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Introduction

The objective of this manual is to train staff on how to repair a water main in a timely and efficient manner while minimizing disruption in service and ensuring the water main repair meets current standards. Should substandard conditions of the peripheral infrastructure be identified, further renovations will be performed. This manual only applies to the repair of the water main at the point of excavation. This procedure also lists additional substandard infrastructure that may require renovation.

Procedural Overview

The Clearances and Locations Work Group will acquire clearances for all utilities, (Gas, power, water, sewer, phone, cable, etc.), before beginning excavation at the request of the Supervisor IV. The Clearances and Locations Work Group will provide the required location numbers, job numbers, drawings and forms to the Supervisor IV as well as organize the removal of some site obstructions such as trees and poles. The Supervisor IV and the Clearances and Locations Work Group representative will mark out the water and sewer lines. The Supervisor IV will request that the Sign Shop and/or the Labourers install the required traffic control devices and ensure they are installed.

Every effort must be made to notify the public affected by a water outage prior to shutting down a water supply line. Before beginning the Supervisor IV will ensure that any underground utilities have been de-energized, if required. The Supervisor IV will coordinate, select and acquire all required equipment and materials and deploy their crew to the job site. Before using the equipment the tandem axle truck and excavator/backhoe operators must perform circle checks, log results and ensure that the regular maintenance schedule for that equipment has been followed. The tandem axle truck operator will ensure that the trailers are clean and in good working order and the water trailers are completely filled before storing. The tandem truck operator will haul the emergency water, shoring and crew trailers, making sure to take the emergency water trailer first and turn on its heater, if required.

The Supervisor IV will decide on the size and location of excavation and discuss with the excavator/backhoe operator the best method for excavating. Before any work begins all staff must be wearing the safety equipment required. Where possible, excavate parallel with the pipe being repaired. Consider the locations of other underground utilities. Excavate the area around the water main break. The Labourers shall locate the underground utilities by hand or with a feeling rod and communicate to the excavator/backhoe operator when the operator nears their location. The Labourers shall inspect shoring before use. The Supervisor IV will confirm that the shoring is safe and installation is in accordance with any regulations. Personnel must stay clear when lifting and lowering shoring. The shoring is installed with the assistance of the excavator/backhoe in accordance with manufactures instructions. Shoring must be placed in the excavation in such a manner as not to disturb any underground services. Shoring must be extended to support trench walls and install end plates installed if required.

Installed access/egress ladder must be left in place while any persons are in the excavation. Labourers shall observe the trench walls for signs of collapse throughout repair. If at any time the bottom Labourer is in danger, the top Labourer must immediately summon their exit from the excavation. The Labourers will ensure
the tools and crew trailer are clean and in good working order. The Labourers will disinfect tools and equipment before use on the water main repair.

The bottom Labourer will expose the pipe, determine location and type of repair and prepare pipe for repair. The top labour will assemble the required materials and pass them to the bottom Labourer. The repair clamp or new pipe must be installed in accordance with training manual. The Supervisor IV will determine how much pipe to replace if pipe replacement is required. A quickie saw is not recommended on asbestos cement pipes as pipe containing asbestos will create dangerous airborne particles while cutting. A recognized dangerous goods carrier must transport asbestos-cement pipe pieces over 5-kgs. Couplers without protective coatings must be covered with Denso paste and tape. A 36lb anode must be attached to the existing metallic water main, one on either end by means of Cadweld. For anode attachment the pipe must be filed to bare metal at point of weld for proper adhesion. All anodes shall be placed in such a manner as to not interfere with compaction and to follow manufactures recommendations. Before backfilling the cardboard anode cover must be wetted. A Denso tape patch must be placed over the Cadweld. Couplers must be blocked securely. The bottom Labourer will observe the new repair for leaks while the top Labourer energizes the main.

Always remove discarded pipe from excavation before backfilling. Support all utilities as required by their owner’s specifications. Have inspectors from each utility confirm their backfill specifications have been met. Ensure main and service connections are bedded to spring line with granular material and compacted. The Supervisor IV insures backfill material meets the requirements. Soil and granular material above the pipe zone must be compacted to a standard proctor density minimum of 98% and be free from frozen or substandard backfill material. Non-shrink backfill must be used beneath concrete or brick. Final grade of all excavations must be smooth and level. The top Labourer will operate hydrant and install the throttle valve and discharge hose for hydrant flushing. The line shall be re-energized/filled. The Supervisor IV will perform or monitor the performance of the water line flushing and water quality testing.

