicle

Watches

Meter Tags

8.0 SAFETY REQUIREMENTS

Personal Protective Equipment

Traffic Cones and Barriers

9.0 INSTRUCTIONS

9.1 The team supervisor shall gather customer data (including at the least the following: customer name and account number, meter brand and serial number, historical consumption, customer classification) from the GIS for the DMA.

9.2 The team supervisor shall retrieve the latest logged data (both pressure and flow) at the Meter Point of the DMA.

9.3 The team supervisor shall analyze the logged data and schedule the conduct of Minimum Night Consumption Calculation during the time of minimum night flow into the DMA. The window can then be estimated from the logged data (see figure below).

9.4 The team supervisor shall select a random sample of customer meters to be included in the study. These customer meters are then mapped and tagged in the field.

9.5 At the start of the activity, the team supervisor shall synchronize the watches of the

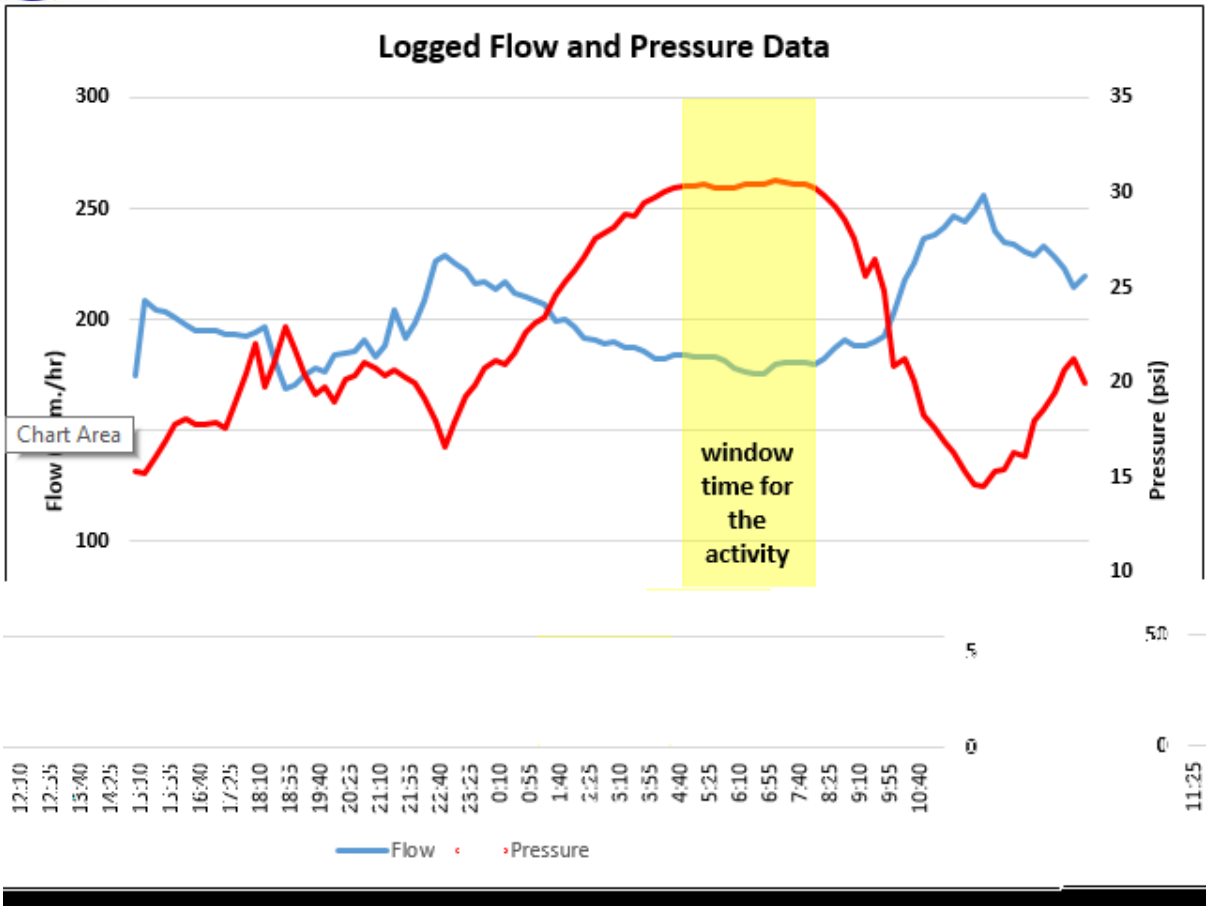
meter readers with each other.

9.6 Meter readers (in teams of two for security reasons), shall read the Initial Reading of the tagged water meters using data sheets similar to Table 1 below. They should be careful to record the meter readings up to the last decimal and whether these meters are turning or not at the time of reading. They also record the time they read the meter.

9.7 After the initial readings are taken, the team supervisor shall then give the signal to commence the taking of final readings. Again the meter readers should take care to record the readings up to the last decimal, whether the meters are turning or not, and the time of the reading.

9.8 After the conduct of the activity, a flow rate computation for the meters included in the study is then made by the team supervisor using the method described in Table 2 below. The resulting average flow rate in liters/hour/connection is then extrapolated for the total number of connections in the DMA. The resulting flow will then be the Minimum Night Consumption in the DMA.

9.9 A further analysis is then made which should result into an estimate of the leakage in the DMA as shown in the last figure below.

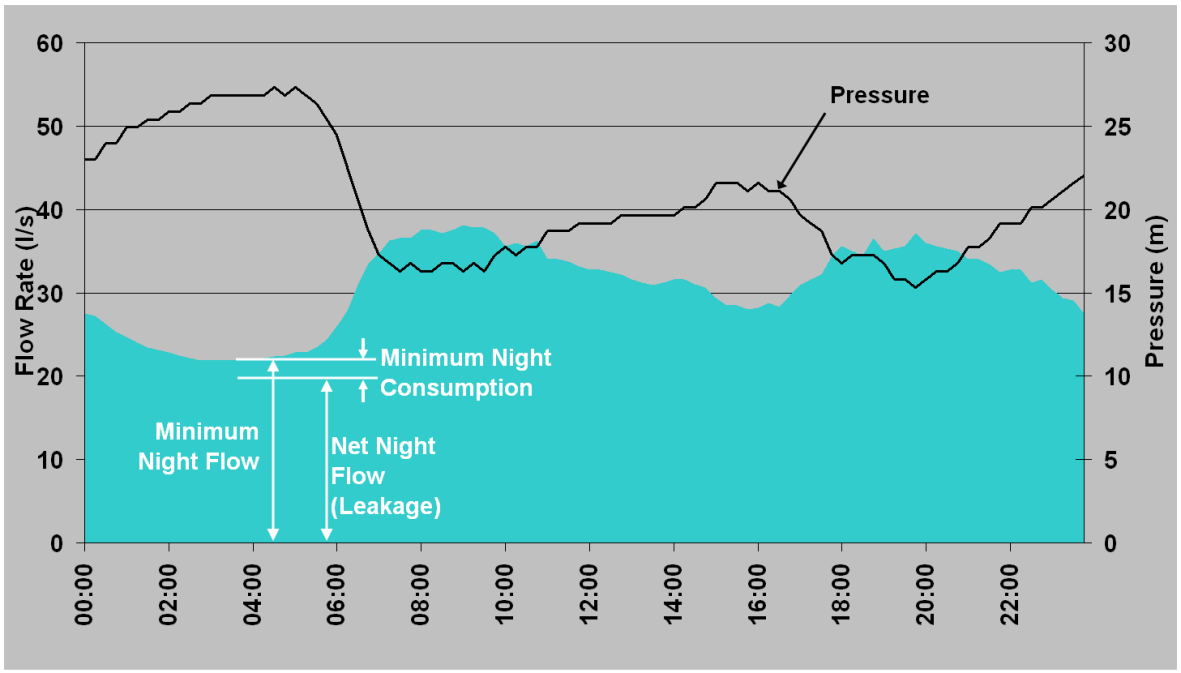


TEAM No.: 01			Initial Reading			Final Reading			Remarks
Route No.	Map No.	Meter Number	Meter Reading	Time	Turning (+) Not-turning (-)	Meter Reading	Time	Turning (+) Not-turning (-)	
1	38	D10031523475	167.8003	1:00:00 AM	-	167.8003	2:30:00 AM	-	
2	36	D10031508326	143.5637	1:12:00 AM	-	143.5637	2:40:00 AM	-	
3	45	D10031510672	684.7154	1:14:00 AM	-	684.7154	2:41:00 AM	-	
4	32	D10031500092	959.2080	1:16:00 AM	-	959.1213	2:43:00 AM	-	
5	73	40080082	1398.5151	1:05:00 AM	-	1398.5151	2:35:00 AM	-	
6	77	40094570	1048.1556	1:09:00 AM	-	1048.1556	2:37:00 AM	-	
7	53	40097828	429.1150	1:50:00 AM	-	429.1556	3:07:00 AM	-	
8	46	40111545	462.9925	1:23:00 AM	-	462.9925	2:47:00 AM	-	
9	145	D10031509675	1326.1477	1:45:00 AM	-	1326.1668	3:04:00 AM	+	
10	8	34280290	2810.8183	2:05:00 AM	+	2810.9956	3:19:00 AM	+	
11	37	40095788	869.8088	1:57:00 AM	-	869.8088	3:12:00 AM	-	
12	64	D10041500695	1221.0058	2:00:00 AM	+	1221.0427	3:15:00 AM	+	
13	19	D10031505750	853.8085	2:48:00 AM	-	853.8085	3:55:00 AM	-	
14	55	33284960	1879.6851	2:37:00 AM	-	1879.6851	3:44:00 AM	-	
15	29	D10031513733	483.8830	2:04:00 AM	-	483.8830	3:18:00 AM	-	
16	28	D10031503905	367.7647	1:54:00 AM	-	367.7647	3:10:00 AM	-	
17	143	D10041513003	168.4234	2:12:00 AM	-	168.4234	3:24:00 AM	-	
18	76	D10031506190	386.5696	2:18:00 AM	-	386.5696	3:25:00 AM	-	
19	150	40096203	1729.0301	2:14:00 AM	-	1729.0301	3:25:00 AM	-	
20	52	40031718	1441.1051	2:10:00 AM	+	1441.1668	3:23:00 AM	+	

