AGENDA
SPECIAL PUBLIC WORKS AND ENGINEERING COMMITTEE MEETING

January 23, 2018, 4:30 PM - 6:30 PM
Board Room, Service and Resource Centre,
411 Dunsmuir Street, Nanaimo, BC

Pages

1. **CALL THE SPECIAL MEETING OF THE PUBLIC WORKS AND ENGINEERING COMMITTEE TO ORDER:**

2. **INTRODUCTION OF LATE ITEMS:**

3. **ADOPTION OF AGENDA:**

4. **ADOPTION OF MINUTES:**

   a. **Minutes** 3 - 7

   Minutes of the Public Works and Engineering Committee Meeting held in the Board Room, Service and Resource Centre, 411 Dunsmuir Street, Nanaimo, BC on Wednesday, 2017-SEP-13 at 4:30 p.m.

5. **PRESENTATIONS:**

6. **REPORTS:**

   a. **Water Metering Policy** 8 - 110

   To be introduced by Poul Rosen, Senior Manager Engineering.

   Purpose: To present options and recommendations regarding the draft "11-5600-03 Water Metering Policy".

   Presentation to be provided by Steve Brubacher, Water Consultant, Urban Systems.

   Recommendation: That the Public Works and Engineering Committee endorse “11-5600-03 Water Metering Policy” and recommend that Council endorse the Policy.

   b. **2018 Strategic Priorities Engineering and Public Works Committee** 111

   To be introduced by Bill Sims, Director of Public Works and Engineering.

   For committee discussion.

c. **2018 Public Works and Engineering Committee Key Date Calendar** 112

For information.

7. **OTHER BUSINESS:**

8. **QUESTION PERIOD:**

9. **ADJOURNMENT:**

MINUTES
OPEN PUBLIC WORKS AND ENGINEERING COMMITTEE MEETING
BOARD ROOM, SERVICE AND RESOURCE CENTRE
411 DUNSMUIR STREET, NANAIMO, BC
WEDNESDAY, 2017-SEP-13, AT 4:30 P.M.

PRESENT:	Members:	Councillor J. Hong, Chair Councillor J. Kipp L. Cake M. Leach R. Irish W. Milligan
	Absent:	M. Donnelly M. Herold W. Wells
	Staff:	B. McRae, Chief Operations Officer P. Rosen, Senior Manager Engineering P. Stewart, Manager Engineering Projects B. Sims, Manager, Water Resources C. Davis, Manager of Sanitation, Recycling and Public Works Administration S. Snelgrove, Deputy Corporate Officer S. Griffin, Recording Secretary

1. CALL THE PUBLIC WORKS AND ENGINEERING COMMITTEE MEETING TO ORDER:

   The Public Works and Engineering Committee Meeting was called to order at 4:30 p.m.

2. INTRODUCTION OF LATE ITEMS

   (a) Add Agenda Item 5(b) – Automation Update.

3. ADOPTION OF AGENDA:

   It was moved and seconded that the Agenda, as amended, be adopted. The motion carried unanimously.

4. ADOPTION OF MINUTES:

   It was moved and seconded that the Minutes of the Regular Meeting of the Public Works and Engineering Committee held in the Board Room Service and Resource Centre, 411 Dunsmuir Street, Nanaimo, BC, on Wednesday, 2017-JUL-12 at 4:30 p.m. be adopted as circulated. The motion carried unanimously.

5. PRESENTATIONS:

(a) Major Capital Projects

Introduced Poul Rosen, Senior Manager, Engineering.

Phil Stewart, Manager of Engineering Projects, provided a presentation on the following Engineering Capital Projects:

1. Millstone Trunk Sewer
    - upgrade of approximately 1km of the millstone trunk sewer,
    - budget for the project $3,024,000,
    - project was scheduled for 2016 but delayed due to weather,
    - completion is excepted within the next 3 – 4 weeks; and,
    - major asset, seismic design and high density piped used.

2. Terminal Avenue Utility Upgrade
    - utility upgrades to be completed in 2017,
    - paving and surface upgrades to be completed in 2018,
    - budget for the 2017 upgrades $2,645,278,
    - budget for the 2018 upgrades $2,145,621; and,
    - paving and surface construction completion in the spring/summer of 2018.

    Committee discussion took place regarding the Terminal Avenue Utility Upgrade and the cross contamination control for the project. Traffic disruption was lower than expected.

3. Linley Valley West Roundabout
    - due to open Monday, September 17, 2017,
    - dual lane roundabout; and,
    - budget for the project $2,193,686.

    Committee discussion took place regarding the Linley Valley West Roundabout on the following:
    - concern about pedestrians in crosswalk and vehicles not being visually aware of pedestrians,
    - crosswalk being painted or having flashing lights,
    - speed limit set at 50km/hr,
    - design is to slow traffic down; and
    - City pays for the roundabout through Development Charges and development contributions.

4. Hammond Bay Road Widening and Utilities
    - tender was out for bids, none had been received,
    - scope includes road widening, sidewalk, street lighting, slope improvements and stabilization, storm sewer replacement,
    - budget $2,208,322,
    - delayed to 2018,
    - widening is a challenging in certain areas,

- Hammond Bay Road is an old road that is not built to current standards; and,
- there are tension cracks along the road which are expensive to upgrade.

5. Bastion Bridge
    - scope includes rehabilitation, seismic retrofit and gateway feature,
    - budget $1,850,00, and,
    - currently on hold until staffing capacity is available.

6. Northfield Road, Boundary Avenue, HWY 19A
    - current issues with left turn from Northfield Road to Boundary Avenue, right turn form Northfield Road to Highway 19A and left turn from Boundary Avenue to Northfield Road,
    - railway standards provide the biggest challenge,
    - left turns back up traffic on the highway and traps cars on the railway,
    - proposed upgrades include protected only left turn signal, dedicated right and left turn signals, acceleration lane, dedicated left turn lane, new signal for rail clearance, pedestrian and cyclist improvements and improved pedestrian crossing,
    - intersection has been studied since the 1970's,
    - proposed design is a comprise,
    - cost haring project between the City and Ministry of Transportation and Infrastructure; and,
    - tender to go out in the fall and construction to start winter of 2018.

Committee discussion took place regarding the flow of traffic in proposed area with commercial and emergency vehicles having access and road space to maneuver.

Phil Stewart, Manager of Engineering Projects, provided a presentation on the following upcoming projects:

1. Projects for 2018:
    - Chase Rive Pump Station,
    - Wellcox Access,
    - Georgia Greenway,
    - Waterfront Walkway, and,
    - Emergency Water Supply.

2. Projects for 2019:
    - Millstone Trunk Sewer (Bowen Park & Pearson Bridge), and,
    - Jingle Pot & Westwood Signalization.

3. Other Projects:
    - Boxwood Road Connector,
    - Terminal Trench upgrades; and,
    - Madsen Road upgrades.

It was moved and seconded that the Public Works and Engineering Committee receive the presentation from Phil Stewart, Manager of Engineering Projects regarding the Engineering Capital Projects. The motion carried unanimously.

(b) Automation Update

Charlotte Davis, Manager of Sanitation, Recycling and Public Works Administration provided a presentation on the Automated Solid Waste Collection which included:

- residents will be given three carts each,
- residents will be given new garbage calendars for October,
- garbage carts have a unique ID tag,
- City of Nanaimo will own the carts,
- mobile app is available to download,
- options for residents with mobility issues; and,
- single family dwellings and units with up to 4 residences will receive the service.

It was moved and seconded that the Public Works and Engineering Committee receive the presentation from Charlotte Davis, Manager of Sanitation, Recycling and Public Works Administration regarding Automated Solid Waste Collection. The motion carried unanimously.

6. OTHER BUSINESS:

(a) Public Works and Engineering Committee 2017 Initiatives

It was moved and seconded that the Public Works and Engineering Committee select the following 2017 Strategic directions:

1. the use of traffic calming measures; and,
2. speed limits and speed limit rationales.

The motion carried unanimously.

7. QUESTION PERIOD:

- Ron Bolin, re: if the presentations would be available to the public and concern about the new carts having rodent protection.
- Robert Fuller, re: requesting a list of qualifications be available to the public for the carry out service and the size of the garbage trucks for smaller more dense areas of town.

8. ADJOURNMENT:

It was moved and seconded at 6:18 p.m. that the meeting terminate. The motion carried unanimously.

____
CHAIR

CERTIFIED CORRECT:

____
CORPORATE OFFICER

CITY OF NANAIMO
THE HARBOUR CITY

Committee Report

File Number: 5260.20.73

DATE OF MEETING January 10, 2018

AUTHORED BY DORIS FOURNIER, MANAGER OF MUNICIPAL INFRASTRUCTURE

SUBJECT 11-5600-03 WATER METERING POLICY

OVERVIEW

Purpose of Report
To present options and recommendations regarding the draft “11-5600-03 Water Metering Policy”.

Recommendation
That the Public Works and Engineering Committee endorse “11-5600-03 Water Metering Policy” and recommend that Council endorse the Policy.

BACKGROUND

Water meters represent an important component of the municipal water system as they measure the consumption of water by users. Meters are proven tools for water conservation, equity billing, minimizing system losses, and delaying supply, treatment and conveyance infrastructure upgrades.

With the mandatory metering program implemented decades ago, the City has approximately 25,350 meters, consisting of about 24,000 residential meters and approximately 1,350 ICI (industrial / commercial / institutional) meters. These meters service approximately 91,000 people. With estimated service life of 20 years, a large portion of the City’s water meters will require renewal in the next five (5) years.

Following good asset management practices, there is an ongoing need to upgrade and replace aging water meter infrastructure. With the average age of the water meter infrastructure nearing its expected useful life, an initiative was undertaken to look at the entire meter life cycle and compatibility with reading systems and interface software. This work was undertaken by Urban Systems, and resulted in a Council-level draft Policy and a Staff-level Strategy for water metering.

This Policy is important to the City, as the purveyor of water, owner of the infrastructure, and governing body. The main aspects of the Water Meter Policy include:

- The vision and goals of the City as articulated in the Official Community Plan being realized through the development of strategies, plans, and standards for water meters.
- Providing clarity to consultants, contractors, developers and Staff around metering requirements.
- Technology selection guidelines that will enhance the long-term value of meter service provided and asset stewardship on a sustainable basis.
- Ensuring coherence with the proposed Cross Connection Control Bylaw.

OPTIONS

1. That the Public Works and Engineering Committee endorse "11-5600-03 Water Metering Policy" and recommend that Council endorse the Policy:
   - **Budget Implication:** With the City already fully metered, there should be no direct financial implications to implement this Policy. However, the Policy is meant to guide asset management decisions, and the selection of technology that may have direct and indirect impacts in the future.
   - **Purchasing Implications:** The proposed Policy recommends that up to a maximum of three (3) meter manufacturers be chosen to supply City meters based on criteria outlined in the 2017 Water Metering Strategy. This will establish a competitive market for water meters; while ensuring a limit on variables such as spare parts, read and software compatibility and Staff familiarity with materials.

2. That the Public Works and Engineering Committee to recommend changes to the draft "11-5600-03 Water Metering Policy".

SUMMARY POINTS

- Water meters represent an important component of the municipal water system.
- The Policy is relevant to the City, as the purveyor of the water, the owner of the infrastructure and the governing body.
- The Policy will ensure that consultants, contractors, developers and Staff have a clear vision of metering requirements and coherence with the proposed Cross Connection Control Bylaw.

ATTACHMENTS

Attachment A - Draft "11-5600-03 Water Metering Policy"

Attachment B - 2017 Water Metering Strategy

Submitted by:	**Concurrence by:**
Doris Fournier Manager, Municipal Infrastructure	Poul Rosen Senior Manager, Engineering

.

CITY OF NANAIMO
THE HARBOUR CITY

WATER METERING STRATEGY

URBAN systems

550 – 1090 Homer Street
Vancouver, BC V6B 2W9
Contact: Steve Brubacher, P.Eng.
T: 604.235.1701
sbrubacher@urbansystems.ca

urbansystems.ca

Report to:

City of Nanaimo
411 Dunsmuir Street
Nanaimo, BC
V9R 5J6

Attn: Rick Borean, AScT, Engineering Projects Technologist

Prepared by:

Urban Systems Ltd.
550 – 1090 Homer Street
Vancouver, BC
V6B 2W9

October 2, 2017

Steve Brubacher, P.Eng.
Project Manager

Jacob Scissons, P.Eng.
Project Engineer

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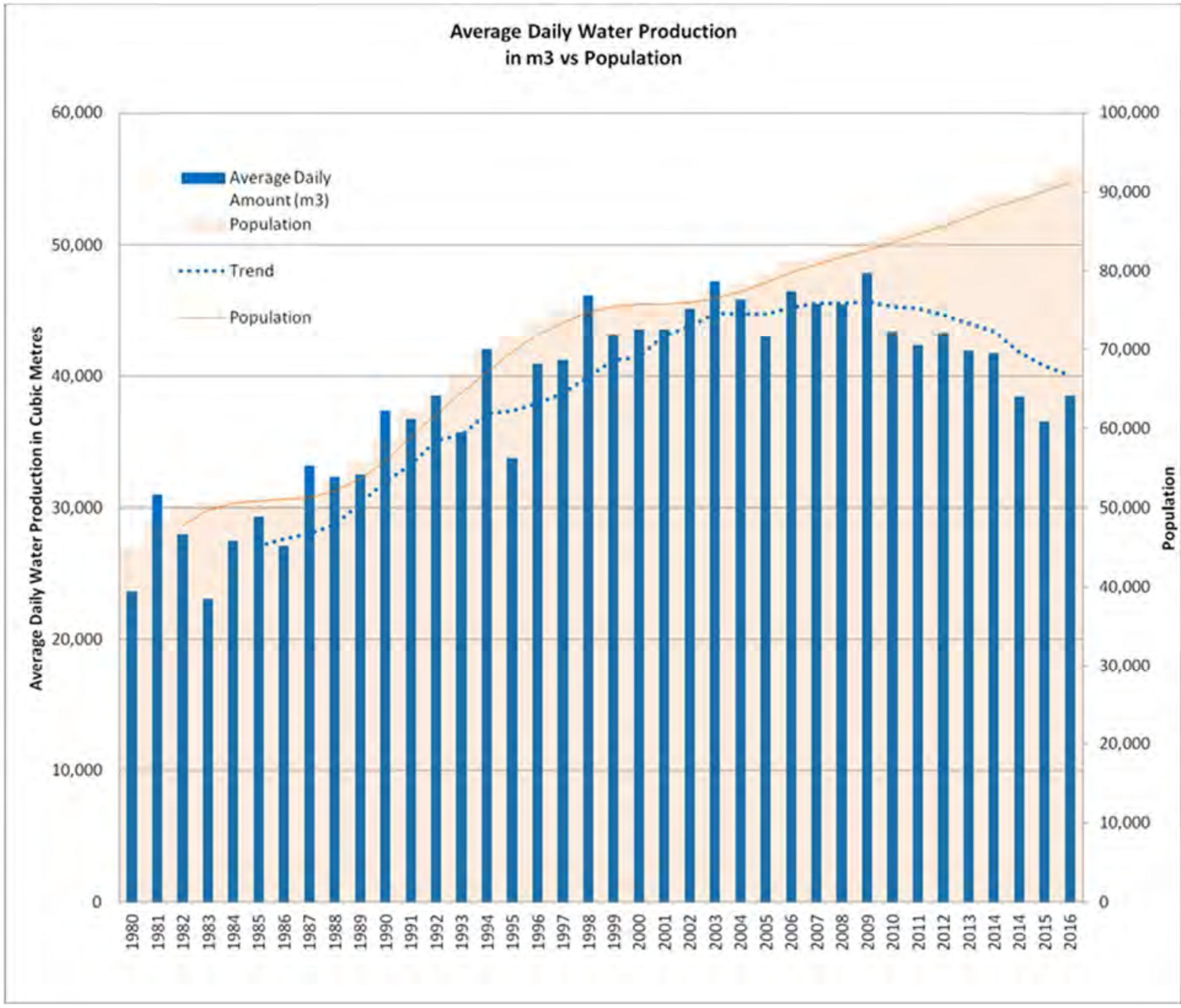
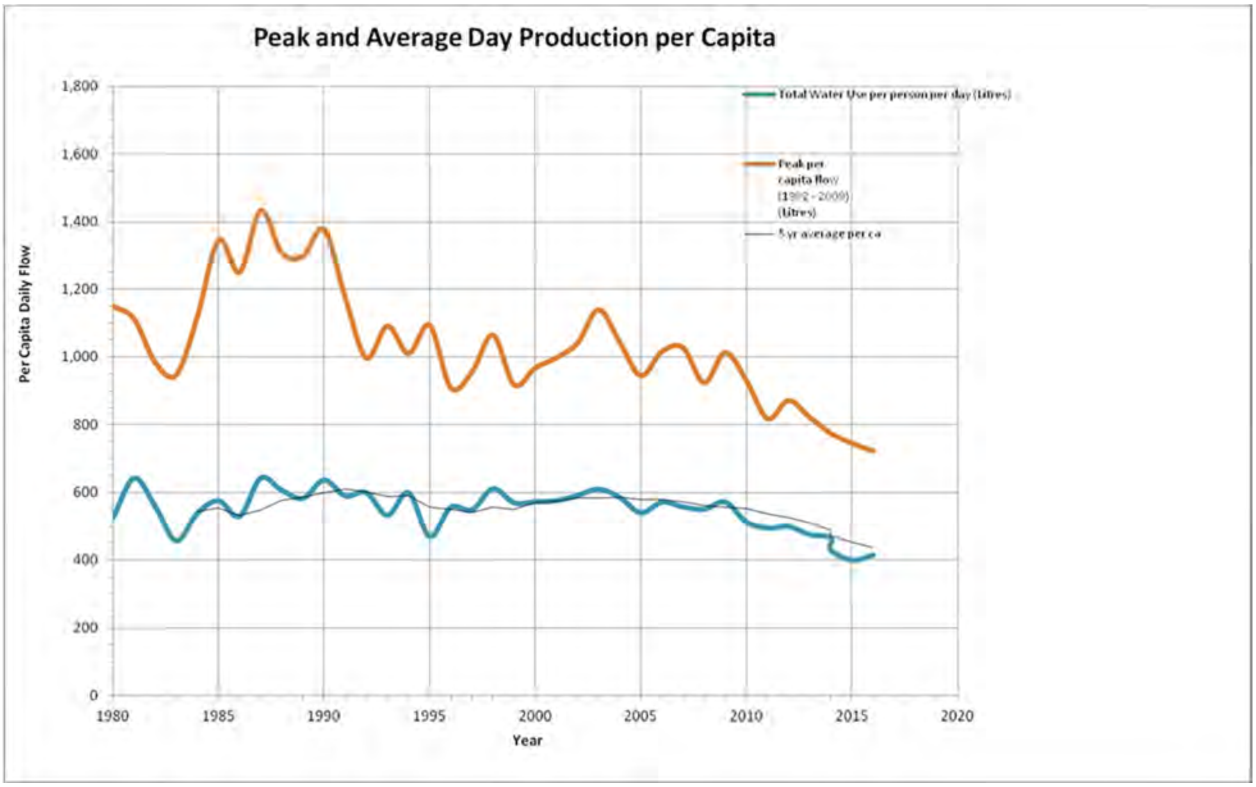
Appendices

1.0 Introduction

The City of Nanaimo (City) has a demonstrated water conservation track record that spans in excess of 35 years. Water efficient design practices are first noted in the City's design standards dating back to 1978 and universal metering was completed by 1983. The City has utilized water meters to provide effective feedback to customers on their water use. The City has also used meters to support the movement to full cost pricing for water services in 1992. The following graphs illustrate what effect these measures have had on the City's overall water use.



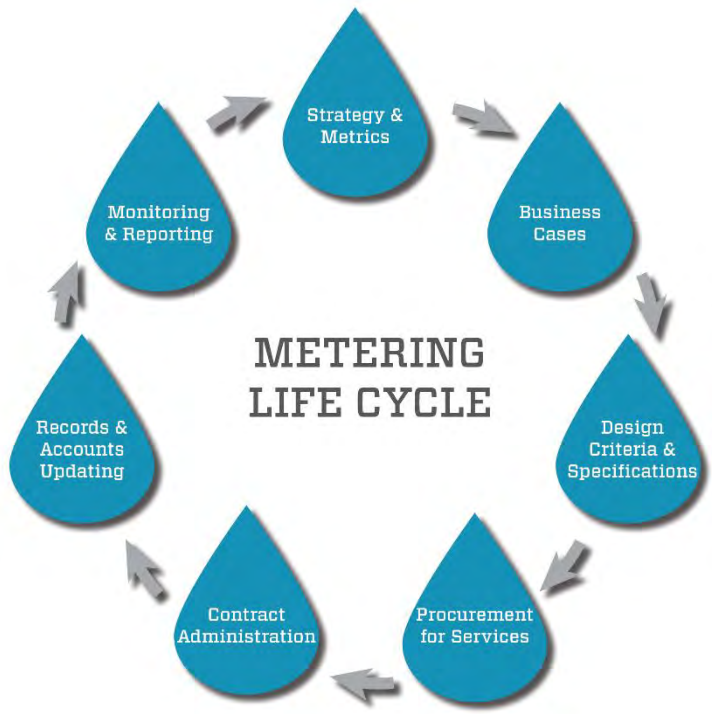
URBAN systems



The City has approximately 25,350 meters, consisting of about 24,000 residential meters and approximately 1,350 ICI (industrial / commercial / institutional) meters. These meters service approximately 91,000 people.

Notwithstanding the many successes of the City's water metering program, there is an ongoing need to upgrade and replace aging infrastructure. As part of this meter replacement initiative the City has decided to step back and consider the entire water metering life cycle so as to inform this Strategy moving forward.

Water meters represent an important component of the municipal water system. They are proven tools used for water conservation, equity billing, minimizing system losses, and delaying supply, treatment and conveyance infrastructure upgrades. Maintaining an appreciation of the life cycle of these assets will assist the City to develop an effective water meter program, specifically tailored for Nanaimo's metering goals and objectives. Life cycle management allows a utility to be proactive with maintenance, testing, and replacement of the meter assets to ensure the optimal performance and value (responsible stewardship of the City's assets). The metering life cycle is presented below. The remainder of this Strategy specifically speaks to each of the life cycle areas.



2.0 Strategy & Metrics

At the outset of any metering program it is important to develop the drivers for the strategy and metrics for measuring progress. Six drivers for the City's Water Metering Strategy have been identified through consultation with staff. Measurers of success have also been quantified. The effectiveness of current practices is also rated based on a scale of **green** (fully meeting), **yellow** (partially meeting), or **red** (not meeting). All drivers are considered to be of relatively equal importance. These are outlined in the table below. As noted, the City sees the greatest opportunity to improve their water metering efforts towards addressing system management, equitable billing, increasing the awareness of the value of water, and delaying supply, treatment and conveyance infrastructure upgrades

Table 1 – Water Metering Strategy Drivers and Metrics

Driver	Measure of Success	Current Practices
Water Conservation	• Targeted 10% reduction in per capita residential water consumption per decade.	🟢
Water System Management and Monitoring	• Target Infrastructure Leakage Index (ILI) of 2.5 or lower (currently 1.5).	🟢
Water Consumption Based Equity Billing	• 100% of connected properties metered. • Billing external bulk customers at equitable rates. • Billing internal customers at equitable rates. • Use water bills as a tool to communicate with customers.	🟡
Raise Awareness of the Value of Water	• Level of public support for water rates. • Public knowledge of City water system. • Public voluntary willingness to conserve water (behavioral change). •	🟢
Water System Forecasting	• Forecasts are accurate and allow for effective prediction of future needs. • Annual assessment.	🟢
Water Supply, Treatment and Conveyance System and Asset Funding	• Adequate funds are available for water system operations as well as infrastructure renewal, replacement, and upgrading.	🟢

3.0 Business Cases

The City has developed six business cases to determine direction for this Water Metering Strategy. These business cases are appended to this Strategy and summarized below.

3.1 Meter Location

The purpose of this business case is to evaluate various configuration options for water meter locations and identify a recommended approach for the City. Specifically, it aims to provide direction on the following questions:

- Are outside or inside water meter installations preferred?
- Should domestic and fire services be separated at the property line or are there situations where combined services are preferred?
- Should stratas have a single meter at the property line or individual meters at each water service?

Through the analysis presented in the business case, the City has determined that:

- Outside meter locations are preferred. The only exception being in the event that sufficient space does not exist within the road right-of-way, then the meter may be installed inside the building.
- Domestic and fire services are to be separated at property line with the domestic line metered and the fire line equipped with a FM Approved / UL Listed double detector check valve assembly. Combined lines (with a FM Approved / UL Listed fire service meter) will only be considered for properties with large building setbacks.
- For multi-family stratas, a single meter is to be installed at property line with a private watermain extended throughout the development. If there are cases where a City owned watermain (within a right-of-way) supplies the various strata units, then each unit is to be individually metered with meters located outside within the City right-of-way.

3.2 City vs Private Ownership

The purpose of this business case is to determine whether water meters should be owned by the City (which is the current practice) or if there are scenarios where private ownership is preferred.

Meter location is a key factor in the assessment of ownership alternatives, as location can impact the level of inherent risk of liability to the City. Accordingly, the findings of the meter location business case are particularly relevant to this evaluation.

The City has confirmed that for outside installations the preference is for the City to own the meter, chamber, and associated piping. For inside water meters, the meter is to be owned by the City with access provided through an agreement between the City and property owner. In all cases, recognized backflow prevention devices are owned by the property owner. Where dual check valves are installed as part of a water meter setter they will be owned by the City.

3.3 Meter Sizing

The purpose of this business case is to develop a clear and consistent meter sizing methodology to be used for new water meters installed in the City. This includes meters for new developments as well as replacement meters for existing customers.

The City has already incorporated the recommendations of this business case into the updated Manual of Engineering Standards and Specifications (MOESS) and adopted the AWWA M22 sizing methodology (with some modifications) for all non-fire service water meters. This is consistent with the recommendations from the 2013 Water Audit (KWL) as well. Fire service meters will continue to be sized in accordance with applicable standards such as the Fire Underwriters Survey (FUS) and National Fire Protection Association (NFPA).

3.4 Metering Technologies

The purpose of this business case is to evaluate alternate metering products that are available in the BC market and identify meters that are best suited to meet the needs of the City.

The business case reviews the currently available technologies and recommends that the City confirm the reading system approach prior to finalizing the meter technology refinement so that meters are compatible with the reading system components. The following criteria are outlined for use when evaluating water meter technologies:

Materials & Dimensions

- Size Range
- Meter Type
- Maincase Material
- Lay Length

Approvals

- AWWA Standard compliant
- NSF 61 Annex F/G for low lead
- Factory Mutual / Underwriters Laboratory Canada certification for fire service application

Performance Specifications

- Normal Operating Range
- Low Flow Registration
- Pressure Loss

Features

- Data Logging Capability
- Automated Meter Reading (AMR) and Advanced Metering Infrastructure (AMI) Compatibility
- Power Requirements and Warranties
- Presence of Test Port

Operations & Maintenance

- Availability of Spare Parts / Field Replaceable Components

Cost

- Price Point (Supply Cost)

Local Considerations

- Availability and Quality of Local Support
- Municipal Applications in Western Canada

A summary of currently available meters evaluated against these criteria is contained in the Business Case. It is recommended that the City limit the number of meters on the approved products list to 3 meter manufacturers to obtain operational efficiencies that include stocking of meters and spare parts and the operational knowledge and understanding required.

3.5 Meter Reading Systems

The purpose of this business case is to evaluate alternate meter reading systems that are available in the BC market and identify systems that are best suited to meet the needs of the City. At the present time, the City relies on a combination of touch pad technology and manually collected reads, aside from a few difficult to access meters that are equipped with a radio and read using a hand-held device. The business case provides a thorough discussion regarding meter reading considerations for the City moving forward. The following criteria are outlined for use in evaluating available meter reading technologies:

Details

- System Type
- Power Requirements
- Radio Licencing Requirements
- One-Way vs Two-Way Communication

Features

- Migration Capabilities
- Compatibility with Alternate Meters
- Interface Software

Local Considerations

- Local Support
- Municipal Applications in Western Canada

A summary of currently available reading systems evaluated against these criteria is contained in the Business Case. From this analysis three reading systems have been selected for additional evaluation.

The City is currently conducting a financial evaluation in parallel to evaluation of other considerations in order to inform the preferred reading system approach. This subsequent business case will evaluate options considering:

a. Maintain status quo – touch read for new installations except for difficult to access meters where radios are installed;
b. Implementation of a walk-by radio read system;
c. Implementation of a drive-by radio read system through utilization of garbage trucks for drive-by collectors;
d. Implementation of a fixed-base radio read system; and
e. Utilization of a hybrid of drive-by and fixed-base reading system– fixed-base radio read for easy to access meters in and around the downtown core and supplemented with a drive-by radio read system for the remainder of the service area.

3.6 Meter Replacement

The City developed a meter replacement business case in 2014. The primary focus of this business case was to ascertain the opportunity to enhance water conservation, improve revenue, and more accurately measure under recording residential and larger bulk water industrial and commercial meters. This business case built on the work completed as part of the 2013 Water Audit (KWL).

The business case outlines that the average age of residential water meters in the City is 14 years and typically the City replaces approximately 3% of the water meter population annually. This current rate of replacement represents a 33-year replacement cycle. The lengthy water meter replacement cycle suggests the City will incur additional apparent water losses as a result of meter inaccuracy due to local factors such as water chemistry and soil conditions that affect the mechanical decline of the water meter.

The City has approximately 750 large water meters ranging in size from 50mm through 150mm diameter which cover residential, commercial, and industrial properties.

The 2013 Water Audit (KWL) outlined potential annual revenue gains of $36,000 if meter accuracy is improved through meter replacement.