Driveways, road surfaces and sidewalks must be swept clean. The Supervisor IV will inspect the site for cleanliness before leaving the site. All unnecessary barricading will be set off to the side of the road prior to leaving the site. The Supervisor IV will submit a plan of the closed valves to the Valve Supervisor. The Supervisor IV will ensure that all the required forms and documentation are complete and submitted.
Method and Techniques

Pre-Repair

As the Water Service Disruption Reports are created, each request for repairs needs to be followed through first by prioritizing them, then submitting them to the Clearances and Locations Work Group.

Notes:

<table>
<thead>
<tr>
<th>City of Saskatoon - Water Service Disruption Report</th>
<th>Item #</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location: ____________________________</td>
<td>WRR #: ______</td>
</tr>
<tr>
<td>Call to Dispatch: ______</td>
<td>Time Dispatched: ______</td>
</tr>
<tr>
<td>Arrival Time: ______</td>
<td>Completion Time: ______</td>
</tr>
<tr>
<td>Crew Members: ______; Date Initiated: ______</td>
<td>Outage Notification Given: Yes; No;</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type of Interruption</th>
<th>Units Affected (Number without service)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Main</td>
<td>Valve</td>
</tr>
<tr>
<td>Water Conn</td>
<td>Hydrant</td>
</tr>
<tr>
<td>Curb Stop</td>
<td>Reaim</td>
</tr>
<tr>
<td>Primary Main</td>
<td>Private Leak</td>
</tr>
<tr>
<td>Primary Valve</td>
<td>Frozen Conn</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>VALVES OPERATED</th>
<th>Location of Valve</th>
<th>GIS No</th>
<th>YYMMDD</th>
<th>Time</th>
<th>Initials</th>
<th>YYMMDD</th>
<th>Time</th>
<th>Initials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrants out of Service</td>
<td>Hydrant</td>
<td>Off</td>
<td>Crew</td>
<td>On</td>
<td>Crew</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Location of Hydrant</td>
<td>GIS No</td>
<td>YYMMDD</td>
<td>Time</td>
<td>Initials</td>
<td>YYMMDD</td>
<td>Time</td>
<td>Initials</td>
<td></td>
</tr>
</tbody>
</table>

Connection drawings for: _________________________________________________________________________________
___________________________________________________________________________________________________
___________________________________________________________________________________________________

Excavation Obstructions: ____________________________

Additional Information Required: Yes; No;

Tree: ______ Comments: _____________________________________

Utility Pole: ______ Comments: _____________________________________

Fence: ______ Comments: _____________________________________

Pavement: ______ Concrete: ______ Paving Stone: ______

Other: _____________________________________________

Temporary Water Provisions: ____________________________

Traffic Controls: ____________________________

Water Trailer: ______ On Site; ______ Arranged For; Detour Required: Yes; No;

Temporary Connection: ______ Installed; ______ Arranged For; Bus Route: Yes; No;

Fill-up: ______ (Time On); ______ (Time Off); ______

PROPERTY DAMAGE: Yes: _______; No ________;

OTHER REMARKS / OBSERVATIONS:

Figure 1 – Water Service Disruption Report.
Section A of the Water Service Disruption Report. Contains the general data, the type of interruption, the units affected and all the valves out of service.

Notes:

Section B of the Water Service Disruption Report contains hydrant, excavation, temporary water, traffic controls and any additional information.