Table 1: Sample Field Sheet for the Customer Meter Night Reading

TEAM No.: 01			Initial Reading		Final Reading		Consumption (Liters)	Δt (Hour)	Flow Rate (L/H)	Remarks
Route No.	Map No.	Meter Number	Meter Reading	Time	Meter Reading	Time				
1	38	D10031523475	167.8003	1:00:00 AM	167.8003	2:30:00 AM	-	1.50	-	
2	36	D10031508326	143.5637	1:12:00 AM	143.5637	2:40:00 AM	-	1.47	-	
3	45	D10031510672	684.7154	1:14:00 AM	684.7154	2:41:00 AM	-	1.45	-	
4	32	D10031500092	959.2080	1:16:00 AM	959.1213	2:43:00 AM	13.30	1.45	9.17	
5	73	40080082	1398.5151	1:05:00 AM	1398.5151	2:35:00 AM	-	1.50	-	
6	77	40094570	1048.1556	1:09:00 AM	1048.1556	2:37:00 AM	-	1.47	-	
7	53	40097828	429.1150	1:50:00 AM	429.1556	3:07:00 AM	40.60	1.28	31.64	
8	46	40111545	462.9925	1:23:00 AM	462.9925	2:47:00 AM	-	1.40	-	
9	145	D10031509675	1326.1477	1:45:00 AM	1326.1668	3:04:00 AM	19.10	1.32	14.51	
10	8	34280290	2810.8183	2:05:00 AM	2810.9956	3:19:00 AM	177.30	1.23	143.76	
11	37	40095788	869.8088	1:57:00 AM	869.8088	3:12:00 AM	-	1.25	-	
12	64	D10041500695	1221.0058	2:00:00 AM	1221.0427	3:15:00 AM	36.90	1.25	29.52	
13	19	D10031505750	853.8085	2:48:00 AM	853.8085	3:55:00 AM	-	1.12	-	
14	55	33284960	1879.6851	2:37:00 AM	1879.6851	3:44:00 AM	-	1.12	-	
15	29	D10031513733	483.8830	2:04:00 AM	483.8830	3:18:00 AM	-	1.23	-	
16	28	D10031503905	367.7647	1:54:00 AM	367.7647	3:10:00 AM	-	1.27	-	
17	143	D10041513003	168.4234	2:12:00 AM	168.4234	3:24:00 AM	-	1.20	-	
18	76	D10031506190	386.5696	2:18:00 AM	386.5696	3:25:00 AM	-	1.12	-	
19	150	40096203	1729.0301	2:14:00 AM	1729.0301	3:25:00 AM	-	1.18	-	
20	52	40031718	1441.1051	2:10:00 AM	1441.1668	3:23:00 AM	61.70	1.22	50.71	
							Average Flow Rate		13.97	

Table 2: Sample flowrate computation



1.0 PURPOSE

The purpose of this document if to ensure the proper operation and maintenance of Pressure Reducing Valves installed in the distribution system. Usually for more complex problems, a qualified technician should be called to service the PRV.

2.0 SCOPE

Pressure Reducing Valve visual inspection, adjustment/repair using standard diagnostics

3.0 RECORDS

Record pressure setting upstream of the PRV on AR PRV-mm-nnn

4.0 ASSOCIATED DOCUMENTS

AR PRV-mm-nnn – Accomplishment Report on Pressure Reducing Valve Operational Maintenance for the specific work

5.0 DEFINITIONS

Pressure Reducing Valve – an equipment used in the water distribution system to reduce pressure to a desired level.

6.0 RESPONSIBILITY

It is the responsibility of the Maintenance and NRW Department Manager to maintain this work instruction and introduce improvements that may be necessary. The Water Distribution Division Manager is responsible for training the Distribution Operation teams on the implementation of this work instruction. The Distribution Operation team members are responsible for the implementation of the instructions in this procedure.

7.0 TOOLS AND EQUIPMENTS

Appropriate Hand Tools

Portable Lighting Equipment

Portable Generator

Dewatering Pump and Hose

8.0 SAFETY REQUIREMENTS

Personal Protective Equipment

Traffic Cones and Barriers

Portable Warning Lights

9.0 INSTRUCTIONS

9.1 Before conducting operational maintenance on the PRV the Team Supervisor shall ensure that the system is depressurized.

9.2 A competent team member shall examine the external surfaces of the PRV, including the flange face surfaces, for any signs of damage.

9.3 A set of diagnostics is shown below and should be used by a competent team member.

INDICATOR	PROBABLE CAUSE	REMEDY
Main valve fails to open	No pressure at the valve inlet	Check inlet pressure
	Main valve diaphragm assembly inoperative	Disassemble, clean and polish stem, replace defective parts
	Pilot valve not opening: 1. No spring compression 2.Damaged spring 3. Spring guide not in place 4. Yoke dragging on inlet nozzle	 1. Tighten adjusting screw 2. Disassemble and replace 3. Assemble properly 4. Assemble properly
	Flow control disc inoperative. Corrosion or excessive scale buildup on stem.	Disassemble, clean and polish stem. Replace worn parts.
Main valve fails to close	Foreign matter between disc and seat or worn disc. Scale on stem or diaphragm ruptured	Disassemble main valve, remove matter, clean parts and replace defective parts
	Flow strainer plugged	Remove and clean or replace
	Isolation valves closed	Open isolation valves
	Pilot valve remain open: 1. Spring compressed solid 2. Mechanical obstruction 3. Worn disc 4. Yoke dragging on inlet nozzle diaphragm nut	 1. Back off adjusting screw 2. Disassemble and remove obstruction 3. Disassemble. Remove and replace disc retainer assembly 4. Assemble properly

	5. Diaphragm damaged or loose diaphragm nut. Leakage from vent hole in cover	5. Disassemble. Replace diaphragm and/or tighten nut
Fails to regulate	Air in main valve cover and/or tubing	Loosen top cover plug and fittings and bleed air
	Pilot valve yoke dragging on inlet nozzle	Assemble properly
	Pilot valve spring not in correct range to control	Check outlet pressure requirements and existing spring

1.0 PURPOSE

The purpose of this document is to ensure the efficient conduct of a Step Test Procedure in a DMA. This procedure would allow the identification of possible leakage in the system through a relatively simple procedure without going through a tedious leak detection using electronic equipment.

2.0 SCOPE

Step Testing preparation, valve identification, valve testing and sounding

3.0 RECORDS

Record all valve locations and step-sections on MAP STP-mm-nnn

4.0 ASSOCIATED DOCUMENTS

MAP STP-mm-nnn – map of the DMA showing step-sections that can be shut-off by corresponding valves

5.0 DEFINITIONS

Minimum Night Flow – the minimum flow rate in the DMA during night time when presumably most customers are asleep.

DMA – District Meter Area, a smaller portion of the distribution system with only one inflow and completely isolated from the network by boundary valves

6.0 RESPONSIBILITY

It is the responsibility of the Maintenance and NRW Department Manager to maintain this work instruction and introduce improvements that may be necessary. The Water Distribution Division Manager is responsible for training Distribution Operation teams on the implementation of this work instruction. The distribution operation team members are responsible for the implementation of the instructions in this procedure.

7.0 TOOLS AND EQUIPMENTS

Vehicle

Hand Tools

Valve T-Wrench

Sounding Stick

8.0 SAFETY REQUIREMENTS

Personal Protective Equipment

Traffic Cones

9.0 INSTRUCTIONS

9.1 The team supervisor shall ensure that the DMA can be shut-off by sections (i.e. by Steps) through the closure of valves within the DMA.

9.2 The team supervisor shall prepare a map of the DMA showing the sections that can be shut-off in steps and the corresponding valves.

9.3 The valves (called Step Valves) shall be identified and operated and sounded if they can be shut-off completely.

9.4 The team supervisor shall verify the latest logged data at the Meter Point DMA in order to ascertain the time of Minimum Night Flow.

9.5 The team supervisor shall then schedule the Step Test Procedure around the time of Minimum Night Flow.

1.0 PURPOSE

The purpose of this document is to ensure the efficient conduct of a Step Test Procedure in a DMA. This procedure would allow the identification of possible leakage in the system through a relatively simple procedure without going through a tedious leak detection using electronic equipment.

2.0 SCOPE

Step valve shut-off and opening, flow rate recording, data analysis

3.0 RECORDS

Record all data and information during the activity on AR STP-mm-nnn

4.0 ASSOCIATED DOCUMENTS

MAP STP-mm-nnn – map of the DMA showing step-sections that can be shut-off by corresponding valves

AR STP-mm-nnn – Accomplishment Report Step Test Procedure for the specific work

5.0 DEFINITIONS

Minimum Night Flow – the minimum flow rate in the DMA during night time when presumably most customers are asleep.

DMA – District Meter Area, a smaller portion of the distribution system with only one inflow and completely isolated from the network by boundary valves

6.0 RESPONSIBILITY

It is the responsibility of the Maintenance and NRW Department Manager to maintain this work instruction and introduce improvements that may be necessary. The Water Distribution Division Manager is responsible for training Distribution Operation teams on the implementation of this work instruction. The distribution operation team members are responsible for the implementation of the instructions in this procedure.

7.0 TOOLS AND EQUIPMENTS

Vehicle

Hand Tools

Valve T-Wrench

Data Loggers

Comuters

8.0 SAFETY REQUIREMENTS

Personal Protective Equipment

Traffic Cones and Barriers

Portable Warning Lights

9.0 INSTRUCTIONS

9.1 The team supervisor shall configure a data logger to record flow in 10-second intervals and install this at the Meter Point of the DMA.

9.2 At the start of the activity, the flow rate shown by the flow meter is recorded

9.3 A competent team member shall then close the first step valve slowly and sound it to check complete shut-off.

9.4 When the valve is shut-off the flow rate is read and recorded

9.5 The second step valve is then shut-off and the flow rate is read and recorded.

9.6 This goes on until all step valves are closed. Care must be taken that an interval of about 10 minutes must observed between valve closures.

9.7 At the end of the activity, all valves are opened slowly from the first valve that was shut-off until the last.

9.8 The following day the team supervisor shall analyze the data gathered during the step-test as well as the data recorded by the data loggers.

9.9 A clear “step” or reduction in flow rate as a section is closed off signifies that the flow is greatest to that section, a clear indication of leakage in the section. Leakage can be estimated as equal to the value of the reduction in flow rate or the “step”.

1.0 PURPOSE

The purpose of this document if to ensure the proper conduct of Data Logging using devices installed in the distribution system. There are 82 pressure monitoring points in the system aside from other points where both pressure and flow are monitored. In each of these, data loggers, from time to time or even permanently, may be installed.

2.0 SCOPE

Data logger configuration, installation, data retrieval and analysis

3.0 RECORDS

Record accomplishment of the data logging activity on AR DTL-mm-nnn

4.0 ASSOCIATED DOCUMENTS

AR DTL-mm-nnn – Accomplishment Report - Data Logging for the specific activity

5.0 DEFINITIONS

Data Logger – a gadget used to record data such as pressure and flow at pre-determined time intervals

6.0 RESPONSIBILITY

It is the responsibility of the Maintenance and NRW Department Manager to maintain this work instruction and introduce improvements that may be necessary. The Water Distribution Division Manager is responsible for training the Distribution Operation teams on the implementation of this work instruction. The Distribution Operation team members are responsible for the implementation of the instructions in this procedure.

7.0 TOOLS AND EQUIPMENTS

Computer with Data Logger Software Installed

Data Loggers

Hand Tools

Brackets and Padlocks

8.0 SAFETY REQUIREMENTS

Personal Protective Equipment

Traffic Cones and Barriers

Portable Warning Lights

9.0 INSTRUCTIONS

9.1 The COWD uses data loggers to measure and record either flow or pressure or both at certain points in the system. This is in order to either monitor the distribution system or to try to isolate and identify problems. In any case, it is the job of the Water Distribution Division Manager to identify the most appropriate points to install data loggers.

9.2 When the point/s are determined, a competent Distribution Operation team member shall configure a data logger to:

- 9.2.1 Enable recording of pressure and/or flow using Channel 1 or 2 or both of the data logger;
- 9.2.2 Log the data at a pre-determined time interval depending on the resolution required;
- 9.2.3 Use the appropriate data logger memory either blocked/stopped where recording is stopped when the memory is full or cyclic/rotating where the older data is overwritten once the memory is full.
- 9.2.4 Synchronize the date and time with the computer used in the configuration.

9.3 When the configuration is done, a team member shall install the logger and secure the data logger with padlocks and brackets.