The business case recommended that meter replacements be focussed on aging residential water meters and oversized ICI meters. A budget of $230,000 for residential meter replacement and $100,000 for ICI meter replacement was recommended in 2015 with a 2% increase per year with a goal to reduce the maximum water meter age to 24 years. These budgets included meter replacement only and do not account for radio read costs.

The recommendations of this business case are being considered in the current financial analysis of meter reading considerations.

4.0 Design Criteria & Specifications

4.1 Content

The Design Criteria, Supplementary Specifications, Approved Products List, and Standard Detail Drawings are required both for new and replacement water meters. These documents provide guidance to City staff, developers, builders, homeowners, and their respective consultants in order to inform the design and construction of metering infrastructure.

4.2 Format

The City has reviewed their current Manual of Engineering Standards and Specifications and determined that moving forward incorporating all design criteria and specifications in the MOESS is preferred. This ensures that all individuals and organizations have a single point of reference. The MOESS is reviewed and approved by Council and updated on an ongoing basis.

5.0 Procurement for Services

The implementation of the ongoing operation and maintenance of a water metering and reading system requires a variety of services which are summarized below:

- **Advisory** – Completion of business cases and assessments, revisions to meter design criteria and specifications, and professional input regarding development, implementation, and refinement of the Water Metering Strategy.
- **Meter Design** – Application of meter sizing and determination of installation details for each specific property.
- **Product Supply** – Supply of water meter radio end-points) as well as ancillary components such as setters, boxes, lids, etc.
- **Product Installation** – Installation of the above-noted infrastructure components.
- **Contract Administration** – Preparation of contract documents, coordination of procurement processes, and administration of the selected form(s) of contract.
- **Product Maintenance** – Ongoing maintenance of the complete water meter assembly including the meter, radio end-point, piping / setter, box / lid, etc.
- **Meter Reading** – Collection of reads and operational data from the various water meters / radio end-points.
- **Data Hosting** – Digital storage of meter reads and data.
- **Billing** – Upload of meter reads and data into Tempest and generation / issuance of water bills.
- **Meter Testing** – Accuracy testing of water meters, in response to billing inquiries or proactively to gauge the performance of the City's meter population.

- **Public Education and Outreach** – Development and / or facilitation of public consultation / engagement with respect to water metering, water rates, water efficiency / conservation, etc.

The following service providers are often engaged during the implementation of water meter and reading system infrastructure upgrades and / or the ongoing operation of the water metering program.

- **City** – In-house resources within the City's Engineering / Public Works, Finance, Operations or other departments.
- **Consultant** – External firm specializing in professional services such as project management, engineering, communications, etc. either engaged directly by the City or by the developer or property owner.
- **Developer** – Property owner or agent for a property owner responsible for the development or redevelopment of parcel(s) or land.
- **Vendor** – Product manufacturer, local supplier, or contractor.

The selection of a provider for a given service depends on several factors such as availability of resources, skillset, and funding. The table in Appendix B provides a summary of procurement options for each aspect of the water metering program along with current and recommended service providers.

6.0 Contract Administration

6.1 Management

The City has an important role to play in all aspects of the implementation of the Water Metering Strategy. The key project management roles are summarized below:

- Project manager for consulting services;
- Project manager for construction contract services;
- Project manager for equipment supply services;
- Project manager for service delivery contract; and
- Project manager for City completed works.

Common responsibilities for all of these roles includes:

- Establishing a budget and monitoring progress towards that budget;
- Establishing a schedule and monitoring progress towards that schedule;
- Obtaining input from other City departments;
- Ensuring that all approvals are in place;
- Ensuring that appropriate public notifications have taken place; and

- Responding to questions from City staff and the public.

The role that other City departments play is largely dependent on the specific nature and scope of the project.

Consideration should be given to appointing a water metering "champion" from the City. This person would be involved in all aspects of the metering program to some extent, but play a more significant role for specific components.

6.2 Service Provider Performance Reviews

Whenever contract for services is required (whether from a consultant, supplier, or contractor) it is valuable both for the City and service provider to conduct performance reviews. It is recommended that this review consider the following key areas and incorporate these into the evaluation criteria for future procurement activities:

- Effectiveness of delivering work on time and on budget;
- Ability to listen to City needs and make adjustments to reflect feedback given in the course of the project;
- Ability to look for opportunities to provide additional value to the City through the course of the project;
- When issues arise, responsiveness and willingness to take responsibility when warranted and seek resolutions;
- If products are supplied, how has the quality of the products met the City expectations for durability and accuracy; and
- If installation services are provided, was the contractor able to resolve all deficiencies noted at substantial completion to meet total performance in a timely fashion; have warranty items been resolved in a quick and timely fashion.

7.0 Records & Accounts Updating

7.1 New Developments

The following records and accounts updating process is followed for all new developments:

Table 7.1 New Development Records and Accounts Updating (50mm and Smaller)

Step	Responsibility	Trigger	Action
1	City	Building Permit Application with 50mm or smaller meters.	• Work Order for new 50mm or smaller meters. • Fill out Meter Service Sheet (50mm and smaller).
2	City	Meter Service Sheet	• Create Meter Account and Assign Billing Route.
3	City	Work Order for new 50mm or smaller meters.	• Completion of Meter Installation. • City Plumbing Inspector inspection and signoff. • Review and confirm information on Meter Service Sheet.

Table 7.2 New Development Records and Accounts Updating (75mm and Larger)

Step	Responsibility	Trigger	Action
1	Builder	Building Permit Application	• Builder completes Meter Information Sheet for 75mm and larger meters.
3	City	Meter Information Sheet	• Create Meter Account and Assign Billing Route.
3	City	Call for inspection on new 75mm or larger meters.	• City Municipal Inspector inspection and signoff. • Review and confirmation of information on Meter Information Sheet.

7.2 Maintenance

For meter maintenance, Work Orders are generated in Tempest either by the meter readers or billing staff when irregularities in meter condition or reads are noted. Once repairs are completed the Tempest file is updated with information on the work completed.

7.3 Capital Watermain Project

For capital watermain projects, it is recommended that a query be conducted in Tempest in order to determine meter age, type, measurement units, read method etc. at the planning stage of the project. This information can be used during the project planning stage to determine what meter upgrading work to include in the capital project. A site inspection is recommended based on this Tempest report in order to confirm that the data in Tempest is correct. A Meter Information Sheet should be completed and City Municipal Inspector inspection following installation so that the information in Tempest is accurate.

8.0 Monitoring & Reporting

8.1 Meter Testing & Replacement

The 2013 Water Audit (KWL) included testing of two supply meters (WPC and Reservoir #1), and 45 residential (19mm) meters. These results indicated the following:

- The accuracy of total source meters is considered acceptable and within 99.5% of tested values.
- The overall accuracy of the residential meters tested was deemed acceptable at 96.5%; however, meter accuracy is shown to decrease with age and is a function of a decline in low flow accuracy.
- The overall apparent losses due to meter inaccuracy was estimated at 250 ML/year. Based on $30.68/ML this equates to $7,670/year.

While large meters were not tested during the 2013 Water Audit (KWL), a desktop review was completed with a focus on appropriate sizing of water meters.

Appendix C contains a detailed discussion on testing and provides a summary of testing intervals based on best practices from the United States.

The 2013 Water Audit (KWL) recommends that ongoing annual testing be completed for residential meters and include 50 meters per year with 25 randomly selected meters and 25 meters that are being removed and replaced due to high cumulative consumption or age.

This frequency of testing is significantly below what has been outlined in best practices however there needs to be a consideration for the value and cost of the testing program. With the estimated lost revenue at under $8,000/year, conducting a formal testing program is not justifiable at this time. It is recommended that the source meters be tested annually and that meter accuracy be further considered the next time the Water Audit is updated. Of course, if the City is projecting to be nearing capacity for treatment or other supply infrastructure, then increasing the interval of meter testing may be warranted. All testing should be completed in accordance with the methodology outlined in AWWA M6.

8.2 Water Audit

The 2013 Water Audit (KWL) contains a number of recommendations which fall into four categories:

Category 1 – Selection and Sizing of Large Meters

These recommendations have now been incorporated into the MOESS. These will be incorporated in any meter replacement work associated with the Water Metering Strategy.

Category 2 – Meter Replacements

The meter replacements in the Water Audit will be reviewed and confirmed with the upcoming business cases on ICI and residential meter replacements. The work in the 2013 Water Audit (KWL) has been used to inform these change outs.

Category 3 – Water Loss Management

The 2013 Water Audit (KWL) recommends leakage surveys and temporary flow monitoring in order to reduce the annual real losses. These recommendations will not be impacted by the Water Metering Strategy.

Category 4 – Future Water Audit Considerations

Yearly Water Audit updates are recommended and will be informed through increased meter accuracy obtained through meter replacement activities.

8.3 Water Metering Strategy Review

It is recommended that the Water Metering Strategy be reviewed annually and updated every 5 – 10 years as the recommendations are implemented.

9.0 Implementation

This Water Metering Strategy presents a comprehensive approach to the ongoing metering program at the City. It is recommended that this Strategy be reviewed by staff and that an overarching Water Metering Policy be developed and adopted that clearly articulates Council support for the direction and responsibilities for this Strategy. With the Policy adopted, this Strategy can be provided to Council for information and updated on an ongoing basis by staff.

Below is a summary of the short term (2016-2017), medium term (2017 - 2020), and long term (2021 +) actions.

Short Term

- Review and finalize Water Metering Strategy;
- Present Water Metering Policy for consideration by Council;
- Complete ICI and residential meter replacement business cases;
- Confirm meter replacement program for ICI and residential customers and obtain budgetary support for implementation;
- Update Approved Products List to align with replacement program;
- Update records and data keeping process (if necessary) to align with replacement program;
- Confirm procurement and contract administration approach for the replacement program;
- Complete updates to the Water Audit as needed; and
- Complete leakage surveys and temporary flow monitoring in priority areas.

Medium Term

- Begin implementation of the meter replacement program;
- Complete reviews of the Water Metering Strategy and update metrics as needed; and
- Continue implementation of leakage survey and temporary flow monitoring in priority areas.

Long Term

- Continue implementation of the meter replacement program;
- Complete update to the Water Metering Strategy every 5 – 10 years or as needed;
- Continue implementation of leakage survey and temporary flow monitoring in priority areas; and
- Complete updates to the Water Audit every 5 – 10 years or as needed.

APPENDIX A

BUSINESS CASES

CITY OF NANAIMO
THE HARBOUR CITY

TECHNICAL MEMO 1

WATER METER LOCATION BUSINESS CASE

URBAN systems

550 – 1090 Homer Street
Vancouver, BC V6B 2W9
Contact: Jacob Scissons, P.Eng.
T: 604.235.1701
jscissons@urbansystems.ca

urbansystems.ca

Report to:

City of Nanaimo
411 Dunsmuir Street
Nanaimo, BC
V9R 5J6

Attn: Doris Fournier, P.Eng., Manager of Municipal Infrastructure

Prepared by:

Urban Systems
550 – 1090 Homer Street
Vancouver, BC
V6B 2W9

June 9, 2015

PROFESSIONAL PROVINCE OF J. D. SCISSONS # 32759 BRITISH COLUMBIA ENGINEER

Jacob Scissons, P.Eng.
Project Engineer

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1.0 INTRODUCTION

This technical memorandum is part of a series of five business cases to inform the development of a Water Metering Strategy for the City of Nanaimo (the City).

The purpose of this business case is to evaluate various configuration options for water meter locations and identify a recommended approach for the City. Specifically, it aims to provide direction on the following questions:

1. **Are outside or inside water meter installations preferred?**
2. **Should domestic and fire services be separated at the property line or are there situations where combined services are preferred?**
3. **Should stratas have a single meter at the property line or individual meters at each water service?**

This technical memorandum summarizes our assessment of each of these questions using a multiple account evaluation including capital, operations and maintenance (O&M), and social considerations. These criteria are applied quantitatively and qualitatively, as appropriate and within the scope of this exercise, to various meter configuration options.

2.0 METER CONFIGURATION OPTIONS

2.1 Domestic Services

We have considered three potential location configurations for domestic meters:

Option #1 – Meter located outside at property line within the City right-of-way;

Option #2 - Meter located outside at property line on private property; and

Option #3 – Meter located inside.

A schematic of these location options is provided on Figure 1 below.

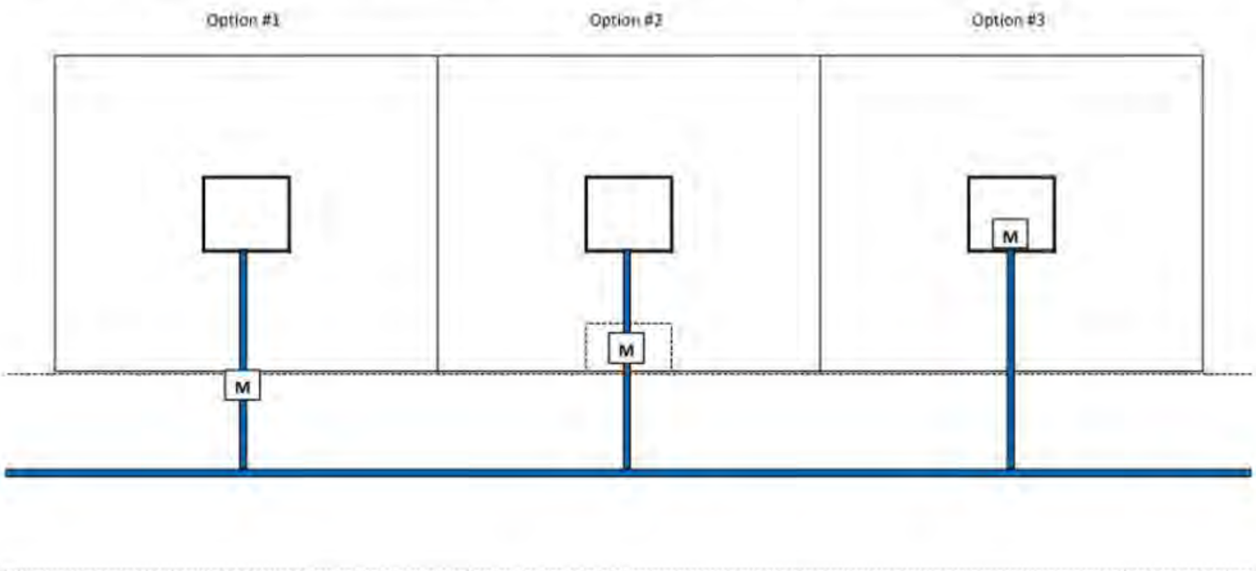

Figure 1: Potential Domestic Meter Locations

2.2 Fire Services

Two alternatives for metering fire services are considered:

Option #1 – Dedicated fire services (separated from domestic); and

Option #2 – Combined fire and domestic services.

2.2.1 Dedicated Fire Service

Option #1 is to separate the fire service from the domestic at the property line. For dedicated fire services, the only flow monitoring that is required on the fire service is a detector meter that is located parallel to the double check valve (referred to as a double detector check valve assembly). This meter is intended to detect flow prior to the double check valve opening. This meter is often referred to as a "tattle tale" meter since it is used to detect unauthorized water use from the fire service. Note that this meter is not used for billing nor is it sized for fire flow volumes that would flow through the double check valve assembly. Municipalities typically apply flat rate billing to dedicated fire services.