Notes:

### Figure 2 - Section A of Water Service Disruption Report

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Location of Hydrant</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>Connection drawings for</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Figure 3 - Section B of Water Services Disruption Report

<table>
<thead>
<tr>
<th>Excavation Obstructions:</th>
<th>Additional Information Required:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tree: Comments:</td>
<td>Correlation Required: Yes; No;</td>
</tr>
<tr>
<td>Utility Pole: Comments:</td>
<td>Slow Leak: Yes; No;</td>
</tr>
<tr>
<td>Fence: Comments:</td>
<td>Hydro Excavate: Yes; No;</td>
</tr>
<tr>
<td>Vehicle: Comments:</td>
<td>Washout Visible: Yes; No;</td>
</tr>
<tr>
<td>Pavement: Concrete: Paving Stone: Blvd:</td>
<td>Broke into Storm Main: Yes; No;</td>
</tr>
<tr>
<td>Other:</td>
<td>Broke into Sanitary Main: Yes; No;</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Temporary Water Provisions:</th>
<th>Traffic Controls:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Trailer: (On Site): (Arranged For):</td>
<td>Detour Required: Yes; No;</td>
</tr>
<tr>
<td>Temporary Connection: (Installed): (Arranged For):</td>
<td>Bus Route: Yes; No;</td>
</tr>
<tr>
<td>From: To:</td>
<td>Post for No Parking: Yes; No;</td>
</tr>
<tr>
<td>Fill-up: (Time On): (Time Off):</td>
<td></td>
</tr>
</tbody>
</table>

PROPERTY DAMAGE: Yes: ; No ;

OTHER REMARKS / OBSERVATIONS:

TWE 03/0401
The Clearances and Locations Work Group will provide: drawings, utility locations, location numbers, and any required forms. If required the Clearances and Locations Work Group will coordinate the removal of objects obstructing the excavation like trees and utility poles.

Notes:

The daily work sheet is created to provide other departments with the location of the Water & Sewer work being performed that day.

Notes:
Section A shows the tasks for each Supervisor IV. In this view status, location, repair type, priority, GIS #, job #, location #, activity #, and GL # are shown. The Staff not at work are listed at the bottom of section A.

Notes:

Figure 6 - Daily Work Sheet Section A
Section B shows additional information on signing, GIS#, utility locations, staffing and comments.

Notes:

<table>
<thead>
<tr>
<th>SIGNING</th>
<th>GIS</th>
<th>UTL+LOC</th>
<th>STAFFING</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>S/S</td>
<td>LABOURERS -</td>
<td>Parker/Klassen</td>
<td></td>
<td></td>
</tr>
<tr>
<td>On Site</td>
<td>BACKHOE OPERATOR -</td>
<td>Dmytrowich - 2343</td>
<td></td>
<td></td>
</tr>
<tr>
<td>On Site</td>
<td>T/A OPERATORS -</td>
<td>Pingue</td>
<td>Gravel required to complete</td>
<td></td>
</tr>
<tr>
<td>On Site</td>
<td>23535</td>
<td>Crew</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SIGNING</th>
<th>GIS</th>
<th>UTL+LOC</th>
<th>STAFFING</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>S/S</td>
<td>LABOURERS -</td>
<td></td>
<td>No homes out!</td>
<td></td>
</tr>
<tr>
<td>S/S</td>
<td>BACKHOE OPERATOR -</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S/S</td>
<td>T/A OPERATORS -</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SIGNING</th>
<th>GIS</th>
<th>UTL+LOC</th>
<th>STAFFING</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>N/A</td>
<td>LABOURERS -</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N/A</td>
<td>BACKHOE OPERATOR -</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N/A</td>
<td>T/A OPERATORS -</td>
<td></td>
<td></td>
<td></td>
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</table>

Section C shows work pending.

Notes:

<table>
<thead>
<tr>
<th>STATUS</th>
<th>LOCATION</th>
<th>REPAIR TYPE</th>
<th>PRIORITY</th>
<th>JOB #</th>
<th>LOC</th>
<th>ACTIVITY</th>
<th>GL SIGNING</th>
<th>GIS</th>
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<tr>
<td>Hold</td>
<td>Boychuck Dr. South of Taylor St.</td>
<td>Storm MH F&amp;C</td>
<td>MBL 760</td>
<td>3010</td>
<td>5-4520</td>
<td>07-210</td>
<td>Crew</td>
<td>21925</td>
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<tr>
<td>Hold</td>
<td>Boychuck Dr. South of Taylor St.</td>
<td>Storm MH F&amp;C</td>
<td>MBL 760</td>
<td>3010</td>
<td>5-4520</td>
<td>07-210</td>
<td>Crew</td>
<td>21924</td>
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<tr>
<td>Hold</td>
<td>4200 Block Taylor Street</td>
<td>Sanitary MH F&amp;C</td>
<td>MBL 563</td>
<td>4520</td>
<td>05-260</td>
<td>Crew</td>
<td>8575</td>
<td></td>
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<tr>
<td>Hold</td>
<td>412 Avenue C South</td>
<td>Curb Stop (C&amp;S)</td>
<td>MP2 4802</td>
<td>1724067</td>
<td>5-4640</td>
<td>02-170</td>
<td>S/S</td>
<td></td>
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<tr>
<td>Hold</td>
<td>213 Avenue I South</td>
<td>Curb Stop (C&amp;S)</td>
<td>MP2 48159</td>
<td>1724067</td>
<td>5-4640</td>
<td>02-170</td>
<td>S/S</td>
<td></td>
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<tr>
<td>Hold</td>
<td>4th Avenue &amp; 23th Street</td>
<td>San Bev Top</td>
<td>MBL 573</td>
<td>3012</td>
<td>5-4620</td>
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<td>S/S</td>
<td>3813</td>
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<td>San Bev Top</td>
<td>FMP 573</td>
<td>3068</td>
<td>5-4620</td>
<td>05-260</td>
<td>S/S</td>
<td>3231</td>
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</table>

Figure 7 - Daily Work Sheet Section B

Figure 8 - Daily Work Sheet Section C
The Supervisor IV will pick up all materials that can be transported with a ¾ ton truck from Public Works stores. (For larger material a truck hoist or tandem truck will be used)

Notes:

Choose excavator/backhoe and shoring types based on size of excavation and soil condition.

Notes:

Figure 9 - Yards Stores

Figure 10 – Shoring on Trailer
Upon arrival at the work site, a good spot for the trailers will be determined in order to keep them clear of the excavation site.

Representatives from utility companies can field locate their lines if required. All buried and overhead utilities shall be identified and marked prior to beginning an excavation. The Clearances and Locations Work Group representative, or the Supervisor IV will mark the city owned utilities. Locations of the utilities will be a determining factor in performing the excavation. Notes:

**APWA Colour Codes**

- Red Electric Power Lines
- Orange Gas, Oil, or Steam
- Yellow Communications Lines, Cables, or Conduit
- Blue Potable Water
- Purple Reclaimed Water, Irrigation, and Slurry Lines
- Green Sewers and Drain Lines
- Pink Temporary Survey Markings
- Gray Proposed Excavation

Figure 11 - Trailer Location

Figure 12 - APWA Colour Codes
Every effort should be made to cut the asphalt or concrete with an earth saw (winter), quickie saw or asphalt saw (summer), prior to excavating.

Notes:

Asphalt or concrete will be stripped, separated and hauled away to the designated reclamation site. Asphalt and concrete are to be recycled.

Notes:

Figure 13 – Concrete Saw

Figure 14 – Recycling
Every effort will be made to notify the public affected by a water outage. Emergency water supply trailers and temporary hook ups are options to consider when there is a water outage. A generic notification letter may be posted on apartments (front and rear doors) where notifying all individuals affected is not possible.

Notes:

When excavating to repair a water main, ensure that the majority of the excavation is on the opposite side of the sewer main, if possible.

Notes:
The trench will be sorted into salvageable material (wet or dry), and non-salvageable material. If stockpiling of salvageable material on site is not a viable option, a dumpsite will be used. The toe of the spoil piles must be a minimum of 1m (3feet 4inches) from the edge of the excavation. 

Notes:

While locating a buried utility deeper than 1.2meters (4feet), shoring shall be placed in excavation prior to a worker probing for the utility.

Notes:
Support buried utilities as required during excavation.

Notes:

**General Excavation Safety**

In the event of a natural gas line hit, the machine shall be immediately turned off, as the engine may ignite the gas, especially in calm conditions.

Notes:

Figure 19 - Supported Utility

Figure 20 - Excavator/backhoe that struck gas line.
Should a power line come to rest on the equipment, do not exit the equipment. Exit only when told it is safe to do so.