9.4 After the activity, the logger is retrieved and the data is download to the computer using appropriate software.

9.5 The data logger software may also be used to produce graphs or other means to visualize the information.

1.0 PURPOSE

The purpose of this document is to institutionalize the procedure for water meter accuracy tests and the interpretation of results thereof. In the past the organization depended on tests using one flow rate only putting in doubt the results of the accuracy test. This document seeks to enhance the methods employed at the Water Meter Testing Laboratory.

2.0 SCOPE

Mounting of water meters, testing at four flow rates, interpretation of test results

3.0 RECORDS

Record results and data of the meter accuracy test on AR MAT-mm-nnn

4.0 ASSOCIATED DOCUMENTS

AR MAT-mm-nnn – Accomplishment Report-Meter Accuracy Test for the specific work

5.0 DEFINITIONS

Qmin (also Q1) – the minimum flow that can be measured by a water meter

Qt (also Q2) – the transitional flow rate

Qn (also Q3) – the nominal flow rate

Qmax (also Q4) – the maximum flow rate

6.0 RESPONSIBILITY

It is the responsibility of the Maintenance and NRW Department Manager to maintain this work instruction and introduce improvements that may be necessary. The Commercial Losses Management Division Manager is responsible for training water meter technicians on the implementation of this work instruction. The water meter technicians are responsible for the implementation of the instructions in this procedure.

7.0 TOOLS AND EQUIPMENTS

Pipe Wrenches

Hand Tools

Gaskets

Water Meter Testing Bench

8.0 SAFETY REQUIREMENTS

Personal Protective Equipment

9.0 INSTRUCTIONS

9.1 Water meters up to 25 mm in diameter can be tested at the COWD Water Meter Laboratory.

9.2 The water meter technician shall mount water meters on the testing bench carefully so that there will be no leaking connections in the system.

9.3 The water meter technician shall then verify that all data for each meter is accurate, such as size, brand, serial number, meter reading, age, average consumption since installation, etc.

9.4 The water meter mechanic shall then test the batch of water meters at four different flow rates, Qmin, Qt, Qn, Qmax (see Table 1 below)

9.5 For each test flow rate the water meter mechanic shall record initial and final meter readings.

9.6 The error for each meter is then computed as:

$$E = \frac{Vr - Va}{Va} \times 100\%$$

Where :

E = meter error in percentage

Vr = volume registered (final reading – initial reading)

Va = actual test volume (from the calibrated tank)

9.7 The Maximum Permissible Error for water meters per ISO 4064 are shown below:

Qmin = +/- 5%
Qt = +/- 2%
Qn = +/- 2%
Qmax = +/- 2%

9.8 Water meters whose errors exceed the above limits are tagged and marked for disposal.

9.9 Water meter performance curves shall also be plotted in the manner shown in Figure 1 below.

9.10 Results of the meter accuracy test and all data gathered for the water meters are recorded on AR MAT-mm-nnn

Table 1: Test Flow Rates for Multijet Water Meters

Flow Rate	Unit	Nominal Diameter (DN), mm			
		15	20	25	40
Q_{min}	liter/hour	30	50	70	200
Q_t		120	200	280	800
Q_{nom}	m^3/hour	1.5	2.5	3.5	10
Q_{max}		3	5	7	20

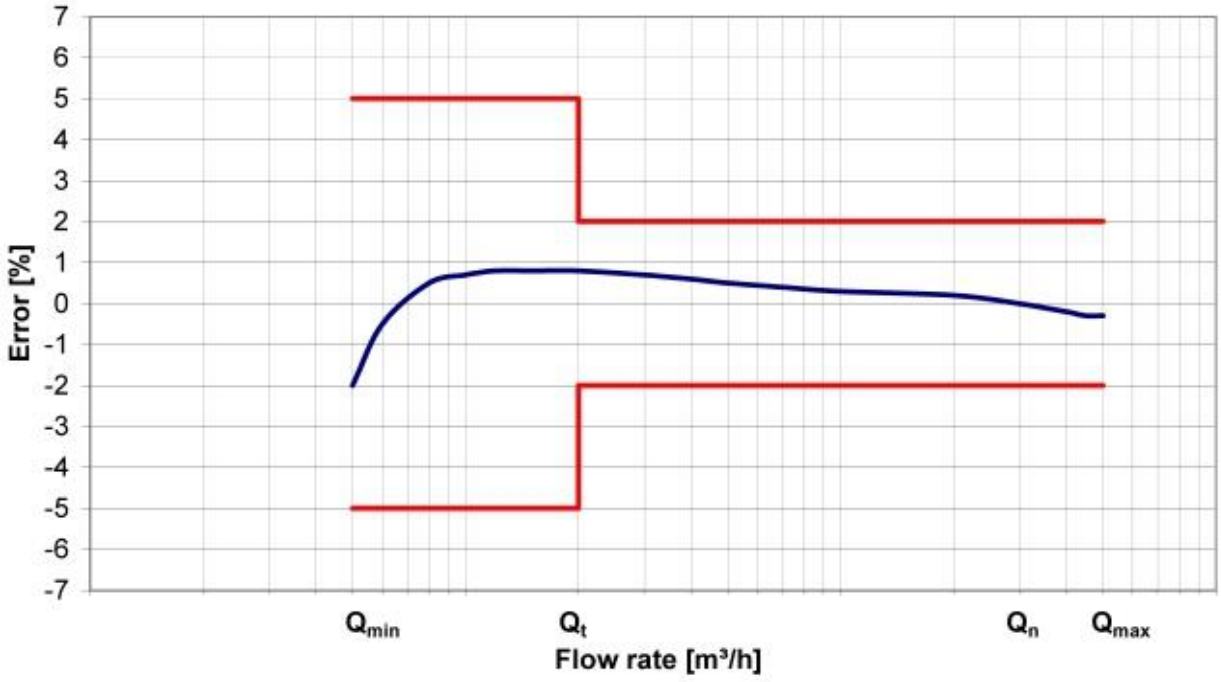


Figure 1: Typical Water Meter Performance Curve

CAGAYAN DE ORO CITY WATER DISTRICT
WORK INSTRUCTION: LEAK DETECTION USING A LEAK NOISE CORRELATOR (ACCELEROMETERS)

1.0 PURPOSE

The purpose of this document is for the efficient leak detection using a leak noise correlator.

2.0 SCOPE

Preparatory activities for leak detection, leak detection using correlator

3.0 RECORDS

Record the mobilization date and time on JO-LKD-mm-nnn

Record all necessary information on JO-LKD-mm-nnn

Record the operating hours for the leak detection equipment used on AR-LKD-mm-nnn

Record the possible leak location on AR-LKD-mm-nnn

Record the date and time of accomplishment of leak detection on AR-LKD-mm-nnn

4.0 ASSOCIATED DOCUMENTS

JO-LKD-mm-nnn – Job Order for Leak Detection-Correlator for the specific work

AR-LKD-mm-nnn – Accomplishment Report for Leak Detection-Correlator for the specific work

5.0 DEFINITIONS

Leak Noise Correlator – an equipment used to locate the possible point of leakage

Ground Microphone – an equipment used to pinpoint the location of a leak usually after conducting leak noise correlation

6.0 RESPONSIBILITY

It is the responsibility of the Maintenance and NRW Department Manager to maintain this work instruction and introduce improvements that may be necessary. The Pipeline Leakage Control Division Manager is responsible for training leak detection teams on the implementation of this work instruction. The leak detection team members are responsible for the implementation of

the instructions in this procedure.

7.0 TOOLS AND EQUIPMENTS

Vehicle

Leak Noise Correlator Equipment (Accelerometers)

8.0 SAFETY REQUIREMENTS

Personal Protective Equipment

Traffic Cones and Barriers

Portable Warning Lights

9.0 INSTRUCTIONS

9.1 Upon receipt of a report of a leakage requiring leak detection, the Pipeline Leakage Control Division Manager shall coordinate with the Water Distribution Division Manager and select the appropriate equipment to be used for leak detection. (This Work Instruction is for Leak Noise Correlator)

9.2 The leak detection team led by the team supervisor shall inspect the site and map out a leak detection plan, including time and possible sites for sensor/transmitter set-up.

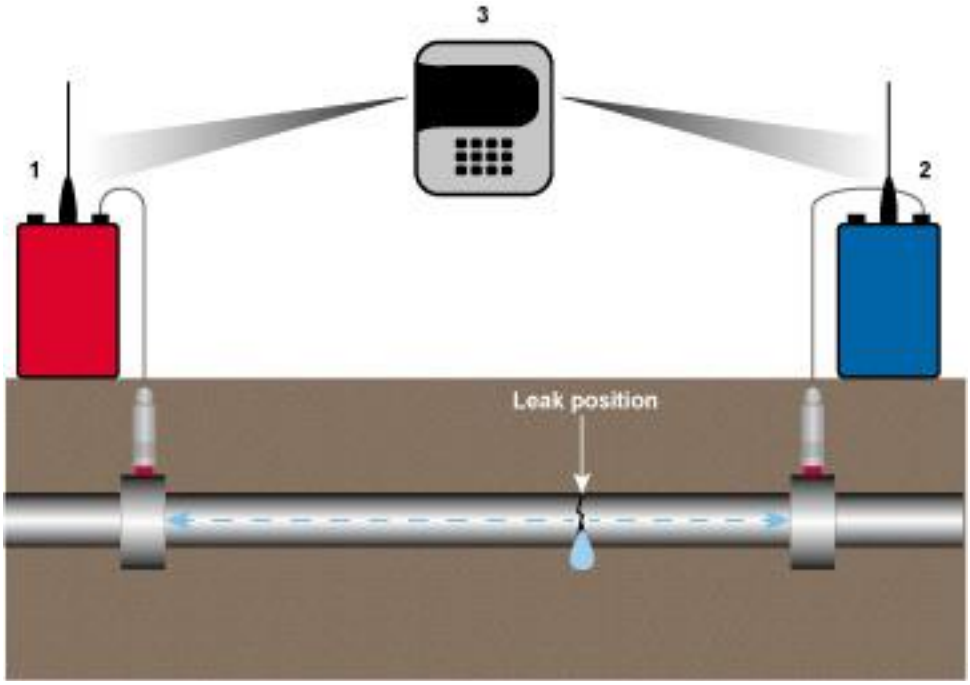
9.3 Upon evaluation that a leak detection can be done, the team supervisor shall prepare a Job Order for Leak Detection (JO-LKD-mm-nnn) showing the location of possible leakage and other information regarding the pipe.

9.4 The supervisor shall deploy a leak detection team to the area. (Note: For efficient leak detection, this is normally done at night when external noise like traffic is at a minimum.)

9.5 The team supervisor or the leadman shall supervise the installation of the sensors/transmitters on two hydrants or two appurtenances like valves or two exposed portions of the mainline such that the suspected leak is between the two points.

9.6 Leak noise correlation is then started and from the results of the correlation the possible area of the leakage is marked by spray paint or chalk on the ground.

9.7 The possible location of the leakage is then reflected in the Accomplishment Report (AR-LKD-mm-nnn)


3
1
2
Leak position

CAGAYAN DE ORO CITY WATER DISTRICT
WORK INSTRUCTION: LEAK DETECTION USING A GROUND MICROPHONE

1.0 PURPOSE

The purpose of this document is for the efficient leak detection using a ground microphone. This is usually done to verify and pinpoint more accurately the leak location detected during leak noise correlation.