2.2.2 Combined Fire / Domestic Service

Option #2 is to combine the fire and domestic services. For combined services, metering the domestic flows means capturing fire flows as well. This configuration results in the need for a larger fire service meter to ensure that the meter does not restrict flows that may be required in the event of a fire. That is, even though domestic flows likely only warrant a small meter, a larger fire service meter is required to satisfy fire flows. Furthermore, the double check valve assembly also needs to be adequately sized to convey fire flows.

Under normal circumstances, the fire service meter is used to register, read, and bill for domestic consumption. If there is a fire and the meter has captured large volumes of water for fire flows, an adjustment to the water bill is sometimes applied (depending on the municipality's bylaw).

2.3 Stratas

The City is seeking guidance on whether strata properties should have a single meter at the property line or individual meters at each water service. This largely depends on the ownership of the watermain servicing the strata. Therefore, the two options for evaluation of metering strata properties are:

Option #1 - City owned watermain installed within a right-of-way; and

Option #2 - Privately owned watermain.

For Option #1, the meter configuration options are consistent with those depicted on Figure 1 since the City right-of-way over the watermain supplying the strata would be essentially the same as the City road right-of-way. Option #2 is illustrated on Figure 2 below.

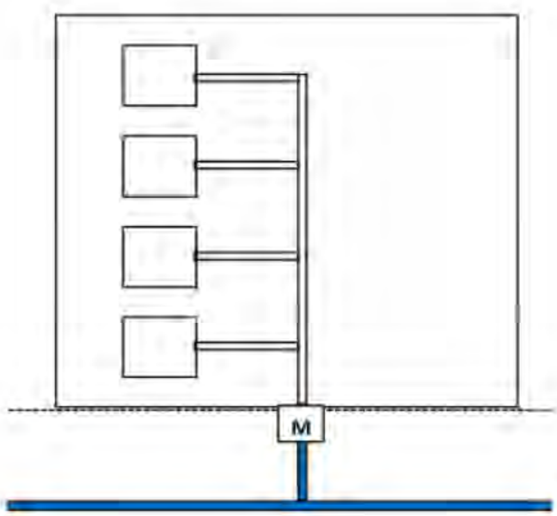

Figure 2: Meter Location for Privately Owned Strata Watermain

URBAN systems

3.0 EVALUATION CRITERIA

Evaluation of the various meter configuration options is based on the accounts and criteria outlined in the following table.

Table 3.1: Multiple Account Evaluation

Account	Criteria	Quantitative Evaluation	Qualitative Evaluation
Capital	Cost	✓	
Operations and Maintenance	Access		✓
	Cost	✓	
Social	Leakage	✓	
	Liability		✓

These accounts take into consideration all stakeholders involved in water metering, including the City, the developer, and the customer. The size of the meter (small or large diameter) is also factored into the evaluation.

3.1 Capital Criteria

The primary capital criterion is cost, which includes the following:

- Total initial cost to supply and install the meter, including associated piping, valves, chambers, etc.
- For inside applications, the cost of the space occupied by the meter that cannot be used for other purposes. (Note this area is not only the physical space of the meter, but also the space in front of the meter that is required in order to perform maintenance and testing).
- The cost to replace or upgrade the meter when it reaches the end of its useful life.

3.2 Operations and Maintenance Criteria

3.2.1 Access

Access is evaluated qualitatively in terms of:

- Accessibility of meters for reading, repair, testing, etc.;
- Requirements for confined space entry; and
- Requirements for access onto private property or entry inside a private building.

3.2.2 O&M Cost

Operations and maintenance costs may include:

- Costs associated with regularly scheduled maintenance and testing; and
- Meter repair or replacement costs, as required.

O&M costs depend largely on access.

3.3 Social Criteria

3.3.1 Social Cost

Social cost is evaluated in terms of unaccounted-for water. This is because in a system where user rates are set to recover the costs of treating and distributing water, all users subsidize the unbilled water that is consumed, lost via leakage, or otherwise undetected. From a social cost perspective, both the City and the private owner need to be responsible for maintaining the water system in a sustainable manner, which is best achieved when water use is optimized and unaccounted water uses and leaks are minimized or eliminated. Sources of unaccounted-for water can include:

- Leaks.
- Unauthorized connections.
- Unreadable meters – when meters are unable to be read due to malfunctioning or inaccessible meter readout, the account use is estimated and actual usage is not captured.
- Inaccurate and / or unregistering meters.

In the case of leaks, potential damage to property may also result in social costs.

3.3.2 Liability

Liability is evaluated qualitatively in terms of risk of cost to the City in the event of damage to areas surrounding a meter as a result of leaks or other issues. Damage may occur in the City right-of-way, on private property, or inside a home / building. This account is closely tied to ownership, as discussed further in a separate technical memorandum.

4.0 EVALUATION

4.1 Domestic Services

4.1.1 Capital Criteria

The table below summarizes the costs for various sizes of meters, for installations outside versus inside. These costs are based on recent Lower Mainland tender prices. The following assumptions should also be noted:

- Inside installations assume the meter is located within a utility room.
- The costs for inside installations include $2,000 per square meter ($m^2$) for the space occupied for the meter assembly.
- For small outdoor meters, costs include installation within a meter box, but not including a setter.
- For large outdoor meters, costs include installation within a belowground chamber complete with bypass piping and isolation valves. An allowance for preparation of engineered shop drawings is also included.

Table 4.1: Meter Supply and Installation Costs

Meter Size	Outside Installation (Option #1 and #2)	Inside Installation (Option #3)
19 mm	$500	$900
25 mm	$600	$1,200
38 mm	$1,300	$2,100
50 mm *	$1,500	$2,600
75 mm	$32,000	$12,000
100 mm	$43,000	$18,000
150 mm	$50,000	$28,000
200 mm	$60,000	$40,000

** 50 mm meters are assumed to be positive displacement (as opposed to compound).*

Key Points:

- For small diameter meters (50 mm or less), the cost for outside meters are lower than inside installations. The higher cost for inside meters is largely due to the unit area cost associated with floor space occupied. The actual value of floor area occupied by the meter will vary from say an ICI meter located within a utility room as opposed to a residential meter installed within a crawl space.

  Note that outside meters installed on a setter would represent costs similar to inside installations for small sizes.

- For large diameter meters (75 mm or greater), the costs for outside installations are higher than inside installations, with the cost differential increasing as meter size increases. This is largely due to the cost of a belowground meter chamber for outdoor installations, which is significantly more than the unit area cost of a utility room.
- Based on capital cost alone, outside meters would be preferred for small sizes and inside meters would be preferred for large sizes.

4.1.2 O&M Criteria

The evaluation of location options under the O&M account is summarized in the table below.

Table 4.2: Operations and Maintenance Evaluation

Criteria	Outside Meter Location (Option #1 and #2)	Inside Meter Location (Option #3)
Confined Space Entry	• Not required for small meters. • Required for large meters.	• Not required for all meter sizes.
Public / Private Access	• Public (City right-of-way or easement).	• Private (access through property and into building).
Testing	• Small meters: Meters removed for bench testing with replacement meter installed. • Large meters: In-situ meter testing typically not a problem outdoors.	• Small meters: Meters removed for bench testing with replacement meter installed. • Large meters: Discharge of test water can be a challenge for in-situ meter testing.
Cost	• Confined space entry access approximately $250 / visit for large meters.	• No confined space access costs.

Key Points:

- For small diameter meters, there is a clear O&M advantage associated with outside meters. This is largely due to ease of access and the fact that confined space entry is not required.
- For large diameter meters located outside, there is a cost associated with confined space entry. However, there are benefits in terms of ease of testing and general access to the meter location.
- For large diameter meters located inside, there can be challenges associated with gaining access from private property owners or tenants and discharging the large volumes of water associated with in-situ meter testing. However, confined space entry is typically not a concern.

4.1.3 Social Criteria

Leakage

In addition to quantifying actual customer water use, water meters are also a useful tool for detecting leaks, and the location of the meter has a direct impact on who ultimately pays for unaccounted-for water: the individual property owner, or the public through the setting of water rates.

In the event of a leak or unauthorized water use along a lateral connection to the City's watermain, payment for unaccounted-for water is by the following:

- Options #1 and #2 (outdoor installation): Property Owner Pays
- Option #3 (indoor installation): Public Pays

Inside meters do not capture water from a leak or unauthorized connection outside of the building; therefore, the City (i.e., the public) pays for this unaccounted-for water. Conversely, meters located at the property line will capture leaks or unauthorized connections between the building and the City watermain resulting in the customer being billed for all water usage, including leaks.

It is beyond the scope of this assignment to quantify leakage in the City's water system; however, the Water Audit that was completed in 2011 provides some pertinent findings. Customer credits associated with leak repairs were estimated at $150,000 per year while unauthorized consumption was assigned an estimated value of $39,000 annually.

When leaks are detected by a meter located at property line (Option #1 or #2), the municipality can assist with repairs and apply customer credits as appropriate. When meters are located inside (Option #3), leaks may go undetected for a long time resulting in increased water rates for everyone.

Key Points:

- Meters located outside at property line provide significant leak detection benefits and support equitable billing.
- Meters located inside the building may result in leaks or unauthorized connections going undetected for long periods of time, resulting in a social cost to the City and its ratepayers.
- Based on this account alone, Option #1 or #2 (outside installations) are preferred.

Liability

Domestic meter location has implications for risk of damage to private property in the event of an issue with the meter. For outside meters, risks may be attributable to a leak that causes damage to landscaping or perhaps a broken meter box lid that causes a tripping hazard. For inside meters, the primary risk of damage may be a leak impacting building contents or the actual structure.

Considering risk as a function or likelihood and consequence, inside meters represent a higher liability than outside meters. For outside meters, the location of the meter on private vs public property dictates the risk level.

***Key Points*:**

- The City's liability is considered lowest for outside meter installations within the City right-of-way.
- The City's liability increases slightly for meters located outside on private property.
- Meters located inside represent the highest liability to the City.
- Based on this account alone, Option #1 (outside within the City right-of-way) is preferred.

4.1.4 Domestic Services Evaluation Summary

The table below summarizes our evaluation of domestic meter location configurations. Green circles represent the highest benefit, yellow circles suggest a moderate benefit, and red circles indicate a drawback.

Table 4.3: Summary of Domestic Meter Evaluation

Account	Criteria	Option #1 (Outside within City right-of-way)	Option #2 (Outside on private property)	Option #3 (Inside)
Capital	Cost	🟢 (small meters) 🔴 (large meters)	🟢 (small meters) 🔴 (large meters)	🟡 (small meters) 🟢 (large meters)
O&M	Access	🟢	🟡	🔴
	Cost	🟢 (small meters) 🟡 (large meters)	🟢 (small meters) 🟡 (large meters)	🟡 (small meters) 🟡 (large meters)
Social	Leakage	🟢	🟢	🔴
	Liability	🟢	🟡	🔴

The evaluation suggests that Option #1 (meter installed outside at property line within the City right-of-way) is preferred in most cases.

4.2 Fire Services

4.2.1 Dedicated vs Combined Fire Services

<u>Dedicated Fire Services</u>

For dedicated fire services, the double detector check valve assembly could be located inside within a utility room or outside at property line. For outside installations, the double detector check valve assembly can be located in the same chamber as the domestic meter.

The cost for an outside installation (within the same chamber as the domestic meter) is typically in the order of 50% higher than an inside installation. Similar to larger domestic meters, this is primarily due to the larger chamber required to accommodate the double detector check valve assembly. Although more costly, locating the double detector check valve assembly at property line offers better premise isolation than inside installations.

Operations and maintenance responsibilities for cross connection control devices are typically assigned to the property owner. In the case of a double detector check valve assembly, the City is only concerned with the tattle tale meter.

Combined Fire Services

Combined fire and domestic services require a fire service meter, which are significantly larger than domestic meters, predominantly due to the size of the strainer. Again, outside installations are typically more costly than inside installations; however, the space required to locate these meters within a utility room is considerable. Regardless of location, the space requirements and costs are further increased if a double check valve assembly is required in addition to the meter.

Another factor to consider is the length of piping required on private property. For zero lot line developments, separated fire and domestic services are quite common. For developments where the building is setback significantly from the property line (ie. a mall), combined fire and domestic services are often proposed to avoid the costs of installing twin waterlines throughout the development. For these reasons, some municipalities allow either combined or dedicated fire services.

With combined services, the meter is sized to convey the required fire flows. Domestic flows are essentially an afterthought. Although the low flow accuracy of fire service meters is improving, there is still a risk that a portion of domestic flows will not be registered.

Key Points

- Dedicated fire services with the double detector check valve assembly located at property line offers the best premise isolation.
- Dedicated fire services with the double detector check valve assembly located inside represents the lowest capital cost.
- Combined fire and domestic services may be more cost effective for properties with significant building setbacks.
- Dedicated fire services with a separate metered domestic service are best suited to capture the expected flows to a property.
- Combined services represent a higher O&M cost to the City given the responsibility for a large fire service meter vs a small domestic meter and tattle tale device.

4.2.2 Fire Services Evaluation Summary

The table below summarizes our evaluation of alternatives for metering fire services. Again, green circles represent the highest benefit, yellow circles suggest a moderate benefit, and red circles indicate a drawback.

Table 4.4: Summary of Fire Service Evaluation

Account	Criteria	Option #1 (Dedicated Fire Services)	Option #2 (Combined Fire and Domestic Services)
Capital	Cost	🟢	🔴
O&M	Access	🟢	🟡
	Cost	🟢	🔴
Social	Leakage	🟢 (if located at PL)	🟢 (if located at PL)
	Liability	🟢	🔴

The evaluation suggests that Option #1 (dedicated fire services) is preferable.

4.2.3 Private On-Site Hydrants

For properties that have private on-site hydrants, it is recommended that the fire service meter or double detector check valve assembly be located at the property line. Alternatively, each hydrant lead would need to be metered or monitored, which is typically not cost-effective.

4.2.4 Single Family Residential Dwellings with Fire Sprinklers

There are two common configurations for residential dwellings that employ fire sprinklers:

- Separate metered domestic service and unmetered fire service; or
- Combined fire / domestic service equipped with a domestic meter.

As outlined in the ANSI / AWWA C714-13 standard, *Cold Water Meters for Residential Fire Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes*, the preferred configuration according to NFPA 13D is to not meter the fire sprinkler supply line. This limits the devices on the water supply line that could restrict or shut off the water supply during a fire.

If there is a desire to meter the fire sprinkler line, use of a meter that satisfies AWWA C714 should be considered. However, meter manufacturers do not appear to offer products that meet these standards, at least not at this time. Several municipalities continue to use meters that are not "fire rated" for combined fire / domestic residential services.

Key Points

- Dedicated, unmetered fire services appear to represent the lowest liability to the City at this time for single family residential dwellings.
- If small diameter meters that satisfy AWWA C714 become available, a combined fire / domestic meter located at property line would provide leak and authorized water use detection benefits without increasing liability.