Notes:

Don't get between excavator bucket and the truck being loaded. Never stand under the bucket of the excavator/backhoe. Keep everyone in work area clear of the swing of the turntable and reach of the excavator/backhoe.

Notes:

Figure 21 - Truck contacted overhead power lines.

Figure 22 – Danger Zone
No worker will enter a trench greater than 1.2m (4 feet) in depth, without the installation of a temporary protective structure.

Notes:

**Preparing for Repair**

Should an excess amount of water be observed in the trench, install a submersible pump.

Notes:
Make sure shoring and trailer, are clean and in proper working order for transporting. Shoring trailers shall not be used to transport material unless designated for such use. Park trailer where there are no overhead lines or tree branches. Look for cracks on eyebolts and chains. Ensure that tie down straps are in good condition (Not frayed or torn).

Notes:

Hook up chain appropriately so as not to crowd lift or flexibility. Keep the chain short when transporting the shoring from the trailer to the excavation, to prevent shoring from swinging.

Notes:

Figure 25 - Shoring on Trailer

Figure 26 – Shoring Installation.
Position the excavator/backhoe far enough back so the shoring can be lifted and lowered safely. Use tag lines whenever possible. Naturally frozen soil is not considered safe and therefore must be shored.

Notes:

Once the shoring is in the excavation the side panels must be expanded hydraulically to be tight against the excavation walls. Endplates must be installed if the ends of the excavation are not sloped.

Notes:

Figure 27 – Shoring in Excavation.

Figure 28 – Shoring with Endplates
All tools must be disinfected prior to use on a water main, especially if they have been previously used on a sewer repair. Ensure that the proper disinfectant applicator is used.

Notes:

Clean off excess dirt with a rag and wire brush prior to soaking with disinfectant. Soak items with disinfectant solution (Min 5% Sodium Hypo-chlorite solution), let soak for a minimum of 7 seconds. Scrub item with a clean rag, then rinse clean with disinfectant solution. Let tools dry before use.

Notes:
After shoring is in place, install and secure the ladder in the excavation. Labourers must wear all the required personal protective equipment.

Notes:

Figure 31 – Labourer Entering Excavation

Three points of contact must be kept on the ladder when in use.

Notes:

Figure 32 - Three Points of Contact
Expose pipe by removing soil with tunnelling tunneling shovel.

Notes:

Pipe should be washed in order to inspect condition of pipe and to determine what method and materials will be used to perform repairs.

Notes:

Figure 33 - Excavating with tunnelling shovel

Figure 34 – Cleaning pipe to Identify break type
For a split pipe, determine if a repair clamp will cover corroded area. If corroded area is too severe, pipe replacement should be performed.

Notes:

Hole in pipe breaks occur due to corrosion of the pipe. In most cases a repair clamp can be used to make the repair.

Notes:
Shear (Circular) pipe breaks occur due to ground movement. Often a repair clamp can be used to make the repair.

Notes:

Figure 37 - Shear Pipe Break
Installing a Repair Clamp

After the soil has been removed from around the pipe, pipe must be cleaned on each side of the break with rasp or scraper.

Notes:

Figure 38 - Cleaning Pipe With a Rasp.

Thoroughly wash pipe of debris to ensure a good seal between the repair clamp and pipe.

Notes:

Figure 39 - Cleaning Pipe With a Rag
Repair clamps come in 300mm (12 inch), 400mm (16 inch) or 600mm (24 inch) lengths. Take repair clamp out of shipping box and back off all nuts to the end of each stud.

Notes:

Pull the two-piece clamp apart. Apply a generous amount of pipe lubricant over the entire gasket surface. This will allow the gasket to slide smoothly over the pipe during installation.

Notes:
Place the lug section of the clamp onto the pipe ensuring that the tapered gasket ends are not folded over. Slide the bolt section of the clamp under the pipe.

Notes:

Grab the lifter bar on each side of the bolt section. Gently spread and pull upwards until they snap into place. There should be no distortion or folds in the gaskets. The tapered gasket ends are still free to move into position, (in the slack below the pipe).

Notes:
Uniformly run down the nuts on each side of the clamp, ensuring that the joints between sections are approximately equal when the clamp lies snug, down on the pipe.