2.0 SCOPE

Preparatory activities for leak detection, leak detection using ground microphone

3.0 RECORDS

Record the mobilization date and time on JO-LKD-mm-nnn

Record all necessary information on JO-LKD-mm-nnn

Record the operating hours for the leak detection equipment used on AR-LKD-mm-nnn

Record the verified leak location on AR-LKD-mm-nnn

Record the date and time of accomplishment of leak detection on AR-LKD-mm-nnn

4.0 ASSOCIATED DOCUMENTS

JO-LKD-mm-nnn – Job Order for Leak Detection-Correlator for the specific work

AR-LKD-mm-nnn – Accomplishment Report for Leak Detection-Correlator for the specific work

5.0 DEFINITIONS

Leak Noise Correlator – an equipment used to locate the possible point of leakage

Ground Microphone – an equipment used to pinpoint the location of a leak usually after conducting leak noise correlation

6.0 RESPONSIBILITY

It is the responsibility of the Maintenance and NRW Department Manager to maintain this work instruction and introduce improvements that may be necessary. The Pipeline Leakage Control

Division Manager is responsible for training leak detection teams on the implementation of this work instruction. The leak detection team members are responsible for the implementation of the instructions in this procedure.

7.0 TOOLS AND EQUIPMENTS

Vehicle

Ground Microphone

8.0 SAFETY REQUIREMENTS

Personal Protective Equipment

Traffic Cones and Barriers

Portable Warning Lights

9.0 INSTRUCTIONS

9.1 Upon receipt of a report of a leakage requiring leak detection, the Pipeline Leakage Control Division Manager shall coordinate with the Water Distribution Division Manager and select the appropriate equipment to be used for leak detection. (This Work Instruction is for Ground Microphone)

9.2 The leak detection team led by the team supervisor shall inspect the site and map out a leak detection plan.

9.3 Upon evaluation that a leak detection can be done, the team supervisor shall prepare a Job Order for Leak Detection (JO-LKD-mm-nnn) showing the location of possible leakage and other information regarding the pipe.

9.4 The supervisor shall deploy a leak detection team to the area. (Note: For efficient leak detection, this is normally done at night when external noise like traffic is at a minimum.)

9.5 A competent team member, using the ground microphone, shall walk the line where the leak was initially located and listen for the leak and try to pinpoint it.

9.6 The team member shall use as many trials as possible, each time temporarily marking the leak location on the ground. As soon as the team member is confident of the result, the leak location shall be marked with spray paint.

9.7 The possible location of the leakage is then reflected in the Accomplishment Report (AR-LKD-mm-nnn)

1.0 PURPOSE

The purpose of this document is to establish an efficient preparatory set of activities to ensure the effective implementation of mainline leak repairs covering all aspects related to it from site preparation to restoration of supply.

2.0 SCOPE

Preparatory activities prior to actual field activities, database verification, leak detection

3.0 RECORDS

Record the mobilization date and time on JO-MLK-mm-nnn

Record all necessary information on JO-MLK-mm-nnn

Record the materials, tools and equipment that will be needed on AR-MLK-mm-nnn

4.0 ASSOCIATED DOCUMENTS

JO-MLK-mm-nnn – Job Order for Mainline Leakage repair prepared for the specific work

AR-MLK-mm-nnn – Accomplishment Record for Mainline Leakage repair for the specific work

5.0 DEFINITIONS

Leak Noise Correlator – an equipment used to locate the possible point of leakage

Ground Microphone – an equipment used to pinpoint the location of a leak usually after conducting leak noise correlation

GIS System – a database system used to hold vital information about the facilities of a water utility

6.0 RESPONSIBILITY

It is the responsibility of the Maintenance and NRW Department Manager to maintain this work instruction and introduce improvements that may be necessary. The Pipeline Leakage Control Division Manager is responsible for training leakage repair teams on the implementation of this

work instruction. The leakage team members are responsible for the implementation of the instructions in this procedure.

7.0 TOOLS AND EQUIPMENTS

Leak Noise Correlator

Ground Microphone

GIS System

8.0 SAFETY REQUIREMENTS

Personal Protective Equipment

Traffic Signs and Barriers

9.0 INSTRUCTIONS

9.1 Upon receipt of a report of a possible mainline leak or failure, the team supervisor (Pipeline Repair Supervisor) or the Pipeline Leakage Control Division Manager shall conduct a site inspection together with a leakage repair team.

9.2 The team supervisor shall then prepare a Job Order (JO-MLK-mm-nnn) for the specific work to be done and a map of the location of the possible mainline leak.

9.3 The team supervisor in coordination with the Water Distribution Division Manager shall check the GIS records for the pipe material and size in the location identified.

9.4 The team supervisor shall ascertain the location of all valves necessary to isolate the leak.

9.5 The team supervisor together with a leak detection team shall locate the leak using Leak Noise Correlators, Ground Microphone or other appropriate leak detection equipment. The projected area of the leak shall be identified on the ground with spray paint.

9.6 After ascertaining that leak repair works could be properly done, the team supervisor or the division manager shall prepare a pro-form Accomplishment Report (AR-MLK-mm-nnn) outlining the scope of activities and the necessary materials, tools and equipment for each part (e.g. site preparation, excavation, actual repair,restoration).

9.7 The division manager or the team supervisor shall deploy the team to the field.

1.0 PURPOSE

The purpose of this document is to establish an efficient preparatory set of activities to ensure the effective implementation of service connection leak repairs.

2.0 SCOPE

Preparatory activities prior to actual field activities, database verification, leak detection if necessary

3.0 RECORDS

Record the mobilization date and time on JO-SLK-mm-nnn

Record all necessary information on JO-SLK-mm-nnn

Record the materials, tools and equipment that will be needed on AR-SLK-mm-nnn

4.0 ASSOCIATED DOCUMENTS

JO-SLK-mm-nnn – Job Order for Service Line Leakage repair prepared for the specific work

AR-MLK-mm-nnn – Accomplishment Record for Service Line Leakage repair for the specific work

5.0 DEFINITIONS

Leak Noise Correlator – an equipment used to locate the possible point of leakage

Ground Microphone – an equipment used to pinpoint the location of a leak usually after conducting leak noise correlation

GIS System – a database system used to hold vital information about the facilities of a water utility

6.0 RESPONSIBILITY

It is the responsibility of the Maintenance and NRW Department Manager to maintain this work instruction and introduce improvements that may be necessary. The Pipeline Leakage Control Division Manager is responsible for training leakage repair teams on the implementation of this

work instruction. The leakage team members are responsible for the implementation of the instructions in this procedure.

7.0 TOOLS AND EQUIPMENTS

Leak Noise Correlator

Ground Microphone

GIS System

8.0 SAFETY REQUIREMENTS

Personal Protective Equipment

Traffic Signs and Barriers

9.0 INSTRUCTIONS

9.1 Upon receipt of a report of a possible mainline leak or failure, the team supervisor (Pipeline Repair Supervisor) or the Pipeline Leakage Control Division Manager shall conduct a site inspection together with a leakage repair team.

9.2 The team supervisor shall then prepare a Job Order (JO-MLK-mm-nnn) for the specific work to be done and a map of the location of the possible mainline leak.

9.3 The team supervisor in coordination with the Water Distribution Division Manager shall check the GIS records for the customer/s possibly affected by the leakage.

9.4 The team supervisor together with a leak detection team shall, if necessary, locate the leak using Leak Noise Correlators, Ground Microphone or other appropriate leak detection equipment. The projected area of the leak shall be identified on the ground with spray paint.

9.5 After ascertaining that leak repair works could be properly done, the team supervisor or the division manager shall prepare a pro-form Accomplishment Report (AR-MLK-mm-nnn) outlining the scope of activities and the necessary materials, tools and equipment.

9.6 The division manager or the team supervisor shall deploy the team to the field.

1.0 PURPOSE

The purpose of this document is to ensure that the working area during mainline leakage repair is safe for excavation and repair work and that all materials necessary are available.

2.0 SCOPE

Preparatory activities, marking and delineation of work area, confirmation of leakage location, installation of traffic signs, location of control valves to shut down flow

3.0 RECORDS

Record the mobilization date and time on JO-MLK-mm-nnn

Record the tools and equipment used on AR-MLK-mm-nnn

Record the date and time of completion of the preparation work on AR-MLK-mm-nnn

4.0 ASSOCIATED DOCUMENTS

JO-MLK-mm-nnn – Job Order for Mainline Leakage repair prepared for the specific work

AR-MLK-mm-nnn – Accomplishment Record for Mainline Leakage repair for the specific work

5.0 RESPONSIBILITY

It is the responsibility of the Maintenance and NRW Department Manager to maintain this work instruction and introduce improvements that may be necessary. The Pipeline Leakage Control Division Manager is responsible for training leakage repair teams on the implementation of this work instruction. The leakage team members are responsible for the implementation of the instructions in this procedure.

6.0 TOOLS AND EQUIPMENTS

Light Truck / Vehicle

Valve keys

Spray Paint or Chalk

Listening Stick or Ground Microphone

Dewatering Equipment

Lights and power generator (if the work is being carried out after dark)

7.0 SAFETY REQUIREMENTS

Personal Protective Equipment for all team members

Traffic Cones, Road Signs, Traffic Lights or Traffic Boards

8.0 INSTRUCTIONS

8.1 The team driver shall park the vehicle in a safe location such that it forms a barrier between operatives working and the oncoming traffic.

8.2 The team supervisor or leadman shall identify exactly where the leak is, using pre-marked location and checking using a listening stick or ground microphone.

8.3 The team supervisor or leadman shall identify the extent of the likely dig and mark this on the ground with spray paint or chalk.

8.4 The team supervisor shall plan the work area, including access, heavy equipment, power generator, dewatering hose, material storage, and safe areas for personnel to plan, layout tools, prepare materials and communicate.

8.5 The team supervisor or leadman shall identify where the spoil will be located pending removal.

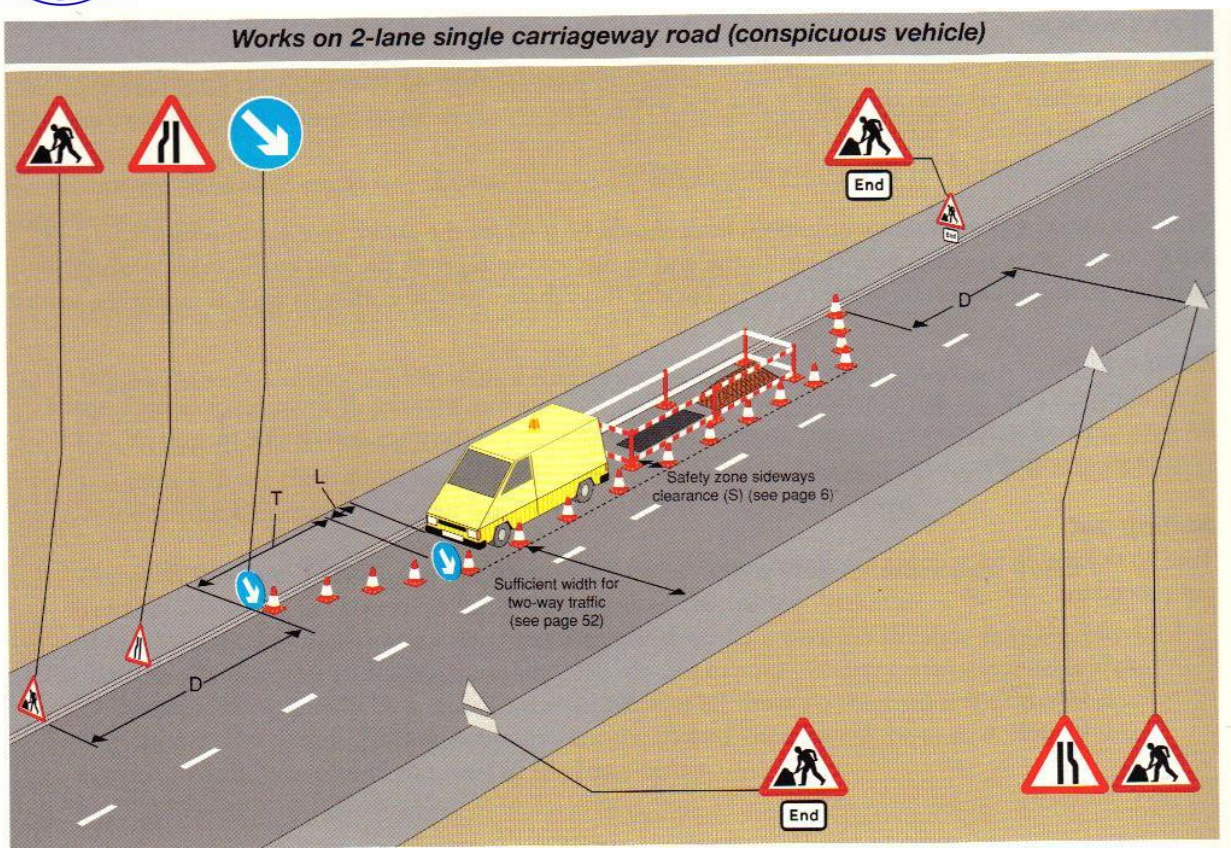
8.6 The leadman and team members shall set up barriers, road cones and road signs to ensure that road users and pedestrians are given warning of the work and kept away from the working area. If required, set up temporary traffic lights or locate an operative to manage traffic flows with a stop/go board.