4.3 Stratas

4.3.1 City vs Private Watermain

City Owned Watermain

For a watermain installed within a City right-of-way, the evaluation for domestic meters outlined in Section 4.1 applies, which suggests that locating the meter outside within the City right-of-way is preferred under most evaluation accounts. It is also assumed that fire hydrants would be installed within the City right-of-way and be owned by the City.

A City owned watermain with individually metered properties may be effective for small strata developments (say in the order of 10 units or less). This way, the cost of a large fire service meter (that may not detect low flows from the limited number of homes) could be avoided. However for larger strata developments, the logistics of installing a City owned watermain throughout the development may prove ineffective. Furthermore, with an increased number of properties, the total flow at any given time is more likely to be within the low flow accuracy for the fire service meter.

A City owned watermain with individually metered properties may also be favourable for mixed use developments since metering (and billing) requirements for residential vs ICI units may differ.

Privately Owned Watermain

For a privately owned watermain, the meter should be located at the property line. The only question is whether the strata is supplied by a combined fire / domestic service or separated services. Again, this is expected to be a function of the size of the strata development.

Providing a separate dedicated fire service may only be cost effective for small stratas. In this case the dedicated fire service should be equipped with a double detector check valve assembly located at property line. For the domestic service, providing a single domestic meter at property line is recommended to capture the consumption to all residences. The strata may or may not choose to sub-meter individual units.

For larger strata developments, it is assumed that a single watermain would be installed for both fire and domestic flows. For this scenario, a fire service meter should be installed at property line. Again, it is up to the strata whether or not to sub-meter individual units.

Key Points

- A City owned watermain with individually metered units should only be considered for small strata developments. This is most likely applicable to bare land stratas.
- For small strata developments with a privately owned watermain, it may be beneficial to separate the fire and domestic services to better capture flows.
- For large strata developments with a privately owned watermain, a single fire service meter located at property line is recommended.

4.3.2 Summary of Strata Metering Evaluation

The table below summarizes our evaluation of alternatives for metering strata properties. Again, green circles represent the highest benefit, yellow circles suggest a moderate benefit, and red circles indicate a drawback.

Table 4.5: Summary of Strata Metering Evaluation

Account	Criteria	Option #1 (City Owned Watermain)	Option #2 (Private Watermain)
Capital	Cost	🔴	🟢
O&M	Access	🟢	🟡
	Cost	🔴	🟢
Social	Leakage	🟢	🟢
	Liability	🔴	🟢

The evaluation suggests that Option #2 (privately owned watermain) is preferable for strata properties in most cases. However, if the watermain loops through the strata and services additional properties on the other side, then the watermain should be owned by the City.

5.0 CONSIDERATIONS FOR INTEGRATION WITH BACKFLOW PREVENTION DEVICES

The City has initiated a Cross Connection Control Program to comply with the updated Vancouver Island Health Authority Operating Permit. Based on our experience with other municipalities, the following are some considerations for integrating metering with backflow prevention devices:

- Locating larger backflow prevention devices inside is typically the most cost effective option.
- For a modest cost increase, the backflow prevention device could be located outside within the same chamber as the water meter.
- Providing a separate outside chamber dedicated to the backflow prevention device represents the highest cost.
- From a social perspective, locating the backflow prevention device outside at the property line provides a higher level of premise isolation. In this configuration, a single backflow prevention device provides protection from the entire site.

6.0 SUMMARY

Based on the analysis and evaluation discussed in this technical memorandum, the following conclusions can be noted regarding the three focus questions.

1. ***Are outside or inside water meter installations preferred?***

   - Locating the meter outside within the City right-of-way (Option #1) is preferred under most evaluation accounts.
   - Inside installations for larger meters (that could be owned by the property owner with requirements for yearly inspections) may be preferred where space limitations or other site challenges exist.
   - The increased capital cost for outside installations can be at least partially offset by benefits such as ease of access, decreased liability, and maximizing leak detection.

2. ***Should domestic and fire services be separated at the property line or are there situations where combined services are preferred?***

   - Separating the domestic and fire services at property line is preferred over combined lines.
   - Locating the double detector check valve assembly at property line offers the highest level of premise isolation as well as the best opportunity to detect leakage or unauthorized water use.
   - Recognizing that space may be limited for outside installations at some sites, the double detector check valve assembly could be located inside (even if the domestic meter is located outside).
   - Based solely on capital cost, combined services may be preferred for properties with large building setbacks.

3. ***Should stratas have a single meter at the property line or individual meters at each water service?***

   - Providing a single fire service meter at property line (with a privately owned watermain) is preferred for larger strata developments.
   - A City owned watermain with individually metered units should only be considered for small strata developments.
   - For small strata developments with a privately owned watermain, separating the fire and domestic services should be considered unless it can be demonstrated that a combined meter could capture the anticipated low flows from the development.

CITY OF NANAIMO
THE HARBOUR CITY

TECHNICAL MEMO 2

CITY VS PRIVATE OWNERSHIP BUSINESS CASE

URBAN systems

550 – 1090 Homer Street
Vancouver, BC V6B 2W9
Contact: Jacob Scissons, P.Eng.
T: 604.235.1701
jscissons@urbansystems.ca

urbansystems.ca

Report to:

City of Nanaimo
411 Dunsmuir Street
Nanaimo, BC
V9R 5J6

Attn: Doris Fournier, P.Eng., Manager of Municipal Infrastructure

Prepared by:

Urban Systems
550 – 1090 Homer Street
Vancouver, BC
V6B 2W9

June 9, 2015

PROFESSIONAL
PROVINCE OF
J. D. SCISSONS
32759
BRITISH COLUMBIA
ENGINEER

Jacob Scissons, P.Eng.
Project Engineer

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1.0 INTRODUCTION

This technical memorandum is part of a series of five business cases to inform the development of a Water Metering Strategy for the City of Nanaimo (the City).

The purpose of this business case is to determine whether water meters should be owned by the City (which is the current practice) or if there are scenarios where private ownership is preferred.

Meter location is a key factor in the assessment of ownership alternatives, as location can impact the level of inherent risk of liability to the City. Accordingly, the findings of the meter location business case (Technical Memorandum #1) are particularly relevant to this evaluation.

2.0 OWNERSHIP ALTERNATIVES

We have considered three ownership alternatives:

Option #1 – City Owned Meter and Assembly;

Option #2 - City Owned Meter, Privately Owned Assembly; and

Option #3 – Privately Owned Meter and Assembly.

The meter "assembly" refers to the box / chamber, lid, valves, piping and any other ancillary components.

Note that we have not included an alternative for a privately owned meter and City owned assembly since this scenario is assumed to be unfavourable.

3.0 EVALUATION CRITERIA

Evaluation of the various ownership options is based on the following criteria:

- Risk
- Revenue
- Maintenance
- Ancillary Benefits
- Legislative Limits
- Cost Effectiveness

4.0 EVALUATION

Considerations associated with City vs Private ownership for each evaluation criterion are provided in the table below. Some criteria apply to the complete water meter assembly, while others are only relevant to the meter. Each consideration is accompanied by a green, yellow, or red circle. Green circles represent a benefit to the City, yellow circles suggest a neutral scenario, and red circles indicate a drawback.

Table 4.1: City vs Public Ownership Evaluation

Evaluation Criteria	Applicable To: (Meter / Assembly)	City Owned	Privately Owned
Risk	Meter + Assembly	• City risk associated with damage to private property is minimized when the meter is located in the City road right-of-way.	• Private ownership of inside meters avoids City risk associated with damage to private property.
		🟢	🟢
Revenue	Meter	• Loss of revenue associated with under-registering or un-readable meters can be actively managed.	• Lack of incentive to maintain meter performance to support City revenue.
		🟢	🔴
Maintenance	Meter	• City can maintain meters in a holistic fashion.	• Consistency of meter maintenance requires City legislation.
		🟢	🔴
	Meter	• Meter testing / replacement can be informed based on the entire meter population (or a specific subset).	• Meter testing / replacement only conducted at the direction of the City.
		🟢	🔴
	Meter + Assembly	• City can stock spare parts and has the in-house skillset to respond to maintenance needs.	• Private owner relies on suppliers / contractors and may lack the skillset to know when maintenance is required.
		🟢	🟡
Ancillary Benefits	Meter	• Meters can be managed as a City asset and serve as a tool for more than billing (future planning, system management, etc.)	• With responsibility associated with meter ownership comes an increased awareness of the value of water.
		🟢	🟢

Table 4.1: City vs Public Ownership Evaluation (cont.)

Evaluation Criteria	Applicable To: (Meter / Assembly)	City Owned	Privately Owned
Legislative Limits	Meter + Assembly	• Additional legislation only required to access meters located on private property.	• Legislation required for meter maintenance, testing, and replacement.
		🟢	🔴
	Meter + Assembly	• City can act proactively (as appropriate).	• City is bound by legislative limits (reactive).
		🟢	🔴
Cost Effectiveness	Meter	• Economies of scale for meter maintenance, testing, and replacement.	• Private owner may be subject to minimum call out charges, overtime / weekend premiums, etc. from contractors.
		🟢	🟡
	Meter + Assembly	• O&M costs increase when meter is located on private property (especially when inside a building).	• When meters are located on private property, City O&M costs associated with coordinating access are avoided by private meter ownership.
		🔴	🟢
	Meter	• Bylaw enforcement costs are minimized.	• Costs associated with bylaw enforcement, notices, etc. are higher.
		🟢	🔴
	Meter	• Water rates need to account for costs associated with meter maintenance, testing, replacement, etc.	• Water rates could be reduced since the private owner is responsible for meter maintenance, testing, replacement, etc.
		🟡	🟡

5.0 SUMMARY

As discussed at the outset of this memo, meter ownership is, in a sense, a function of meter location. The discussion below outlines the suitability of each ownership option with respect to alternate meter locations. For convenient reference, the meter location alternatives discussed in Technical Memorandum #1 are also provided below.

Option #1 – City Owned Meter and Assembly

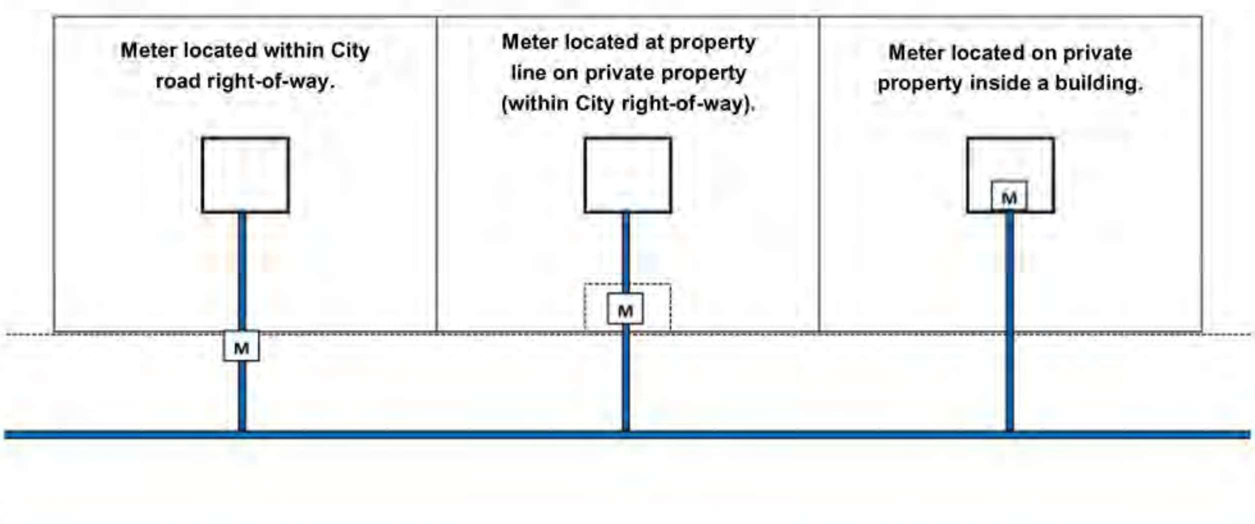
- Best suited for meters located within the City road right-of-way.
- Potentially suitable for meters located at property line on private property (within a City right-of-way).
- Not suitable for meters located on private property inside a building.

Option #2 - City Owned Meter, Privately Owned Assembly

- Best suited for meters located at property line on private property (within a City right-of-way).
- Potentially suitable for meters located on private property inside a building.
- Not suitable for meters located within the City road right-of-way.

Option #3 – Privately Owned Meter and Assembly

- Best suited for meters located on private property inside a building (particularly for ICI customers).
- Potentially suitable for meters located at property line on private property (a City right-of-way would not be required in this case).
- Not suitable for meters located within the City road right-of-way.



6.0 DISCUSSION

We recognize that due to inherent variation in site constraints across developments throughout the City, different meter location options will exist, as outlined in Section 5.0. As such, preferred ownership alternatives will exist for varying meter location installations. Minimizing risk of liability to the City should be a key factor when considering meter location and ownership.

Overall, the assessment indicates that there is a benefit for meters to be owned by the City. Meters are a City asset and serve as a tool for managing revenue from water use, system planning and management.

For meters located at property line, the meter and assembly should be owned by the City. This applies to meters located within the City road right-of-way or on private property within a City right-of-way. This is considered the lowest risk, highest benefit option.

The only scenario where privately owned meters should be considered is for inside installations. This is based on potential liability risks associated with leaks as well as access challenges for meter maintenance, testing, and replacement. If inside meters are privately owned, the City would need to implement means of ensuring that privately owned meters are operating and functioning properly. It is also important to ensure that all meters are easily readable by City staff by means of a touch pad mounted on the outside wall or equipping the meter with a radio. The following should be considered:

- Registering covenants on properties with private meters to ensure and enforce conformance to City metering requirements.
- Ensuring that installed meters meet the City's approved products list.
- Requiring regular testing and maintenance of meters and eventual replacement as a requirement by bylaw. This work could be completed by the City forces for a fee.

As previously mentioned, all meters are currently owned by the City. If private meter ownership (for inside locations) is adopted, it should only apply to new meters. That is, meters installed as part of a new development or replacement of an existing meter at an existing building. That way there will be no transition of ownership for an existing meter.

Notwithstanding potential liability risks or access challenges associated with inside meters, several of the other evaluation criteria support City ownership of all meters, regardless of location. If inside meters are owned by the City (as per the current protocol), we recommend that the assembly (piping, valves, etc.) be privately owned in an effort to minimize risk.

7.0 CROSS CONNECTION CONTROL CONSIDERATIONS

The following considerations are provided with respect to integration of water meters and backflow prevention devices:

- Generally, recognized cross connection control devices (ie. testable devices) are privately owned.
- If the backflow prevention device is at the same location as the water meter (either at property line on private property or inside the building), a privately owned meter / assembly may be of increased benefit to the City. The reason being that consistent ownership of the meter and backflow prevention assemblies would provide clarity regarding O&M responsibilities, liability, etc.
- Unrecognized cross connection control devices (such as dual checks on setters) could be either City or privately owned. These devices are not typically testable and thereby not recognized under most cross connection control programs. Without a clear private property owner responsibility for testing, ownership can be consistent with that of the meter / assembly to align with O&M responsibilities, liability, etc.