Notes:

Alternately tighten all nuts in uniform steps, using the strong arm.

Notes:

Figure 44 – Run Down Nuts

Figure 45 - Tighten Bolts
Tighten the bolts with a torque wrench to 75 – 80 ft-lbs. The clamp is now installed.

Notes:

The dial at the top of the torque wrench shows the torque in ft-lb.

Notes:

Figure 46 - Torque Bolts

Figure 47 - Torque Wrench
Install treated blocks snugly underneath the repair clamp - use as many blocks as required.

Notes:

**Attaching a Sacrificial Anode**

Metallic pipe requires a 36 lb sacrificial anode to be installed. Robar couplers require a 24 lb anode. The anodes will be installed by means of Cadweld.

Notes:
Prepare Pipe for Cadweld, by filing or grinding the pipe to bare metal at the point of anode wire attachment.

Notes:

Prep Cadweld with charge.

Notes:

Figure 50 - Filing Pipe

Figure 51 - Preparing Cadweld Charge
Insert stripped anode wire into sleeve.

Notes:

Attach 36-lb. Sacrificial anode’s wire to pipe, with the Cadweld connector.

Notes:

Figure 52 - Sleeve on Anode Wire

Figure 53 – Cadweld Connector
The Cadweld charge is lit with an igniter. A face shield and goggles must be worn when igniting the Cadweld.

Notes:

Figure 54 – Lighting Cadweld

Ignite Charge

Notes:

Figure 55 - Cadweld lit
Wait until the weld has cooled then gently tug on the wire to check if it is attached.

Notes:

Apply a tar patch or mastic equivalent over weld. Sacrificial anode is now installed

Notes:

Figure 56 - Cadweld Completed

Figure 57 - Denso Tape Patch
In order for the anode to work, the cardboard packaging must be wet. Depending on the ground conditions, it can take several months to a year before a dry anode will soak up enough groundwater to work efficiently. In order to allow the anodes to begin operating sooner, it is standard practice to soak the anodes with water before backfilling.

Notes:

Figure 58 - Anode
Replacing a Section of Pipe

The failed section of pipe is cut from the existing pipe using a quickie saw. Cut pipe square. A face shield and goggles must be worn when using the quickie saw, hydraulic cutters or the angle grinder.

Notes:

When cutting pipe, start at the bottom of pipe and work your way to the top, allowing water to drain.

Notes:

Figure 59 - Quickie Saw

Figure 60 - Cutting Pipe
Keep pipe wet while cutting to minimize airborne particles. Appropriate respiration tile cutters shall be used for A/C pipe. Keep pipe wet while cutting to minimize airborne particles. Appropriate respiration equipment must be used. A/C pieces under 5kgs must be double bagged and labelled for transport to the landfill. A dangerous goods carrier must transport A/C pieces over 5kg, and 24hr notice must be given to the landfill scale operators before delivering the A/C pipe. It's recommended to go to the next joint when replacing A/C pipe to avoid cutting all together.

Notes:

Hydraulic pipe cutters can be used on CI pipe.

Notes:

Figure 61 – Tile Cutters

Figure 62 - Hydraulic Pipe Cutters
After cutting both ends of failure, a crowbar may be used to dislodge failed pipe from existing bedding, being careful not to damage ends of good pipe. Check both ends of cut pipe for corrosion or cracks, which will require removal before taking an overall measurement.

Notes:

The defective section of pipe is removed from the excavation to make room for the installation of the new valve. (Ensure that labourer is out of the excavation when the excavator/backhoe or truck hoist is removing the failed valve).

Notes:
Take overall measurement. Be sure to subtract 12mm (½ inch) from overall measurement to allow for easier installation of new pipe. Relay measurement to top labourer.

Notes:

Cut the replacement pipe to the overall measurement minus 12mm (1/2 inches). The replacement pipe shall be PVC, unless otherwise stated.

Notes:
Couplers are used to connect the existing and replacement pipes. There are several different types of couplers, Robar, Romac and Maxi-fit to name a few.

Notes:

**Transition Coupler Installation**

A transition coupler is available if required. Straight, transition and reducing couplers are used to make a non-restrained connection between two pipes of the same nominal size but with different outside diameters. An example would be 100mm (4inch) PVC and A/C pipe.