8.7 The team members shall unload all mechanical and hand tools required and stack tidily within the marked out working area. Leakage repair materials may be brought to the site only when the leak is uncovered and the exact requirements are known.

8.8 The leadman and the team members shall check the area for cables and other underground utilities and mark the location of any cables.

8.9 The team supervisor or leadman shall locate the control valves which will need to be operated to shut down flows once the pipe is uncovered and the leak location is confirmed.

Personal Protective Equipment



Typical Working Area Layout

1.0 PURPOSE

The purpose of this document is to ensure the safe excavation down to the level and around the main pipe to be repaired.

2.0 SCOPE

Pavement cutting, excavation and exposure of pipe, necessary shoring, leak isolation

3.0 RECORDS

Record the mobilization date and time on JO-MLK-mm-nnn

Record the tools and equipment used on AR-MLK-mm-nnn

Record the operating hours for each equipment including fuel consumed on AR-MLK-mm-nnn

Record the date and time of completion of the preparation work on AR-MLK-mm-nnn

4.0 ASSOCIATED DOCUMENTS

JO-MLK-mm-nnn – Job Order for Mainline Leakage repair prepared for the specific work

AR-MLK-mm-nnn – Accomplishment Record for Mainline Leakage repair for the specific work

5.0 DEFINITIONS

Dewatering Pump – sometimes called a mud pump, an equipment used to pump out water from excavated areas

Sump – sometimes called a bell-hole, an expanded excavation around a leaking portion of the pipe to facilitate dewatering and repairs

6.0 RESPONSIBILITY

It is the responsibility of the Maintenance and NRW Department Manager to maintain this work instruction and introduce improvements that may be necessary. The Pipeline Leakage Control Division Manager is responsible for training leakage repair teams on the implementation of this work instruction. The leakage team members are responsible for the implementation of the

instructions in this procedure.

7.0 TOOLS AND EQUIPMENTS

Light Truck / Vehicle

Road Saw or Concrete Cutter

Mechanical Excavator (Backhoe)

Dewatering Pump and Hose

Hand Excavation Tools

8.0 SAFETY REQUIREMENTS

Personal Protective Equipment

Traffic Signs and Barriers (from WI MLK-02)

Adequate Shoring Materials

9.0 INSTRUCTIONS

9.1 The equipment operator (road saw/concrete cutter) shall cut through the road surface with the road saw following the edge of the marked out area.

9.2 The equipment operator (excavator) shall remove the tarmac road surface using a mechanical excavator and set this to one side.

9.3 The equipment operator (excavator) shall continue excavation using mechanical means provided there is no buried apparatus in the vicinity.

9.4 If buried cables are within the area, excavation should be carried out by hand by the team members. Attention to safety is essential.

9.5 The team supervisor ore leadman shall ensure that the sides of trenches are shored up if required and that any exposed pipes, cables or ducts are properly secured in place and supported from underneath or hung from above.

9.6 The equipment operator (excavator) should continue the excavation up to the depth when the pipe is expected to be exposed. At this point excavation should be done by hand by the team members to avoid damaging the water pipe any further.

9.7 The team supervisor shall ensure that adequate working space is excavated for detailed inspection around the pipe. Extra space may need to be provided to allow

for any necessary cutting and or jointing equipment to be used safely and effectively.

9.8 If water is encountered before the pipe is exposed, the leadman shall have a pump hose lowered into the excavation to keep the excavation as dry as possible.

9.9 Since a burst pipe under high pressure can quickly fill an excavation, entry to the excavation should not be permitted until the team supervisor confirms that the excavation is safe to enter.

9.10 Once the excavation has reached the level of the pipe to be repaired, a sump should be dug by the team members to allow the dewatering pump to operate continuously. The discharge of any dewatering system should be checked by the team supervisor or the leadman to ensure free outflow and that there is no danger or inconvenience caused by flooding from the outlet.

9.11 Once the pipe has been uncovered and the location of the leak has been verified, if the pipeline needs to be drained, the leak should be isolated using the valves which were identified by the team supervisor. (Note: This is not required if the repair could be done using a repair clamp.)

9.12 Extreme care should be taken by the team member assigned in operating a valve to ensure it is closed or opened slowly and smoothly. If there are any problems operating the designated valves, the supervisor should be contacted as a matter of urgency.

1.0 PURPOSE

The purpose of this document is to ensure the efficient repair of minor or small leaks in mains which can be repaired using a repair clamp without shutting off the water supply.

2.0 SCOPE

Assessment of the type of leak, selection of appropriate repair clamp, installation and fitting of repair clamp, backfilling

3.0 RECORDS

Record the mobilization date and time on JO-MLK-mm-nnn

Record the tools and equipment used on AR-MLK-mm-nnn

Record the operating hours for each equipment including fuel consumed on AR-MLK-mm-nnn

Record the date and time of completion of the repair work on AR-MLK-mm-nnn

4.0 ASSOCIATED DOCUMENTS

JO-MLK-mm-nnn – Job Order for Mainline Leakage repair prepared for the specific work

AR-MLK-mm-nnn – Accomplishment Record for Mainline Leakage repair for the specific work

5.0 DEFINITIONS

Dewatering Pump – sometimes called a mud pump, an equipment used to pump out water from excavated areas

Sump – sometimes called a bell-hole, an expanded excavation around a leaking portion of the pipe to facilitate dewatering and repairs

Repair Clamp – a repair fitting usually made of stainless steel that is fitted around a pipe using bolts

6.0 RESPONSIBILITY

It is the responsibility of the Maintenance and NRW Department Manager to maintain this work instruction and introduce improvements that may be necessary. The Pipeline Leakage Control Division Manager is responsible for training leakage repair teams on the implementation of this work instruction. The leakage team members are responsible for the implementation of the instructions in this procedure.

7.0 TOOLS AND EQUIPMENTS

Light Truck / Vehicle

Appropriate Repair Clamp

Hand Tools

Mechanical Excavator (Backhoe)

Dewatering Pump and Hose

Hand Excavation Tools

8.0 SAFETY REQUIREMENTS

Personal Protective Equipment

Traffic Signs and Barriers (from WI MLK-02 and WI MLK-03)

Adequate Shoring Materials

9.0 INSTRUCTIONS

9.1 After the excavation and exposure of the leaking pipe is done from WI MLK-03, the team supervisor or leadman shall ascertain the type of leak and the type of repair that is required.

9.2 If the team supervisor finds evidence of previous repairs, this may indicate that the overall condition of the pipe is poor and a larger section should be replaced. This Work Instruction is therefore not applicable.

9.3 When the leak found consists of small holes or a circumferential failure, an appropriate repair clamp, depending on the material and size of the pipe shall be

prepared by the team supervisor or leadman.

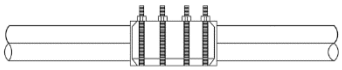
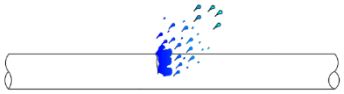
9.4 The fitting that is to be used will be checked for any defects, damage and contamination before it is used.

9.5 For split collar repairs, place over the section of faulty pipe and install by the manufacturer's instructions.

9.6 When complete the main shall be recharged.

9.7 When the main is fully charged the repair fitting should be checked for any leaks. If any are seen the repair clamp must be fitted again.

9.8 Once the leak repair has been checked and found to be robust the excavation can be backfilled using appropriate sand bedding and protection around the pipe.

Leak Type	Remedy
 PIN HOLES / HOLES	 USE OF REPAIR CLAMP
 CIRCUMFERENTIAL FAILURE	

1.0 PURPOSE

The purpose of this document is to ensure the efficient repair of leaks in mains which would require the use of a "cut-out". This is for instances where main failure are so large that a clamp is not sufficient.

2.0 SCOPE

Assessment of type of leak, selection of appropriate sleeve coupling or adaptor, cutting the required section of main, replacing the cut section with new pipe material, jointing, backfilling

3.0 RECORDS

Record the mobilization date and time on JO-MLK-mm-nnn

Record the tools and equipment used on AR-MLK-mm-nnn

Record the operating hours for each equipment including fuel consumed on AR-MLK-mm-nnn

Record the date and time of completion of the repair work on AR-MLK-mm-nnn

4.0 ASSOCIATED DOCUMENTS

JO-MLK-mm-nnn – Job Order for Mainline Leakage repair prepared for the specific work

AR-MLK-mm-nnn – Accomplishment Record for Mainline Leakage repair for the specific work

5.0 DEFINITIONS

Dewatering Pump – sometimes called a mud pump, an equipment used to pump out water from excavated areas

Sump – sometimes called a bell-hole, an expanded excavation around a leaking portion of the pipe to facilitate dewatering and repairs

Sleeve Coupling – a fitting usually made of stainless steel that is used to join two pipe sections together

Cut-out – a method of mainline repair where a section is cut and replaced with a new pipe

section

6.0 RESPONSIBILITY

It is the responsibility of the Maintenance and NRW Department Manager to maintain this work instruction and introduce improvements that may be necessary. The Pipeline Leakage Control Division Manager is responsible for training leakage repair teams on the implementation of this work instruction. The leakage team members are responsible for the implementation of the instructions in this procedure.

7.0 TOOLS AND EQUIPMENTS

Light Truck / Vehicle

Sleeve Coupling or appropriate adaptor

Adequate pipe section/s

Cutting Equipment

Hand Tools

Mechanical Excavator (Backhoe)

Dewatering Pump and Hose

Hand Excavation Tools

8.0 SAFETY REQUIREMENTS

Personal Protective Equipment

Traffic Signs and Barriers (from WI MLK-02 and WI MLK-03)

Adequate Shoring Materials

9.0 INSTRUCTIONS

9.1 After the excavation and exposure of the leaking pipe is done from WI MLK-03, the team supervisor or leadman shall ascertain the type of leak and the type of repair that is required. (This Work Instruction describes the procedure for repairing leaks

using a pipe cut-out.)