CITY OF NANAIMO
THE HARBOUR CITY

TECHNICAL MEMO 3

METER SIZING METHODOLOGY

BUSINESS CASE

URBAN systems

550 – 1090 Homer Street
Vancouver, BC V6B 2W9
Contact: Jacob Scissons, P.Eng.
T: 604.235.1701
jscissons@urbansystems.ca

urbansystems.ca

Report to:

City of Nanaimo
411 Dunsmuir Street
Nanaimo, BC
V9R 5J6

Attn: Doris Fournier, P.Eng., Manager of Municipal Infrastructure

Prepared by:

Urban Systems
550 – 1090 Homer Street
Vancouver, BC
V6B 2W9

July 29, 2015

Jacob Scissons, P.Eng.
Project Engineer

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1.0 INTRODUCTION

This technical memorandum is part of a series of five business cases to inform the development of a Water Metering Strategy for the City of Nanaimo (the City).

The purpose of this business case is to develop a clear and consistent meter sizing methodology to be used for new water meters installed in the City. This includes meters for new developments as well as replacement meters for existing customers.

2.0 IMPORTANCE OF SIZING METERS APPROPRIATELY

Proper sizing of meters is critical to accurately record customer water consumption while providing the desired level of service.

When meters are oversized, low flows may not be registered resulting in lost revenue to the City. The unregistered consumption contributes to apparent losses in the municipal water system impacting the City's Infrastructure Leakage Index (ILI) targets. From the developer's perspective, an oversized meter would represent an unnecessary cost premium compared to a properly sized meter.

Undersized meters may introduce pressure losses that jeopardize the level of water service provided to a customer. This is most common when the meter is smaller than the water service size. Downsizing the meter from the water service is very common (even encouraged); however, the designer must ensure that system performance is not impacted by the meter assembly.

3.0 SIZING METHODOLOGIES

3.1 Hunter Sizing Methodology

In 1940, Roy Hunter developed a methodology for estimating peak water demands based on the type and number of fixtures being used at a given time. ***Fixture Units*** were identified for various types of fixtures, which are unitless values intended to represent the probability of simultaneous use. A series of curves (referred to as the Hunter Curves) were developed as a means of correlating total fixture units to total peak demand for various types of development. Over the years, the Hunter method has been incorporated into plumbing codes across North America, including the British Columbia Building Code (BCBC).

Experience has shown that the Hunter sizing methodology is prone to overestimating peak water demands in many cases (and thus resulting in oversizing water service lines and meters). The conservatism in this method is considered a result of overestimating the probability of simultaneous fixture use.

3.2 AWWA M22 Sizing Methodology

The AWWA sizing methodology was developed in 1975 and is documented in the *AWWA Manual of Water Supply Practices M22 Sizing Water Service Lines and Meters*. This sizing methodology is based on ***Fixture Values***, which represent the peak flow of a fixture when it is operated without the interference of other fixtures. The AWWA method sought to replace the Hunter curves with a new series of curves based on actual field measurements with the intention of more accurately reflecting the probability of multiple fixtures being operated simultaneously.

3.3 Comparison and Uptake

Practitioners were initially hesitant to adopt the AWWA sizing methodology since the projected water demands were significantly lower than those derived using the Hunter method. The AWWA Manual M22 provides a sample comparison of the two methods based on a development consisting of 36 multi-family buildings. The findings are depicted in the figure below.

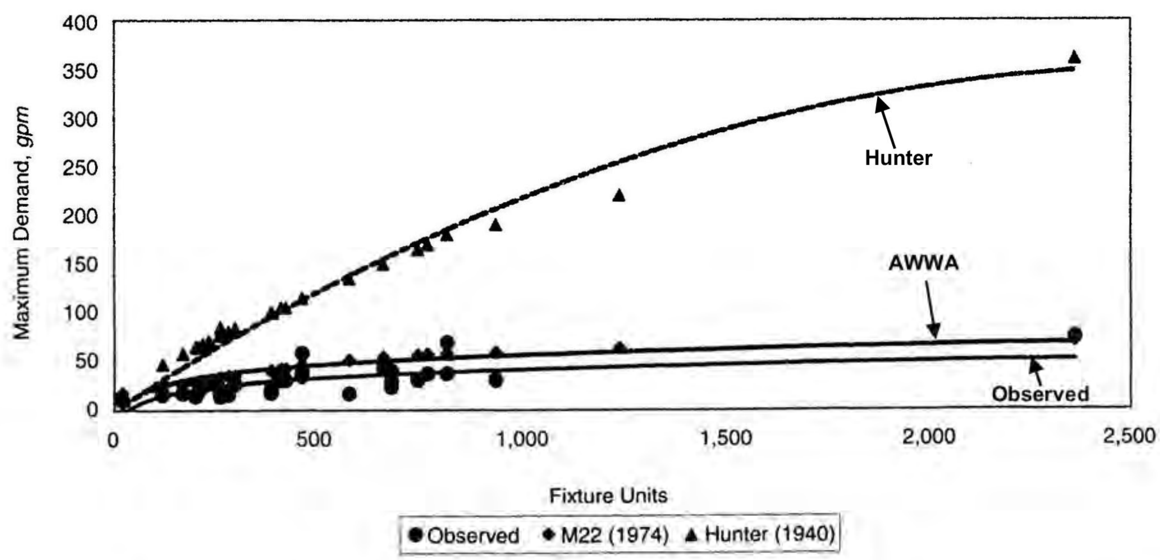

Figure 4-4 Fixture units versus maximum demand multifamily housing: Observed data and data predicted by M22 (1975) and Hunter (1940)

For this specific case, there was a close correlation between the AWWA curve and the observed flows, while the Hunter curve revealed a significant overestimation of peak demand.

Based on our experience, water services are typically sized based on the Hunter fixture unit method, which is referenced by most plumbing codes (including the BCBC). However, more and more utilities are choosing to adopt the AWWA fixture value method for meter sizing. The reason being that an oversized water service may represent a higher cost, but would not typically affect performance. However, the fact that an oversized meter may not register low flows and lead to lost revenue is additional incentive to support a smaller, properly sized meter.

A typical installation scenario sees a meter that is one to two pipe sizes smaller than the water service. For phased developments, the meter piping assembly should be designed to accommodate the meter size required for build-out.

4.0 APPLICABILITY

The AWWA methodology is intended for sizing domestic meters servicing multi-family developments or industrial / commercial / institutional (ICI) properties. Although this sizing methodology could also be used for single family residential properties, it is not considered necessary. Rather, we recommend that all water service connections to single family residential properties be equipped with a 19 mm diameter meter unless the applicant can demonstrate the need for a larger meter.

The AWWA sizing methodology was developed for domestic water meters. It is not intended for sizing fire service meters. The applicant or their engineer should be responsible for sizing fire service meters in accordance with applicable standards such as the Fire Underwriters Survey (FUS) and National Fire Protection Association (NFPA).

Also, there may be unique developments (such as a car wash or a fish farm), for which the AWWA sizing methodology is not well suited. This is because the fixture values and probability curves were not developed for these less common land uses. For these types of applications, we suggest that the City require the applicant to submit calculations signed and sealed by an engineer justifying the proposed water meter size.

5.0 PRESSURE ADJUSTMENT

The fixture values used in the AWWA sizing methodology represent the peak flow in US gallons per minute at a base pressure of 60 psi at the meter outlet. The AWWA Manual M22 provides pressure adjustment factors in Table 4-1 for a range of 35 psi to 100 psi. We do not recommend adjusting for pressures greater than 80 psi for the purposes of meter selection. Rather, installation of a pressure reducing valve should be required at properties within areas of the City where system pressures are higher.

6.0 IRRIGATION DEMAND

6.1 Piped Irrigation Systems

There are several methods utilized to estimate peak irrigation demands. The AWWA Manual M22 outlines an approach based on the size of individual irrigation zones, the type of sprinkler head, and the design application rate. One of the criticisms with this method is that it requires specific details and information that is generally retained by the irrigation system designer and not necessarily available to the designer of the meter assembly.

The City of Surrey previously required applicants to identify projected irrigation demands using the AWWA method, which is based on the number of 100 ft^2 sections of spray or rotary type irrigation combined with pre-specified multipliers. Surrey found that applicants struggled to complete this step of the meter sizing calculation given the variations in irrigation system designs (different types of sprinkler heads, automatic vs manual controls, zone cycling ability, etc.). Further, applicants indicated that the peak irrigation flow had been provided by the irrigation system designer or manufacturer in many cases and questioned the need to "back-calculate" to satisfy the City's sizing protocol.

Surrey has since revised this step of their meter sizing calculation to simply require the applicant to identify the total irrigation demand. However, there is a qualification that irrigation demands in excess of 50 GPM require submission of a detailed irrigation plan outlining appropriately designed zones. This approach has been more effective.

We suggest that Nanaimo consider a similar approach to Surrey for estimating peak irrigation demands since it provides flexibility for various irrigation system designs and types. It also places the responsibility on the applicant to identify the irrigation demand, as opposed to completing a City specified calculation. However, based on discussions with local irrigation system design and installation companies, the typical design flow to a single irrigation zone is about 35 GPM for larger commercial properties and about 10 to 15 GPM for residential properties. This flow may vary depending on the size of the water service connection. In consideration of the above, adopting a maximum irrigation demand of 35 GPM for the purpose of meter sizing is recommended.

6.2 End-of-Hose Sprinklers

Some customers may irrigate lawns using end-of-hose sprinklers connected to an exterior hose bib. However, hose bibs may also be used to fill watering cans, wash vehicles, etc. The question is: should hose bibs be treated like a piped irrigation system or a domestic fixture?

Flows from domestic fixtures contribute to the total peak domestic demand and are adjusted to account for the probability of simultaneous use using the AWWA curves. However, irrigation demands are typically added to domestic demands without probability adjustment to determine the total peak demand.

Since most new homes utilize piped irrigation systems, we recommend that hose bibs be treated like domestic fixtures. This will avoid compounded conservatism in the sizing calculation.

7.0 TOTAL PEAK DEMAND

The AWWA sizing methodology determines the total peak demand based on the peak domestic demand (adjusted for pressure and probability of simultaneous use) plus the total irrigation demand. Some utilities feel that this leads to an overestimation of peak hour water use. The argument is based on whether customers are irrigating at the same time as peak domestic water use occurs.

For example, the City of Surrey now requires that meters be sized based on the greater of domestic or irrigation flows. Since implementing this change, Surrey has seen less oversizing of meters without compromising the level of service.

Another approach is to use a weighted combination of the domestic and irrigation demands to determine the total peak demand. The weighting is sometimes pre-populated while in other cases the applicant proposes how flows are combined.

The City of Nanaimo *Waterworks Rate and Regulation Bylaw* indicates that during water use restrictions "no person shall water lawns, trees, shrubs and gardens between the hours of 10:00 am and 4:00 pm". The morning peak for domestic use is typically earlier than 10:00 am and the evening peak is typically later than 4:00 pm. This means that there is a good chance that customers will be irrigating at the same time as peak domestic water use.

Based on the above, we recommend that the City require that meters be sized based on the total peak domestic plus irrigation demands. If the City observes oversizing of meters or if irrigation restrictions are changed in the future, the meter sizing procedure could be revised accordingly.

8.0 METER SELECTION

Once the total peak demand is derived, the next step is to select the appropriate meter size and type. We have seen two common "safety factors" incorporated into this step:

- Sizing the meter based on a percentage of the manufacturer specified peak instantaneous flow rating; and
- Specifying a maximum allowable pressure loss across the meter assembly at the total peak demand flow rate.

We have also seen these safety factors relaxed with increased comfort in the sizing methodology. For example, the City of Surrey previously specified that meters be sized based on 80% of the peak instantaneous flow rate and based on a maximum pressure loss of 7 psi. As part of the recent updates to their sizing methodology, Surrey has eliminated the maximum pressure loss requirement and increased the percentage of peak instantaneous flow to 90%.

Based on discussions with the City, we recommend incorporating the following safety factors in the meter selection step of the sizing procedure:

- Total peak demand not to exceed 80% of the manufacturer specified peak instantaneous flow rating; and
- Pressure loss at total peak demand not to exceed 5 psi.

Again, these safety factors could be adjusted in the future if the City sees a trend of meters being oversized.

9.0 A NOTE ON UNITS

The AWWA sizing methodology is based on the US customary measurement system. Fixture values are defined in <u>US gallons per minute</u> at 60 <u>psi</u>. The AWWA probability curves and pressure adjustment factors were also developed using US customary units.

Recognizing that in Canada we use the metric system of measurement, it may seem odd that a City of Nanaimo engineering publication include US customary units. That being said, we do not recommend converting the tables and graphs to reflect metric units. Doing so would place unnecessary responsibility on the City and cause confusion for applicants who may rely on the AWWA Manual 22 for guidance.

10.0 SUMMARY

We recommend that the City adopt a meter sizing methodology based on the AWWA Manual M22 with the following modifications / specifics:

- Treat hose bibs as domestic fixtures;
- Adjust for pressures up to a maximum of 80 psi;
- Require applicants to identify the total irrigation demand (with appropriate backup for demands in excess of 35 GPM);
- Calculate total peak demand based on the total peak domestic plus irrigation demands;
- Size meters based on 80% of the manufacturer specified peak instantaneous flow rating; and
- Specify a maximum pressure loss of 5 psi at the total peak demand.

Appendix A

Water Meter Sizing Calculation Sheet

CITY OF NANAIMO
THE HARBOUR CITY

Water Meter Sizing Calculation Sheet

For Non-Fire Service Meters

AWWA M22 Fixture Value Methodology

General Information

Customer Name: ____________________ File No. ____________

Address / Legal Description: ____________________ Building Permit No. ____________

____

Occupancy Type: Industrial ☐ Commercial ☐ Institutional ☐

Multifamily ☐ Agricultural ☐ Other ☐ ____________

Is this a phased development? Yes ☐ No ☐

Calculations pertain to: Buildout ☐ Phase ☐ Phase No. ____________

Step 1: Calculate Total Domestic Fixture Value

Fixture	Fixture Value (GPM @ 60 psi)		No. of Fixtures		Fixture Value
Bathtub	8	x		=	
Bedpan Washers	10	x		=	
Bidet	2	x		=	
Dental Unit	2	x		=	
Dishwasher	2	x		=	
Drinking Fountain - Public	2	x		=	
Hose Bibs (c/w 50 ft wash down):					
- 1/2 inch	5	x		=	
- 5/8 inch	9	x		=	
- 3/4 inch	12	x		=	
Kitchen Sink	2.2	x		=	
Lavatory	1.5	x		=	
Showerhead (Shower Only)	2.5	x		=	
Service Sink	4	x		=	
Toilet:					
- Flush Valve	35	x		=	
- Tank Type	4	x		=	
Urinal:					
- Pedestal Flush Valve	35	x		=	
- Wall Flush Valve	16	x		=	
Wash Sink (Each Set of Faucets)	4	x		=	
Washing Machine	6	x		=	

For single family residential properties, the meter size shall be 19 mm, unless the Applicant can demonstrate the need for a larger meter.

CITY OF NANAIMO
THE HARBOUR CITY

Water Meter Sizing Calculation Sheet

Step 1 (cont.)