Notes:

Figure 67 - Couplers and Clamps

Figure 68 - Transition Coupler
**Maxi-fit Coupler Installation**

All Maxi-fits components are coated, eliminating the need for further protection such as on site wrapping.

Notes:

The Maxi-fit coupler can be slipped over either the existing pipe or on the replacement pipe. The coupler is then centred over existing and new pipe.

Notes:

Figure 69 - Maxi-fit Couplers

Figure 70 - Maxi-fit Coupler on Pipe
Couplers are assembled using bolts tightened in the pattern shown. The bolts of a Maxi-fit coupler are then tightened with a 40-50 ft-lb torque.

Notes:

Zinc anode Protecto caps are supplied with this type of coupler. Protecto caps eliminate the need for a mechanically attached anode on the coupler. Protecto caps are threaded onto the end of each bolt.

Notes:

Figure 71 - Bolt torque pattern.

Figure 72 - Protecto Caps
If connecting to metallic pipe, a 36lb sacrificial anode must be attached to the pipe, (Use the same procedure as given in this manual). Support coupler by snugly placing treated block beneath it.

Notes:

Replacement pipe and coupler must be properly supported. Bedding material (Crushed rock and/or base gravel) must be placed underneath both pipe and coupler. Both shall be covered with the same material.

Notes:

Figure 73 - Maxi-fit Couplers

Figure 74 – Bedding Material
**Installing Robar Couplers**

Robar couplers will require dismantling. There are 3 main parts to a Robar coupler, the top section called the collar, the black rubbers called the gaskets, and middle section called the sleeve.

Notes:

Robar collar and gasket are sloped over the existing pipe. Pipe lubricant can be used for ease of installation.

Notes:

![Figure 75 - Robar Coupler](image)

![Figure 76 - Robar Coupler gasket](image)
Slip the other collar and gasket, and the sleeve over the new pipe. Centre Center coupler sleeve over the existing pipe and replacement pipe stubs. Install the bolts into the two collars.

Notes:

Coupler bolts are assembled and tightened as per Figure 71 - Bolt torque pattern. Torque bolts with 70-80 ft-lbs.

Notes:

Figure 77 – Centre Coupler

Figure 78 - Tightening Bolts
After installation, couplers must be blocked securely using treated wooden blocks.

Robar couplers require a 24lb anode and metallic pipe requires a 36lb anode. Attach anodes as described in the anode installation section of this manual.

Notes:
**Post-repair**

Remove all hand tools from excavation, exit, and remove ladder. Never throw tools out of excavation. Clean tools prior to storing.

Notes:

![Figure 81 - Worker exiting excavation](image1)

Disinfect throttle valve and hydrant port with disinfectant solution. Attach throttle valve and hose onto hydrant. Ensure throttle valve is open and run hose to the storm manhole or catch basin; alternately a diffuser can be used.

Notes:

![Figure 82 - Disinfecting Throttle Valve](image2)
Open the valve upstream of the repair to flush the main past the repair. Air will be expelled from the water main while it fills with water. Open the valve slowly. Opening it too fast can create water hammer, which can further damage the water main.

Notes:

Test for turbidity and chlorine. Flush though hydrant until turbidity and chlorine levels have been reached. Take a water sample from the hydrant with the water sample jar. Deliver water sample to the water treatment plant for bacteriological testing. Follow the procedures in the water quality SOP.

Notes:
Turn the hydrant off, slowly. The water main is now under pressure. Check the new repair for leaks. Listen to the hydrant for sounds that could indicate another break in the main.

Notes:

Excavator/backhoe operator removes shoring from excavation, placing it on trailer. Ensure all shoring equipment and its trailer have been serviced and are ready for the next job. Keep shoring clean. Keep shoring & trailer clean. End plates should be stored in proper place on trailer and be easily accessible.

Notes:

Figure 85 - Inspecting For Leaks

Figure 86 – Removal of shoring
**Backfill, General Information**

If soil conditions at base of excavation are saturated and/or unstable, remove unsuitable material below pipe and replace with crushed rock and/or granular material.