9.2 The team supervisor or leadman shall ensure that the pipe should be replaced to 300 mm beyond the location of damage to the pipe. (If in doubt the whole pipe length should be replaced, in which case both joints may need to be cut out and two replacement pipe sections used.)

9.3 Where it is possible, the team supervisor or leadman shall ensure that mains supply should be maintained until ready for the repair of the new section, maintaining positive pressure to reduce the risk of contamination of the water supply.

9.4 The team supervisor shall ensure that the leak has been isolated (see WI MLK-03).

9.5 The team supervisor or leadman shall ensure that the section of the main which will need to be removed shall be marked and cut using a disc cutter and temporary support must be placed under the main to prevent any movement while the cutting takes place. For HDPE and PVC pipes this will be done with a hand saw.

9.6 The section of main that needs to be removed from the excavation can be lifted to the surface of the excavation by the team members but care must be taken with the manual handling issues involved with lifting. If necessary, the excavator can be used providing the correct lifting sling and tackle is used.

9.7 The team supervisor or leadman shall ensure that the removed section of pipe must be placed in a suitable position outside the excavation and without the risk of rolling back into the excavation or rolling into traffic/pedestrians.

9.8 The leadman shall see to it that all cut edges should be prepared i.e. scraped, deburred, chamfered.

9.9 A sleeve coupling or another appropriate adaptor shall be used with the new pipe section to be installed.

9.10 The leadman shall ensure correct expansion gaps and good alignment of the new pipe section.

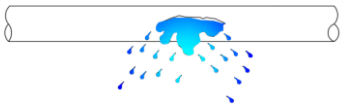
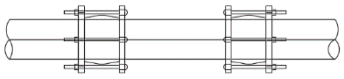
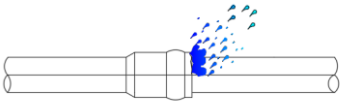
9.11 The leadman shall ensure that all bolts should be tightened evenly and sequentially as recommended by the manufacturer.

9.12 If any coatings to the pipe are damaged, e.g. polythene wrapping on ductile iron, the leadman shall ensure that this is replaced.

9.13 When complete the main shall be recharged.

9.14 When the main is fully charged the repair fitting should be checked for any leaks. If any are seen the repair clamp must be fitted again.

9.15 Once the leak repair has been checked and found to be robust the excavation can be backfilled using appropriate sand bedding and protection around the pipe.

Leak Type	Remedy
 LONGITUDINAL FAILURE	 USE OF SLEEVE TYPE COUPLINGS AND SHORT PIPE
 JOINT FAILURE (BELL/SOCKET END)	

1.0 PURPOSE

The purpose of this document is to ensure the effective reinstatement (backfilling) and bring the excavation up to the surface minimizing subsequent surface subsidence and ensuring a safe road surface. This also ensures the efficient restoration of water supply to customers

2.0 SCOPE

Granular or sand bedding or protection around the pipe, backfilling, compaction, installation of sub-base course, pavement restoration, restoration of water supply

3.0 RECORDS

Record the mobilization date and time on JO-MLK-mm-nnn

Record the tools and equipment used on AR-MLK-mm-nnn

Record the operating hours for each equipment including fuel consumed on AR-MLK-mm-nnn

Record the date and time of completion of the restoration work on AR-MLK-mm-nnn

4.0 ASSOCIATED DOCUMENTS

JO-MLK-mm-nnn – Job Order for Mainline Leakage repair prepared for the specific work

AR-MLK-mm-nnn – Accomplishment Record for Mainline Leakage repair for the specific work

5.0 DEFINITIONS

Dewatering Pump – sometimes called a mud pump, an equipment used to pump out water from excavated areas

Sump – sometimes called a bell-hole, an expanded excavation around a leaking portion of the pipe to facilitate dewatering and repairs

Hydrant- an appurtenance used usually for fire-fighting purposes but may also be used eject water from a mainline for maintenance purposes

Blow-off Valve – an appurtenance used to eject water from a mainline for maintenance

purposes

6.0 RESPONSIBILITY

It is the responsibility of the Maintenance and NRW Department Manager to maintain this work instruction and introduce improvements that may be necessary. The Pipeline Leakage Control Division Manager is responsible for training leakage repair teams on the implementation of this work instruction. The leakage team members are responsible for the implementation of the instructions in this procedure.

7.0 SUPPLIES, TOOLS AND EQUIPMENTS

Light Truck / Vehicle

Compacting Equipment

Suitable Granular (sand) Material

Suitable Backfill Material

Suitable Sub-base Course Material

Hand Tools

Mechanical Excavator (Backhoe)

Dewatering Pump and Hose

Hand Excavation and Compacting Tools

8.0 SAFETY REQUIREMENTS

Personal Protective Equipment

Traffic Signs and Barriers (from WI MLK-02 and WI MLK-03)

Adequate Shoring Materials

9.0 INSTRUCTIONS

9.1 The team supervisor or leadman should ensure that the bottom of the excavation is

reasonably clear of water and any soft ground. Otherwise all soft soil should be removed by the team members from the excavated trench.

9.2 The team members shall place suitable granular (sand) bedding and protection around the pipe in layers not exceeding 150 mm and compacted by hand carefully. It is important that this completely surrounds the pipe and runs the whole length of the pipe.

Notes:

9.2.1 (FOR LEAK REPAIRS USING REPAIR CLAMPS WHERE THE MAIN IS NOT DRAINED DOWN) The repair clamp should be monitored for leakage by the leadman carefully. If it is found to be sound, then the granular or sand backfill should be brought up and over the pipe and carefully compacted.

9.2.2 (FOR LEAK REPAIRS WHERE THE MAIN HAS BEEN DRAINED DOWN) The leadman should see to it that the joints should be clear of fill so that they can be inspected for leakage.

9.3 Once the granular fill is placed to 150 mm above the crown of the pipe, selected excavated material may be used, otherwise the team supervisor or leadman shall prepare suitable backfill materials. This should be dry and free of any large lumps of clay, rock or tarmac or any other debris. It should be placed in layers of 150 mm and compacted by hand well, before another layer is placed.

9.4 Heavy compaction equipment should not be used until at least 150 mm of fill above the crown of the pipe has been placed. This compaction equipment shall be used by a competent team member.

9.5 The pipe should then be refilled (if it has been drained down) carefully by slowly opening the closed gate valves. This should be done by a competent team member.

9.6 Once the pipe has been filled, the team supervisor shall check the repair to ensure that it is not leaking. At this stage some bolt re-tightening may be required due to the increase in pressure.

9.7 The team supervisor or leadman shall ensure that any other utilities in the same trench should have granular fill carefully placed around the cables, ducts or pipes as

above.

9.8 The team members shall at all times exert efforts to keep the excavation dry during reinstatement.

9.9 The reinstatement should be brought up to 450 mm below the road surface, after which suitable sub base material should be placed and well compacted in layers not more than 150mm using a vibrating plate or roller. If concrete/asphalt is not due to be placed until another day this sub base shall be brought up to level with the road surface.

9.10 The leadman shall ensure that the repaired section should be thoroughly flushed by running water to waste via a hydrant or blow-off valve.

9.11 The leadman shall ensure that all valves are restored to their original status.

9.12 The team supervisor may then make checks with customers that the water supply has been restored.

9.13 The concrete or asphalt road pavement is then restored.

1.0 PURPOSE

The purpose of this document is to make a repair to a service pipe effectively and ensure that the repair will last and water can be restored as quickly as possible.

2.0 SCOPE

Excavation to expose the leaking service pipe, Excavation to expose the parent mainline, Replacement of entire service connection

3.0 RECORDS

Record the mobilization date and time on JO-SLK-mm-nnn

Record the tools and equipment used on AR-SLK-mm-nnn

Record the date and time of completion of the preparation work on AR-SLK-mm-nnn

4.0 ASSOCIATED DOCUMENTS

JO-SLK-mm-nnn – Job Order for Service Line Leakage repair prepared for the specific work

AR-SLK-mm-nnn – Accomplishment Record for Service Leakage repair for the specific work

5.0 DEFINITIONS

HDPE – high density polyethylene pipe, a black colored pipe commonly used for service lines

Clamp Saddle – a material used for connecting an HDPE pipe to the main pipe

6.0 RESPONSIBILITY

It is the responsibility of the Maintenance and NRW Department Manager to maintain this work instruction and introduce improvements that may be necessary. The Pipeline Leakage Control Division Manager is responsible for training leakage repair teams on the implementation of this work instruction. The leakage team members are responsible for the implementation of the instructions in this procedure.

7.0 TOOLS AND EQUIPMENTS

Sufficient length of HDPE pipe (from water main to property)

Clamp Saddle

Couplings for HDPE Pipe

Tools and equipment for installing the clamp saddle and for making HDPE joints

8.0 SAFETY REQUIREMENTS

Personal Protective Equipment

Traffic Signs and Cones

9.0 INSTRUCTIONS

9.1 The team supervisor of leadman should note that for the service pipes, a complete replacement will normally be required. A point repair is acceptable only in exceptional conditions (e.g. the service line is very new, the mainline is inaccessible).

9.2 The team members shall uncover the pipe at the point of leakage to verify the material used for the service and the extent of the leak.

9.3 Once it has been ascertained that the service pipe will need to be replaced the parent main should be located and excavated by the team members and the best route for the new service pipe ascertained by the leadman.

9.4 Where possible, the leadman should try to maintain the water supply to the property until the new connection is to be made.

9.5 If the replacement requires a road crossing, the leadman should ensure that the pipe will be inserted in a duct.

9.6 Traffic controls for the road crossing will also need to be considered. This should generally have been identified by the team supervisor.

9.7 A trench should be excavated by the team members to install the new service. If necessary road plates can be used to allow the whole trench

to be excavated while maintaining traffic flow.

9.8 Alternatively, the leadman and the team members can use a boring machine to allow the crossing of the new service connection.

9.9 The fittings and valves that are to be used shall be checked by the leadman for any defects, damage and contamination before they are used.

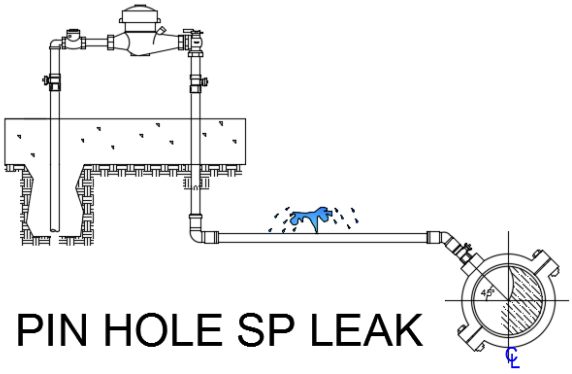
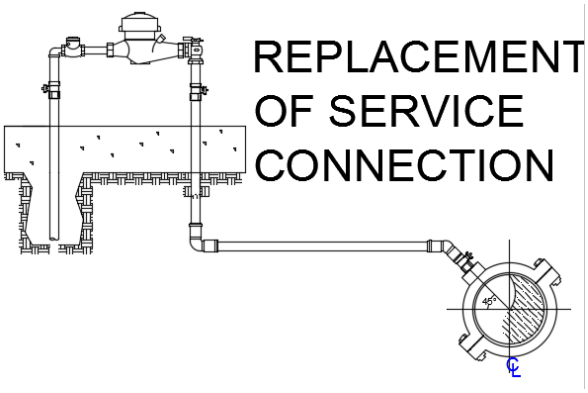
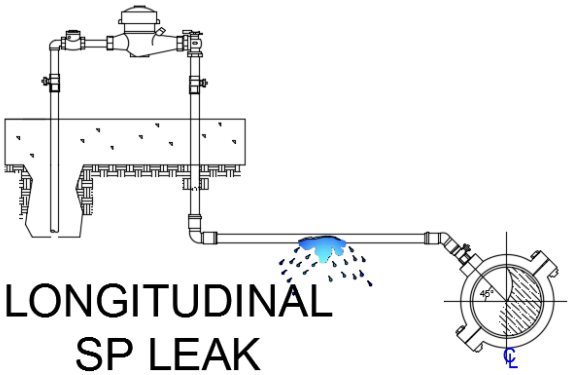
9.10 The leadman shall see to it that the fittings will be installed as recommended by the manufacturers' instructions and by a competent team member.