Fixture	Fixture Value (GPM @ 60 psi)		No. of Fixtures		Fixture Value	
Other:						
______	______	x	______	=	______	
______	______	x	______	=	______	
______	______	x	______	=	______	
			Total Domestic Fixture Value	=	______	**GPM (A)**

Step 2: Calculate Probable Peak Domestic Demand

Refer to Figure 4-2 or 4-3 — **Probable Peak Domestic Demand** = ______ **GPM (B)**

Step 3: Apply Pressure Adjustment Factor

City Water System Pressure (not to exceed 80 psi) = ______ psi

Pressure Factor from Table 4-1 = ______ (C)

Adjusted Peak Domestic Demand (B x C) = ______ **GPM (D)**

Step 4: Identify Irrigation Demand

Total Irrigation Demand = ______ **GPM (E)**

For irrigation demands greater than 35 GPM, a detailed irrigation plan shall be provided with appropriately designed zones.

Step 5: Calculate Total Peak Demand

Total Peak Demand (D + E) = ______ **GPM (F)**

Step 6: Select Water Meter

Water Meter Make / Model: = ______

Water Meter Size * = ______ inches

Water Service Connection Size = ______ inches

* Total Peak Demand (F) not to exceed 80% of Meter Rated Peak Instantaneous Flow
* Pressure Loss at Total Peak Demand (F) not to exceed 5 psi

Professional Certification

Name: ______

Company: ______

Date: ______

Comments: ______

______

______

______

______

Seal

For single family residential properties, the meter size shall be 19 mm, unless the Applicant can demonstrate the need for a larger meter.

Appendix B

Water Meter Sizing Calculation Example

CITY OF NANAIMO
THE HARBOUR CITY

Water Meter Sizing Calculation Sheet

For Non-Fire Service Meters

AWWA M22 Fixture Value Methodology

Example

General Information

Customer Name:	Example	File No.	Example
Address / Legal Description:	Example	Building Permit No.	Example
	Example		

Occupancy Type: Industrial [ ] Commercial [ ] Institutional [ ] Multifamily [X] Agricultural [ ] Other [ ] ______

Is this a phased development? Yes [ ] No [X]

Calculations pertain to: Buildout [X] Phase [ ] Phase No. ______

This meter sizing calculation is based on the AWWA M22 Fixture Value Methodology. Applicant's Engineers are expected to purchase and use the *AWWA Manual of Water Supply Practices M22 Sizing Water Service Lines and Meters* when completing this methodology.

This section includes general information about the customer and proposed development.

A 30 unit townhouse complex has been chosen as an example to demonstrate the use of this sizing methodology.

Step 1: Calculate Total Domestic Fixture Value

Fixture	Fixture Value (GPM @ 60 psi)		No. of Fixtures		Fixture Value
Bathtub	8	x	30	=	240
Bedpan Washers	10	x		=	
Bidet	2	x		=	
Dental Unit	2	x		=	
Dishwasher	2	x	30	=	60
Drinking Fountain - Public	2	x		=	
Hose Bibs (c/w 50 ft wash down):					
- 1/2 inch	5	x	30	=	150
- 5/8 inch	9	x		=	
- 3/4 inch	12	x		=	
Kitchen Sink	2.2	x	30	=	66
Lavatory	1.5	x	90	=	135
Showerhead (Shower Only)	2.5	x	30	=	75
Service Sink	4	x		=	
Toilet:					
- Flush Valve	35	x		=	
- Tank Type	4	x	90	=	360
Urinal:					
- Pedestal Flush Valve	35	x		=	
- Wall Flush Valve	16	x		=	
Wash Sink (Each Set of Faucets)	4	x	30	=	120
Washing Machine	6	x	30	=	180
Other:					
		x		=	
		x		=	
		x		=	
			Total Domestic Fixture Value	=	1386 **GPM (A)**

In this example, the following fixtures are identified for each of the 30 units in the proposed development:

- 1 bathtub
- 1 shower
- 3 toilets (tank type)
- 3 bathroom sinks
- 1 dishwasher
- 1 kitchen sink
- 1 washing machine
- 1 laundry sink
- 1 hose bib (1/2 inch)

These fixtures yield a Total Domestic Fixture Value of 1386 GPM.

Note: If a fixture is proposed that is not on the list then the peak flow value (fixture value) can be included on one of the blank lines under "Other" based on the manufacturer's information.

CITY OF NANAIMO
THE HARBOUR CITY

Water Meter Sizing Calculation Sheet

For Non-Fire Service Meters

AWWA M22 Fixture Value Methodology

Example

Step 2: Calculate Probable Peak Domestic Demand

Refer to Figure 4-2 or 4-3

Probable Peak Domestic Demand = 65 **GPM (B)**

The AWWA Manual M22 includes two graphs (Figures 4-2 and 4-3) which provide a correlation between the Total Domestic Fixture Value and Probable Peak Domestic Demand for various development types.

For this example, Figure 4-3 applies since the Total Domestic Fixture Value is in the "high range". The "Apartments" curve indicates that a Total Domestic Fixture Value of 1386 GPM corresponds to a Probable Peak Domestic Demand of 65 GPM.

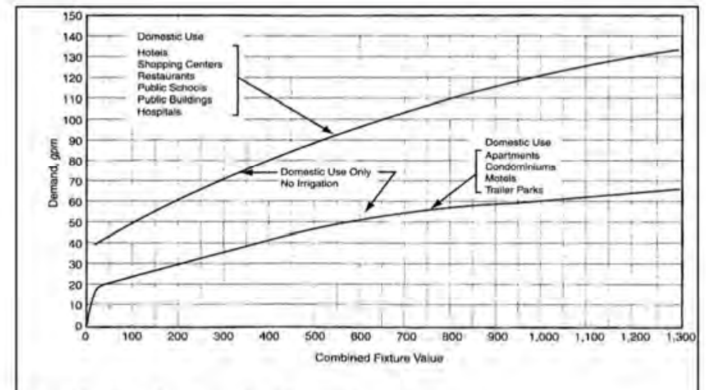

Figure 4-2 Water flow demand per fixture value—low range

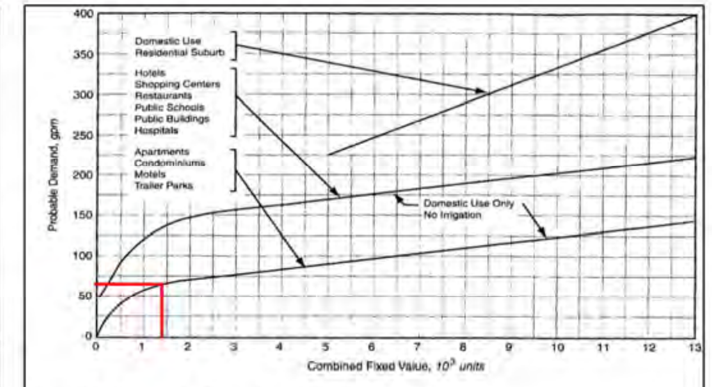

Figure 4-3 Water flow demand per fixture value—high range

Step 3: Apply Pressure Adjustment Factor

City Water System Pressure (not to exceed 80 psi) = 70 psi

Pressure Factor from Table 4-1 = 1.09 (C)

Adjusted Peak Domestic Demand (B x C) = 70.85 **GPM (D)**

The fixture values listed in Step 1 are based on a pressure of 60 psi. This step increases or decreases the peak demand based on the pressure at the outlet of the meter. Table 4-1 in the AWWA M22 Manual provides adjustment factors for various pressures.

For this example, the pressure downstream of the meter is identified as 70 psi. From Table 4-1, the pressure adjustment factor is 1.09 and the Adjusted Peak Domestic Demand is 70.85 GPM.

Note that for the purpose of this sizing methodology, the maximum pressure for which to apply an adjustment is 80 psi.

Table 4-1 Pressure adjustment factors*

Working Pressure at Meter Discharge (*psi*)	Average Flow from 50 ft of ⅝-in. Hose and Sprinkler (*gpm*)	Pressure Adjustment Factor
35	6.7	0.74
40	7.2	0.80
50	8.1	0.90
60	9.0	1.00
70	9.8	1.09
80	10.5	1.17
90	11.2	1.25
100	12.1	1.34

*derived from Table 4-1 and 4-2 of Manual M22 (1975).

NOTE: To convert psi to kPa: psi × 6.89476; to convert gpm to m^3/hr: gpm × 0.227

CITY OF NANAIMO
THE HARBOUR CITY

Water Meter Sizing Calculation Sheet

For Non-Fire Service Meters

AWWA M22 Fixture Value Methodology

Example

Step 4: Identify Irrigation Demand

Total Irrigation Demand = 23.2 **GPM (E)**

For irrigation demands greater than 35 GPM, a detailed irrigation plan shall be provided with appropriately designed zones.

The Total Irrigation Demand is identified in this step. The AWWA Manual M22 provides guidance for calculating irrigation demands. However, the Applicant's Engineer may refer to an irrigation system design flow specified by the manufacturer or identified by the irrigation system designer.

For this example, an area of 2000 ft^2 is irrigated by a spray irrigation system. The AWWA M22 Manual indicates that for spray irrigation each "section" represents a flow of 1.16 GPM. A "section" is defined as 100 ft^2. So the calculation yields:

Total Irrigation Demand = 2000 ft^2 / 100 ft^2 = 20 sections x 1.16 GPM = 23.2 GPM

Step 5: Calculate Total Peak Demand

Total Peak Demand (D + E) = 94.05 **GPM (F)**

The Adjusted Peak Domestic Demand of 70.85 GPM from Step 3 is combined with the Total Irrigation Demand of 35 GPM from Step 4 to yield a Total Peak Demand of 105.85 GPM.

Step 6: Select Water Meter

Water Meter Make / Model: = Sensus OMNI C^2

Water Meter Size * = 1.5 inches

Water Service Connection Size = 2 inches

* Total Peak Demand (F) not to exceed 80% of Meter Rated Peak Instantaneous Flow
* Pressure Loss at Total Peak Demand (F) not to exceed 5 psi

The selected meter is a 1.5" Sensus OMNI C^2.

The manufacturer specified maximum intermittent flow rating for this meter is 200 GPM.
80% of 200 GPM = 160 GPM > 94.05 GPM

The manufacturer specified pressure loss for this meter (with strainer) at 94.05 GPM is approximately 4 psi (< 5 psi).

Professional Certification

Seal

Name: Example

Company: Example

Date: Example

Comments:

Seal

This section is for the Applicant's Engineer to certify the water meter sizing calculation.

The comments space is provided to explain any unique aspects of the development that impact the proposed meter sizing.

CITY OF NANAIMO

THE HARBOUR CITY

TECHNICAL MEMO 4

METER TECHNOLOGY EVALUATION

BUSINESS CASE

URBAN systems

550 – 1090 Homer Street
Vancouver, BC V6B 2W9
Contact: Jacob Scissons, P.Eng.
T: 604.235.1701
jscissons@urbansystems.ca

urbansystems.ca

Report to:

City of Nanaimo
411 Dunsmuir Street
Nanaimo, BC
V9R 5J6

Attn: Doris Fournier, P.Eng., Manager of Municipal Infrastructure

Prepared by:

Urban Systems
550 – 1090 Homer Street
Vancouver, BC
V6B 2W9

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Jacob Scissons, P.Eng.
Project Engineer

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1.0 INTRODUCTION

This technical memorandum is part of a series of five business cases to inform the development of a Water Metering Strategy for the City of Nanaimo (the City).

The purpose of this business case is to evaluate alternate metering products that are available in the BC market and identify meters that are best suited to meet the needs of the City.

2.0 METER TECHNOLOGIES

In their simplest form, water meters measure and record the amount of water that passes through them. However, there a several different technologies used by meter manufacturers to achieve this. An overview of common meter types and technologies is provided in the following sections beginning with meters typically suited for lower flows / smaller sizes and increasing to higher flow / larger size applications.

2.1 Positive Displacement

Positive Displacement (PD) meters have been the standard for measurement of residential and small commercial accounts for the past 100+ years, with only minor changes and enhancements to improve performance.

Two common types of PD meters are oscillating piston and nutating disk. Both methods rely on the water to physically displace the moving measuring element in direct proportion to the amount of water that passes through the meter. The piston or disk moves a magnet that drives the register.

PD meters are generally very accurate at the low to moderate flow rates typical of residential and small commercial users. Because displacement meters require that all water flows through the meter to "push" the measuring element, they generally are not practical in large commercial or industrial applications requiring high flow rates or low pressure loss. PD meters normally have a built-in strainer (screen) to protect the measuring element from rocks or other debris that could stop or break the measuring element. PD meters normally have bronze, brass, or plastic bodies with internal measuring chambers made of moulded plastics and stainless steel.

2.2 Fluid Oscillator

Fluidic oscillator meters measure the frequency with which a fluid entering the meter attaches to one of two opposite diverging side walls and then the other, due to the Coanda effect (the tendency of a fluid jet to attach itself to a nearby surface).

This technology only measures the flow of water, so it is not affected by the presence of air or particles in the water system. With no moving parts in the measuring chamber, it can be used where sand and grit are present in the water.

In the past, this technology struggled at low flows due to minimum flow rates required for the Coanda effect to start. However, recent advancements have seen significantly improved low flow accuracy for fluid oscillator meters.

2.3 Magnetic

Magnetic flow meters are based on Faraday's law of induction: the induced electromotive force in any closed circuit is equal to the time rate of change of the magnetic flux through the circuit. In simpler terms, the meter measures an electrical signal that is produced when ionized water flows through a magnetic field. The faster the water flows, the more voltage is created and measured. Voltage is linearly proportional to speed; as water speed increases, voltage increases and the measure of volume increases.

Until recently, magnetic water meters were only available in larger sizes and used primarily in process type applications. Improvements in the technology has seen a rise in the production of these meters for potable water applications in all sizes down to those typical for small residential uses. As these are essentially a velocity type meter, a challenge for manufacturers was obtaining low flow accuracy. This has now been achieved and some manufacturers have brought out magnetic meters in residential sizes.

Since magnetic meters have no mechanical measuring element inside the flow chamber, there is no reduction in accuracy over time; there is linear performance over the flow range. These meters maintain accuracy at both forward and reverse flow directions.

2.4 Ultrasonic

As the name implies, ultrasonic meters utilize a sound wave directed into the flow stream to determine the velocity and hence derive the flow volume. There are two types of ultrasonic measurement: Doppler and Transit-time. Doppler is generally used where there are particulates or air bubbles in the flow stream and typically require a minimum of approximately 25 ppm (parts per million) at roughly 30 microns in order for the ultrasonic signal to be reflected efficiently. Transit-time is better suited for ultra-pure fluids such as potable water.

Transit-time meters use an ultrasonic transducer to send sound waves upstream and downstream through the water, the difference of which is used to determine its velocity, which is then translated into a measure of water volume. Dual-beam meters provide better accuracy by accounting for variations in the flow profile.

Similar to magnetic meters, there is no measuring element hindering the path of water flow. This means that pressure loss is not a concern and the meter maintains its accuracy until the battery life is depleted.