Notes:

Cover services connection and mains with 150mm [6in.] of granular material and compact. Use spoil material if suitable. If not, bring in clean backfill material.

Notes:

Figure 87 - Saturated Soil

Figure 88 – Backfill
Non-shrink backfill shall be used when concrete or brick will be replaced, for example; curb boxes and hydrants. Leave non-shrink backfill a minimum of 300mm (12 inch) below grade.

Notes:

Ensure utilities are backfilled according to the specifications of the owner of the utility. A representative from the utility may be required to inspect and approve the bedding.

Notes:
Backfill material should be free from loam [fertile material] sod, boulders, foreign material and frozen lumps.

Notes:

Mechanical methods of compaction are required. Select the method of compaction based on suitability.

Notes:
Handheld plate tampers are to be used for compacting in the pipe zone, around manholes etc. Backfill shall be placed in 150mm (6 inch) lifts.

Notes:

Hydraulic tamper [excavator attachment] cannot be used closer than 1m (3ft.) directly above pipe or service. Backfill shall be placed in 150mm (6 inch) lifts.

Notes:
Vibratory roller packer must be used for larger excavations. Backfill shall be placed in 150mm (6 inch) lifts.

Notes:

Bucket tamping is not an approved method of compacting.

Notes:
Leave adequate room for asphalt or concrete as per the Roadway Section's instruction. If on grass do not leave topsoil higher than existing grade to accommodate turf.

Notes:

Before leaving the site any unnecessary traffic control devices will be removed, as per traffic control manual.

Notes:
Others will perform site restoration.

Notes:

Figure 99 - Repaving an excavation
Resources Required

People

1 - Supervisor IV
2 - Labourers
1 - Excavator/Backhoe operator
2 - Tandem axle truck operators
1 - Loader operator (as required)

Figure 100 - Crew

Equipment / Tools

Figure 101 - Feeling rod
Notes:

Figure 102 - Tunnelling Shovel
Notes:
Figure 103 - Shovels
Notes:

Figure 104- Broom
Notes:

Figure 105 - Scraper
Notes:

Figure 106 - Rasp / File
Notes:
Figure 107 - Cordless drill
Notes:

Figure 108 - Strong Arm
Notes:

Figure 109 - Torque wrench
Notes:

Figure 110 - Cadwelder
Notes:
Figure 111 - Sledge Hammer

Notes:

Figure 112 - Pick Axe

Notes:

Figure 113 - Valve Key

Notes:

Figure 114 - Disinfectant Sprayer

Notes:
Figure 115 - Quickie Saw
Notes:

Figure 116 - Tile Cutter
Notes:

Figure 117 - Hydraulic Cutter
Notes:

Figure 118 – Emergency Water Supply Trailer
Notes:
Figure 119 - Crew Trailer

Notes:

Figure 120 – Excavator/backhoe

Notes:

Figure 121 - Shoring & Trailer

Notes:

Figure 122 – Truck

Notes:
Figure 123 - Front End Loader
Notes:

Figure 124 - Hydrant Key
Notes:

Figure 125 - Hydrant Hose
Notes:

Figure 126 - Diffuser
Notes:
Figure 127 - Hydraulic Tamper [excavator attachment]

Notes:

Figure 128 - Vibrator Roller Packer

Notes:

Figure 129 - Handheld Plate Tamper

Notes:

Figure 130 - Vibratory Compactor

Notes:
Figure 131 - Chlorine Tester
Notes:

Figure 132 - Turbidity Meter
Notes:

Figure 133 – Asphalt/Concrete Saw
Notes:
Material

Figure 134 - Robar Coupler
Notes:

Figure 135 - Maxi-fit Coupler
Notes:

Figure 136 - Repair Clamps
Notes:

Figure 137 - PVC Pipes
Notes:
Figure 138 - 36lb Anode

Notes:

Figure 139 - Anode wire sleeve

Notes:

Figure 140 - Denso tape

Notes:

Figure 141 - Denso Paste

Notes:
Figure 142 - Water sample Jar

Notes:

Figure 143 - Cadweld charge

Notes:

Figure 144 - Treated block

Notes:

Figure 145 - Cleaning rags

Notes:
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Notes:
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