9.11 When the trench has been excavated and the new service has been laid from the meter to the water main the new connection can now be made.

9.12 A new tapping clamp may be installed by a competent team member on the old tapping point on the parent main, making sure that any bolts are done up evenly and to the correct torque.

9.13 The leadman shall see to it that the service pipe be flushed before connecting to the customers supply and checked for leaks. When flushing has been completed then a competent team member shall connect to the customer's side and recheck for leaks.

9.14 Backfill using adequate sand bedding and protection around the new service line should then be made.

Leak Type	Remedy
	
	

1.0 PURPOSE

This document ensures the efficient installation of service connections (including its replacement) using standard fittings and materials.

2.0 SCOPE

Excavation for mainline tapping, excavation for service pipe, installation of service connection fittings and meters, backfilling

3.0 RECORDS

Record the mobilization date and time on JO-SCI-mm-nnn

Record the tools and equipment used on AR-SCI-mm-nnn

Record the operating hours for each equipment including fuel consumed on AR-SCI-mm-nnn

Record the full Property Address or Plot No with the meter reference number and initial reading are on AR-SCI-mm-nnn.

Record the meter location details with sketch and triangulated measurements from permanent structure points where possible with their specified meter return forms on AR-SCI-mm-nnn. (Note: These are then plotted into the GIS)

Record the date and time of completion of the restoration work on AR-SCI-mm-nnn

4.0 ASSOCIATED DOCUMENTS

JO-SCI-mm-nnn – Job Order for Service Connection Installation prepared for the specific work

AR-SCI-mm-nnn – Accomplishment Report for Service Connection Installation prepared for the specific work

5.0 DEFINITIONS

HDPE – high density polyethylene pipe, a black colored pipe commonly used for service lines

Clamp Saddle (also Saddle Clamp) – a material used for connecting an HDPE pipe to the main

pipe

6.0 RESPONSIBILITY

It is the responsibility of the Engineering Department Manager to maintain this work instruction and introduce improvements that may be necessary. The Construction Division Manager is responsible for service connection installation teams on the implementation of this work instruction. The installation team members are responsible for the implementation of the instructions in this procedure.

7.0 MATERIALS, TOOLS AND EQUIPMENTS

A new Water Meter

Fittings for the service pipe and meter assembly

Adequate Length of HDPE pipe

Tools and equipment for installing the fittings and for making service pipe joints.

Hand Excavation Tools

Mechanical Excavation Equipment

Hand Compacting Tools

Mechanical Compacting Equipment

Granular (sand) material

Appropriate Backfill Material

8.0 SAFETY REQUIREMENTS

9.0 INSTRUCTIONS

9.1 The Service Connection Installers shall excavate down to the water main and expose the proposed tapping point.

9.2 The installers shall also excavate the proposed path of the service pipe to its appropriate depth.

9.3 Install the appropriate saddle clamp.

9.4 Install the HDPE service pipe using approved fittings as per manufacturer's instructions. (Note: Water must be shut-off until the connection is complete.)

9.5 Installer to confirm meter assembly location is large enough to permit fitting, removal, maintenance and reading.

9.6 Installer shall confirm prior to meter installation, the property details for the property actually being supplied.

9.7 As soon as the connection is ready, the control valve shall be opened to allow water to flow into the service connection.

9.8 Service pipe and supply pipe (service connection) shall be flushed before meter is installed. The internal terminations, within the property to be supplied, are first checked and tested to ensure proper connection and isolation for controlled flushing.

9.9 Following meter installation (please refer to the diagram below), a tap inside the property to be turned on to prove effective operation of the installed meter and to purge any air from the supply pipe.

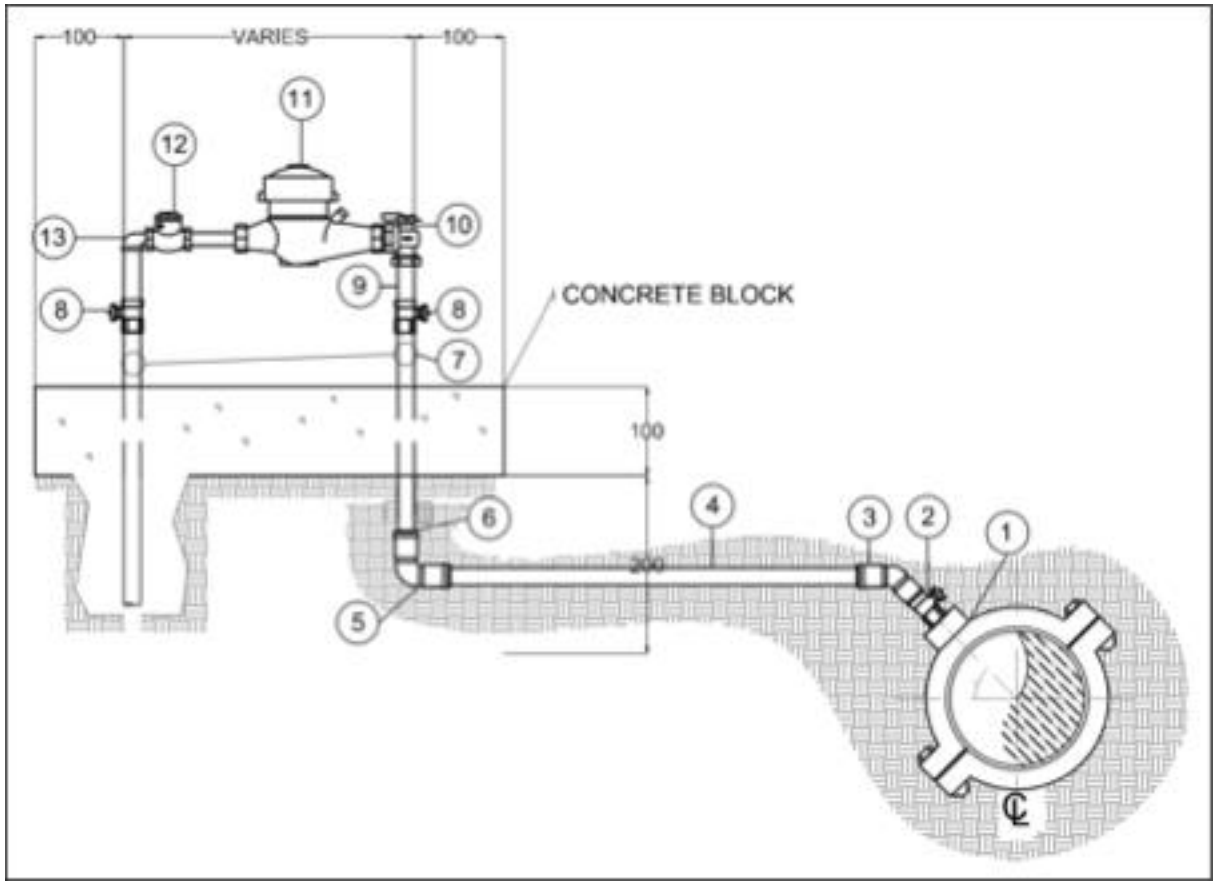
9.10 The new meter is to be suitably tagged with its respective supplied property details.

9.11 Installer to ensure that the full Property Address or Plot No with the meter reference number and initial reading are recorded and entered on the form specified (AR-SCI-mm-nnn).

9.12 Installer to provide meter location details with sketch and triangulated measurements from permanent structure points where possible with their specified meter return forms.

9.13 All excavations shall be backfilled using appropriate granular (sand) bedding and protection around the mainline (see WI MLK-07).

Standard Water Meter Installation



LABEL LEGEND

LABEL NO.	ITEM DESCRIPTION	END CONNECTION
①	SADDLE CLAMP	FTE
②	BRASS STRAIGHT BALL VALVE	MTE x FTE
③	MALE ADAPTOR 45 BEND (PUSH-IN)	MTE x SE
④	PE TUBE-ISO, SDR 11	
⑤	FEMALE ADAPTOR 90 BEND (PUSH-IN)	FTE x SE
⑥	G.S BUSHING	MTE x FTE
⑦	G.S NIPPLE	MTE x MTE
⑧	BRASS STRAIGHT BALL VALVE	FTE x FTE
⑨	G.S NIPPLE	MTE x MTE
⑩	BRASS ANGLE VALVE	FTE x FTE
⑪	WATER METER	MTE x MTE
⑫	BRASS CHECK VALVE	FTE x FTE
⑬	STREET ELBOW	MTE x FTE

1.0 PURPOSE

The purpose of this document is to ensure the efficient handling of customer requests and complaints received on the telephone. The primary objective of the organization is to provide excellent water service to the customer and this starts with the handling of queries, complaints, and calls. This document seeks to institutionalize service in the real sense of the word.

2.0 SCOPE

Responding to customer requests or complaints received on the telephone, recording the concerns, preparing job orders

3.0 RECORDS

Record all customer concerns and details on CSR-mm-nnn

Record customer concerns and details including map of the location on JO CSR-mm-nnn

4.0 ASSOCIATED DOCUMENTS

CSR-mm-nnn – Customer Service Request Record for the specific work

JO CSR-mm-nnn – Job Order Customer-Service Request prepared for the specific work

5.0 DEFINITIONS

GIS – Geographical Information System showing among others customer data, appurtenances data, maps, etc.

6.0 RESPONSIBILITY

It is the responsibility of the Commercial Department Manager to maintain this work instruction and introduce improvements that may be necessary. The Customer Service Division Manager is responsible for training the customer service representatives on the implementation of this work instruction. The customer service team members are responsible for the implementation of the instructions in this procedure.

7.0 TOOLS AND EQUIPMENTS

Telephone

GIS

Computers

8.0 SAFETY REQUIREMENTS

Not applicable.

9.0 INSTRUCTIONS

9.1 Upon lifting the telephone the customer service representative shall smile and greet the party on the other line with:
"Good Morning/Afternoon, Cagayan de Oro City Water District, this is (name of representative), how may I help you?

9.2 The representative shall then take down the request or complaint from the customer and record these on the CSR-mm-nnn

9.3 If the customer's concern is just a query which the representative can provide, s/he shall endeavor to do so (e.g. query on status of accounts or service application). If absolutely necessary, the representative may forward the call to a colleague but must explain the concern in detail himself/herself

9.4 The representative shall take care to take down details and landmarks of the customer's location

9.5 Before ending the conversation, the representative shall get contact details from the customer in case of a need to contact the customer for further details or to relay information

9.6 The representative shall then prepare a job order, JO CSR-mm-nnn which spells out the specific concern of the customer

9.7 The representative shall then use the GIS and locate the customer in the map and draw the map including landmarks on JO CSR-mm-nnn

9.8 The representative shall then endorse the job order to the appropriate department for action

9.9 The representative, after three days, shall call the department concerned and ask for feedback on the customer request/complaint

1.0 PURPOSE

The purpose of this document is to ensure the efficient handling of customer requests and complaints received in person. The primary objective of the organization is to provide excellent water service to the customer and this starts with the handling of queries, complaints. This document seeks to institutionalize service in the real sense of the word.

2.0 SCOPE

Responding to customer requests or complaints received in person, recording the concerns, preparing job orders

3.0 RECORDS

Record all customer concerns and details on CSR-mm-nnn

Record customer concerns and details including map of the location on JO CSR-mm-nnn

4.0 ASSOCIATED DOCUMENTS

CSR-mm-nnn – Customer Service Request Record for the specific work

JO CSR-mm-nnn – Job Order Customer-Service Request prepared for the specific work

5.0 DEFINITIONS

GIS – Geographical Information System showing among others customer data, appurtenances data, maps, etc.

6.0 RESPONSIBILITY

It is the responsibility of the Commercial Department Manager to maintain this work instruction and introduce improvements that may be necessary. The Customer Service Division Manager is responsible for training the customer service representatives on the implementation of this work instruction. The customer service team members are responsible for the implementation of the instructions in this procedure.

7.0 TOOLS AND EQUIPMENTS

GIS

Computers

8.0 SAFETY REQUIREMENTS

Not applicable.

9.0 INSTRUCTIONS

9.1 Upon facing the customer service representative shall smile and greet the customer: "Good Morning/Afternoon, Sir/Maam (regardless of the age or status of the customer, other vernacular terms like Manang, Manong, Day, Dong shall not be used), how may I help you?

9.2 The representative shall then take down the request or complaint from the customer and record these on the CSR-mm-nnn

9.3 If the customer's concern is just a query which the representative can provide, s/he shall endeavor to do so (e.g. query on status of accounts or service application). If absolutely necessary, the representative may refer the customer to a colleague but must accompany and introduce the customer and explain the concern in detail himself/herself

9.4 The representative shall take care to take down details and landmarks of the customer's location

9.5 The representative shall get contact details from the customer in case of a need to contact the customer for further details or to relay information

9.6 The representative shall then prepare a job order, JO CSR-mm-nnn which spells out the specific concern of the customer

9.7 The representative shall then use the GIS and locate the customer in the map and draw the map including landmarks on JO CSR-mm-nnn (the representative may do this by seeking assistance from the customer

9.8 At this point the representative may allow the customer to leave

9.9 The representative shall then endorse the job order to the appropriate department for action

9.10 The representative, after three days, shall call the department concerned and ask for feedback on the customer request/complaint

1.0 PURPOSE

The purpose of this document is to ensure the efficient treatment of water before it is distributed to the customers. Maintaining Water Quality that meets the PNSDW shall at all times be the primary aim of the COWD.

2.0 SCOPE

Feeding Rate calculation, feeding rate adjustments, chlorine or chlorine dioxide residual monitoring

3.0 RECORDS

Record Feeding Rate and resulting Chlorine or Chlorine Dioxide Residual on AR WTM-mm-nnn

Record actual Feeding Rate and Chlorine or Chlorine Dioxide Residual on AR OPR-mm-nnn

4.0 ASSOCIATED DOCUMENTS

AR WTM-mm-nnn – Accomplishment Report on Water Treatment for Feeding Rate setting or adjustment and the resulting Chlorine or Chlorine Dioxide Residual

AR OPR-mm-nnn – Accomplishment Report of Operators for the specific work detail or shift

AR WQM-mm-nnn – Accomplishment Report on Water Quality Monitoring

5.0 DEFINITIONS

Gas Chlorine – the most commonly used treatment chemical in the water industry

Chlorine Dioxide – a chemical usually generated by a Chlorine Dioxide Generator used as a substitute for Gas Chlorine especially in areas close to populated areas.

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

Chlorine Dioxide Residual – the level of chlorine dioxide detected in the product water. To maintain safety, this is maintained at 0.2 to 0.4 PPM according to PNSDW.

PNSDW – Philippine National Standards for Drinking Water

6.0 RESPONSIBILITY

It is the responsibility of the Production Department Manager to maintain this work instruction and introduce improvements that may be necessary. The Operation/Production Division Manager and the Quality Control Officer are responsible for training Production Operators on the implementation of this work instruction. The Production Operators are responsible for the implementation of the instructions in this procedure.

7.0 TOOLS AND EQUIPMENTS

Automated Gas Chlorine Feeding Equipment

Chlorine Dioxide Generator

Chlorine Dioxide Dosing Pump

Hand Tools

8.0 SAFETY REQUIREMENTS

Personal Protective Equipment

Gas Chlorine Safety Gear

9.0 INSTRUCTIONS

9.1 The Production Department Manager and the Quality Control Officer shall ensure that all Production Facilities (i.e., Booster Stations, and Production Wells which are fed directly to the network) are treated with either Gas Chlorine or Chlorine Dioxide.

9.2 The Quality Control Officer shall compute the initial feeding rate of either Gas Chlorine or Chlorine Dioxide using the following formulas:

9.2.1 For Gas Chlorine

Feed Rate = Q x PPM

Where :

Q = flow rate in million liters per day

PPM = desired chlorine residual in parts per million

Feed Rate = feeding rate of gas chlorine in kilograms per day

9.2.2 For Chlorine Dioxide

Feed Rate = (Q x PPM / CONC) x (1000/24)

Where :

Q = discharge rate in million liters per day

PPM = desired chlorine residual in parts per million

CONC = concentration of Chlorine Dioxide Solution in grams/liter

Feed Rate = feeding rate of Chlorine Dioxide in liters per hour

9.3 The Quality Control Officer shall oversee the feeding of either gas chlorine or chlorine dioxide and adjust the feeding rate when the desired chlorine residual is not attained. (Note: The desired chlorine residual may not be attained depending on the Physical and Chemical properties of the water.)

9.4 When the desired chlorine residual or chlorine dioxide residual is already attained the Quality Control Officer shall record the Feeding Rate (and any future adjustments) in either, kilograms per day (for Gas Chlorine), or liters per hour (for Chlorine Dioxide) on the AR WTM-mm-nnn.

9.5 The Production Department Manager shall oversee the implementation of the Feeding Rate by the Production Operators.

9.6 The Production Operators shall record the Feeding Rate and the Chlorine Residual on the AR OPR-mm-nnn.

9.7 When the Chlorine Residual or Chlorine Dioxide Residual falls below the desired level, the Production Operator shall inform the Quality Control Officer immediately.

9.8 The Quality Control Officer shall make adjustments to the Feeding Rate until the required Chlorine Residual is attained.

1.0 PURPOSE

The purpose of this document is to ensure the efficient monitoring of the quality of water as it is distributed to the customers. Maintaining Water Quality that meets the PNSDW shall at all times be the primary aim of the COWD.

2.0 SCOPE

Water sampling at designated sampling points, laboratory analysis for microbiological quality, water sampling at all production sources and at least 5 to 8 samples along transmission mains, physical and chemical analysis by an outside laboratory.

3.0 RECORDS

Record results of microbiological monitoring results on AR WQM-mm-nnn for the specific work

Record the physical and chemical monitoring results on AR WQM-mm-nnn for the specific work

4.0 ASSOCIATED DOCUMENTS

AR WTM-mm-nnn – Accomplishment Report on Water Treatment for Feeding Rate setting or adjustment and the resulting Chlorine or Chlorine Dioxide Residual

AR OPR-mm-nnn – Accomplishment Report of Operators for the specific work detail or shift

AR WQM-mm-nnn – Accomplishment Report on Water Quality Monitoring

5.0 DEFINITIONS

Gas Chlorine – the most commonly used treatment chemical in the water industry

Chlorine Dioxide – a chemical usually generated by a Chlorine Dioxide Generator used as a substitute for Gas Chlorine especially in areas close to populated areas.

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

Chlorine Dioxide Residual – the level of chlorine dioxide detected in the product water. To maintain safety, this is maintained at 0.2 to 0.4 PPM according to PNSDW.

PNSDW – Philippine National Standards for Drinking Water

6.0 RESPONSIBILITY

It is the responsibility of the Production Department Manager to maintain this work instruction and introduce improvements that may be necessary. The Operation/Production Division Manager and the Quality Control Officer are responsible for training Laboratory Technicians on the implementation of this work instruction. The Laboratory Technicians are responsible for the implementation of the instructions in this procedure.

7.0 TOOLS AND EQUIPMENTS

Automated Gas Chlorine Feeding Equipment

Chlorine Dioxide Generator

Chlorine Dioxide Dosing Pump

Hand Tools

Residual Chlorine Test Kit

Turbidimeter

Laboratory Equipment

8.0 SAFETY REQUIREMENTS

Personal Protective Equipment

Gas Chlorine Safety Gear

9.0 INSTRUCTIONS

9.1 Microbiological Monitoring of Water Quality

9.1.1 The Quality Control Officer shall conduct monthly monitoring of the

Microbiological Quality of Water distributed by COWD by testing for the following parameters:

- E. Coli
- Total Coliform
- Heterotropic Plate Count (HPC)
- Residual Chlorine
- Turbidity (added by COWD to the monthly monitoring)

9.1.2 The Quality Control Officer shall ensure that the required number of samples and the appropriate sampling points as specified in the PNSDW are met. (Note: at present the required number of samples is 83.)

9.1.3 The monthly monitoring shall follow the schedule described below:

- One-fourth of the number of samples shall be taken from the field and tested during the first week of every month;
- The second one-fourth during the second week, the third during the third week, the final batch during the fourth week.

9.1.4 The Quality Control Officer shall record the results on AR WQM-mm-nnn

9.1.5 When any sample turns out positive for E.Coli, Total Coliform or HPC the following measures shall be performed:

- For E. Coli contamination, the Quality Control Officer in coordination with the Public Relations Officer shall immediately issue a “Boil Water Advisory” to customers in the affected area.
- The Quality Control Officer shall initiate flushing activities in the affected area, increase Chlorine or Chlorine Dioxide Feeding Rate, and monitor Chlorine Residual.
- Another sample shall be taken and tested from the same sampling point. If this turns out positive for E. Coli, Total Coliform, and HPC the above procedure (i.e. flushing, increased feeding of chlorine, monitoring) is repeated.
- If after another sample is tested and taken and the result turns out to be positive for E.Coli, the system shall be shut-down.

9.2 Physical and Chemical Monitoring of Water Quality (Note: At the moment COWD is sourcing this out with an accredited laboratory.)

9.2.1 The Quality Control Officer shall conduct annual monitoring of the Microbiological Quality of Water distributed by COWD by testing for the following basic parameters:

- Color

- Turbidity
- Aluminum
- Chloride
- Copper
- Hardness
- Hydrogen Sulfide
- Iron
- Manganese
- pH
- Sodium
- Sulfate
- Total Dissolved Solids
- Zinc

9.2.2 The annual monitoring and testing shall be done for all production sources (e.g. Production Wells, Springs, Bulk Water Supplier).

9.2.3 The annual monitoring and testing shall also be done in at least 5 to 8 sampling points in the Transmission Lines. (Note: COWD adds this in its Physical and Chemical Monitoring even when this is not required in the PNSDW.)

9.2.4 The Quality Control Officer shall record the results in the AR WQM-mm-nnn