2.5 Turbine

Turbine meters are a velocity type meter. They can accommodate higher flow rates with less pressure loss than PD meters and are less susceptible to jamming from debris. These meters are best suited for higher, steady-state flow rates where low-flow measurement is not a significant percentage of the total flow (i.e. irrigation and process flows). Performance is not linear across the flow range and generally not as accurate as a PD meter at the very low flows.

Installation requirements are very specific and must be followed to ensure proper meter performance. Turbine meters must be installed with a strainer to protect the meter impeller and to provide flow conditioning. Proper upstream and downstream pipe lengths are critical to ensure accurate measurement. It is common to see improperly installed turbine meters which makes replacement difficult and piping modifications almost a certainty.

2.6 Compound

Compound meters provide greater rangeability by combining a low-flow element (typically a PD chamber) with a higher-flow turbine meter element. A check valve regulates flow between the two metering chambers. The flow rate where this switching occurs is referred to as the cross-over point and can be problematic if flows are consistently in this range.

Compound meters are more complex than other meter types and have been prone to premature failure due to issues with the cross-over valve. The use of two measuring technologies can increase complexity and service requirements. Most manufacturers utilize two registers requiring additional set up in the billing system. As a result of the above, some manufacturers have discontinued the compound meter in favour of other technologies.

Compound meters are useful where flows are highly variable and can accurately measure a wider flow range than any other meter. Common applications include multi-unit residential buildings and mixed use buildings consisting of residential and commercial spaces.

3.0 METERS TO BE EVALUATED

The evaluation considers meters from the manufacturers listed below, which were identified based on several factors including availability and quality of local support, types and sizes of meters offered, and demonstrated performance.

- Neptune
- Sensus
- Elster (Honeywell) / ABB
- Master Meter
- Badger

Other metering technologies marketed in North America, such as those offered by Hersey, Performance, Carlon, etc., have not been included primarily based on the lack of proven local support or installations. Further, these products do not appear to provide any advantages over the locally supported metering technologies that are included in the evaluation.

4.0 EVALUATION CRITERIA

The evaluation of the various water meters includes the criteria listed below. A detailed evaluation matrix is included in **Appendix A**, which provides pertinent information regarding each of these criteria for each metering product.

Materials & Dimensions

- Size Range – provides an indication of potential uses for each metering product (ie. residential vs commercial uses).
- Meter Type – indicates the technology that the meter design is based on (as discussed in Section 2.0).
- Maincase Material – indicates the use of "conventional" materials (bronze, ductile iron) vs newer materials such as polymers and plastics.
- Lay Length – uncommon lay lengths may suggest challenges associated with meter replacement in the future.

Approvals

- AWWA Standard – demonstrates that the product meets these industry accepted performance standard.
- NSF 61 Annex F/G – confirms that the product satisfies current "low lead" requirements.
- Factory Mutual / Underwriters Laboratory Canada – confirms that the product is suitable for fire service applications (as discussed in Section 6.3).

Performance Specifications

- Normal Operating Range – identifies the "rangeability" or the meter, which may exceed AWWA standards.
- Low Flow Registration – the low flow accuracy of the meter is reflective of the meter's ability to minimize lost revenue.
- Pressure Loss – this is important to understand potential implications to customers' water pressure associated with the meter.

Features

- Data Logging Capability – the ability of the meter to record consumption data beyond that required for billing.
- Automated Meter Reading (AMR) and Advanced Metering Infrastructure (AMI) Compatibility – indicates the most common reading systems used with each metering product.
- Power Requirements and Warranties – outlines the type of battery used and the associated manufacturer warranty for battery life.

- Presence of Test Port – indicates if the meter can be tested in place or if installation of a downstream test port would be required to do so.

Operations & Maintenance

- Availability of Spare Parts / Field Replaceable Components – indicates if the meter could be repaired / refurbished or if a complete replacement meter is required.

Cost

- Price Point (Supply Cost) – assigns a high, mid, or low price point to each meter.

Local Considerations

- Availability and Quality of Local Support – outlines available customer and technical support associated with each manufacturer.
- Municipal Applications in Western Canada – provides an example of other municipalities (and private utilities) that use each metering product.

5.0 Manufacturer Product Lines

Metering technologies have evolved significantly over the past decade. Some advancements have been driven by legislation, such as "lead free" or "low lead" laws in the United States, while other innovations focus on enhancing "smart metering" features. Each manufacturer has taken a slightly different approach with their product lines. A brief summary is provided below.

5.1 Neptune

Neptune continues to produce mechanical meters with bronze maincases. This is not surprising since they operate a foundry in Alabama. In 2001, Neptune switched from leaded bronze to a lead free bronze alloy that complies with NSF 61 requirements.

Neptune has recently announced that they will be releasing an ultrasonic meter branded as the Mach 10. This meter appears to be an alternative to their T-10 positive displacement meter. With no moving parts, the ultrasonic meter will allow Neptune to offer a small diameter, non-mechanical meter which seems to be in demand in some markets.

For large diameter and fire service applications, Neptune continues to offer a selection of compound meters, which utilize a turbine meter for high flows and a positive displacement meter for low flows.

5.2 Sensus

The Sensus water meter product line has seen several changes over recent years. Two new small diameter meters were introduced, both comprised of polymer maincases. The iPERL is an electromagnetic meter with several enhanced features. The accuSTREAM is a positive displacement meter with a polymer maincase. Shortly after the release of these meters, Sensus announced that their SR and SRII bronze positive displacement meters would be discontinued. In response to backlash from several customers, the SRII meter remains in production.

Sensus has also overhauled their large diameter and fire service meters. Their compound meters have been discontinued and replaced with the OMNI line. The OMNI meters utilize "floating ball technology" with varying accuracy tolerances and onboard features available in the R^2, T^2, C^2, and F^2 models.

Another recent change relevant to Sensus is their local distributorship, which has moved from Corix Water Products LP to KTI Limited.

5.3 Elster (Honeywell)

Elster, who was recently acquired by Honeywell, no longer manufactures mechanical (positive displacement or compound) meters. For small diameter sizes, they market a fluid oscillator meter (the SM700 model). The Q700 fluid oscillator meter was recently released, which features enhanced low flow registration, a polymer maincase, and metallic threads. The Q700 meter is currently only available in the 16mm x 19mm size.

For large diameter and fire service applications, the compound meter has been replaced with the evoQ4 magnetic meter. The factory calibration and battery are designed for a ten year service life, with the price point reflective of this.

Until recently, Elster represented and supported the ABB AquaMaster magnetic meter. However, this role is now being fulfilled by Metercor.

5.4 Master Meter

Master Meter is relatively new to the BC market. For small diameter sizes, they offer a positive displacement meter as well as a multi-jet option. Their "showcase" meter is the Octave, which is an ultrasonic meter marketed for medium and large diameter applications. An advertised advantage of the Octave is its low flow accuracy compared to that of a battery powered magnetic meter.

5.5 Badger

For small diameter applications, Badger offers positive displacement meters that are available with either bronze or composite maincases. The Badger E-Series is an ultrasonic meter that is new the market that provides a small diameter meter option with no moving parts. A series of compound and turbine meters are available for large diameter and fire service applications.

6.0 RECOMMENDED PRODUCTS

All of the meters that were evaluated are NSF 61 compliant and meet applicable AWWA material and performance standards. The main differentiators between products are with respect to enhanced features, power requirements, quality of customer support, and local installations.

6.1 Small Diameter Meters

For small diameter applications, we understand that the City values simplicity and robustness coupled with sound performance and quality customer support. In this regard, the ***Neptune T-10*** and ***Sensus SRII*** meters appear to be most suitable. Both of these meters have metallic threads, which is important since the City does not utilize setters (the pipe support system commonly used for small diameter meters). There have been reports of cross-threading challenges where meters with plastic threads are installed inline (ie. without setters). The bronze positive displacement meters also allow for field replacement of most major components. Both of these meters are typically equipped with an electronic register with battery life guaranteed for 20 years.

Note that the Neptune T-10 meter is available in sizes up to 50mm diameter, while the Sensus SRII meter is available up to 25mm diameter. Depending on the preferred product line, the types of metering technologies offered for the 38mm and 50mm diameter sizes will vary.

Battery Power: All of the small diameter meters that were evaluated have a battery life that is guaranteed for 20 years. For non-mechanical meters (such as the Sensus iPERL and Elster SM700) the meter is supplied as a complete factory sealed unit. There is no ability to replace the battery, just the entire meter. For the positive displacement meters (such as the Neptune T-10 and Sensus SRII) the electronic registers are battery powered. The register is field replaceable, but the battery is not. After 20 years of service, many municipalities replace the entire meter. However, the factory sealed register (including battery) can be changed at any time with the maincase enclosed measuring chamber remaining in service.

6.2 Large Diameter Meters

As discussed in Section 5.0, many manufacturers have moved away from compound meters in favour of other technologies. In addition to potential challenges associated with the cross-over valve (as previously discussed), compound meters can also be tricky to connect to some AMR/AMI (reading) systems. This is because they utilize two registers (one for the positive displacement meter and one for the turbine meter). Connecting the dual registers to another manufacturer's radio end-point can be less than straightforward. If it is the City's desire to move to AMR/AMI reading with flexibility for the AMR/AMI vendor, then the compound meter may not be the best choice for the City. However, if the City is willing to include large diameter meter supply in with an AMR/AMI system purchase contract then the issue with compound meters may be able to be resolved.

Some manufacturers offer magnetic or ultrasonic meters for medium and large sizes (as opposed to compound meters). These meters are typically installed without a strainer, provide good low flow accuracy, and have minimal pressure losses. The relevance of these factors are outlined below.

- A strainer is essentially a screen that is installed upstream of the meter chamber to protect the measuring components. Since magnetic and ultrasonic meters do not have any moving parts, they are less susceptible to damage and thereby do not require a strainer.
- Low flow accuracy is important for all meters to minimize lost revenue associated with undetected flow. Since large diameter meters are typically installed in high flows applications, there is an increased chance that these larger meters will not be able to capture low flows.

- Pressure losses typically increase with flow rate. Since large diameter meters are used to accommodate higher flow requirements, it is important to ensure that pressure losses do not impact the level of service being provided to the customer.

Large diameter meters tend to require more power than mechanical meters, which is why battery life is typically only guaranteed for 10 years. In some cases, the meter calibration is also limited to a 10 year horizon. Without a strainer, magnetic and ultrasonic meters have a shorter lay length than mechanical meters. This can be beneficial for meter replacements with challenging piping configurations. We understand that the City is seeking a meter for new installations at property line wherever possible and within this chamber installation the lay length reduction that these meters provide does not impact the chamber size. The magnetic and ultrasonic meters are newer technologies with limited local installations or demonstrated performance. The City could consider approving these products at a later date once their performance has been proven. Alternatively, the City could pilot some of these technologies by installing a single meter and gathering first-hand experience and data.

Based on the complete suite of evaluation criteria, the ***Sensus OMNI C²*** meter is considered best suited for the City's needs. The C^2 model is slightly more expensive than the T^2, but provides better low flow accuracy. However, it should be noted that the battery life of the OMNI meters is guaranteed for 10 years (as opposed to 20 years for other mechanical meters). The Neptune TRU/FLO compound meters may be worth considering once the City has determined its direction for the AMR/AMI reading system and resolved any compatibility issues.

Battery Power: The only large diameter meters with a 20 year guaranteed battery life are the mechanical compound meters (Neptune TRU/FLO and Badger Recordall). Similar to the small diameter positive displacement meters, the electronic registers containing the battery are field replaceable without taking the meter out of service. All other large diameter meters that were evaluated have a 10 year battery life. The Elster evoQ4 is designed for a 10 year service life in terms of accuracy calibration and battery life. The complete meter is changed out as opposed to individual components such as the register. The Master Meter Octave is supplied as a factory sealed unit including the register and meter body. The battery can be replaced by an authorized technician, however the meter must be taken out of service to do so. Although the Sensus OMNI meters have a 10 year battery life, the factory sealed register containing the battery is field replaceable allowing the meter to remain in service until accuracy or other factors trigger replacement. Without the ability to replace the battery there would be a disconnect in the service life of the battery vs the rest of the meter.

6.3 Fire Service Meters

As discussed in Technical Memo #1, separated fire and domestic services are recommended over combined services. This means that there should be limited instances where the City will require a new fire service meter. However for cases such as changing out an existing meter, the City should identify fire service meters that meet their needs.

Our evaluation included the following fire service meters, which are all Factory Mutual (FM) Approved and Underwriters Laboratory (UL) Listed.

- Neptune HP Protectus III
- Neptune HP Fire Service Turbine
- Sensus OMNI F^2
- Elster evoQ4 Fire Service Meter
- Badger Recordall Fire Service Meter

Factory Mutual Global is a property insurance and risk management organization specializing in property protection. FM Approval signifies that a product will perform as expected and support property loss prevention. Underwriters Laboratories is an independent, not-for-profit product safety certification organization that has been testing products and writing safety standards since 1894. Specifying FM Approved and UL Listed meters for all fire service applications has become a best practice implemented by most municipalities.

Fire service meters are typically installed on services supplying water for both fire and domestic uses. For combined fire and domestic needs, it is important to consider the low flow accuracy of the meter. Fire service meters that consist solely of a turbine meter are best suited for industrial applications. They do not have the low flow registration capabilities required to capture domestic flows.

Some manufacturers have sought FM Approval and UL Listing of their magnetic and ultrasonic meters to expand their marketability to include fire service applications. As previously discussed, these types of meters appear to be best suited where pressure losses and lay length are governing factors. However strictly based on price, the evoQ4 Fire Service Meter offers potential cost savings (primarily since a strainer is not required). The performance of this new meter is yet to be proven through local installations.

Considering all evaluation criteria, the ***Sensus OMNI F^2*** meter is well suited for combined fire and domestic lines. Another popular fire service meter is the ***Neptune HP Protectus III***, recognizing that this is a compound meter with dual registers and this meter may be suitable once the AMR/AMI reading system direction and compatibility issues are resolved.

<u>Battery Power:</u> Battery considerations for fire service meters are consistent with those discussed above for large diameter meters.

7.0 PROCUREMENT CONSIDERATIONS

Procurement options for meter supply are closely tied to the selection of a reading system. Meter reading technologies are discussed in detail in Technical Memo #5. In terms of procurement, a competitive Request for Proposal (RFP) process can be an effective means of evaluating alternate readings systems and their ability to meet the City's needs. Once a reading system is selected, there are two common meter supply approaches:

1. Incorporate meter supply in the scope of the reading system RFP. This would provide competitive pricing for the first multi-year contract. However, it may be difficult to "lock in" pricing for more than say 5 years. This means that meter supply pricing may creep higher beyond the initial contract. A clause could be included in the contract to lessen or alleviate this risk (such as capping price increases with the Consumer Price Index). The other challenge with this approach is that it generally requires two different forms of contract for the reading system and the meter supply. The reading system contracts are typically driven by the supplier and may have minimum durations. To further complicate this matter, some meter manufacturers have different companies that are willing to sign each contract which complicates how an RFP is responded to. Neptune currently is one company that can sign both the reading system and meter supply contracts as a single organization. However in the case of Sensus, the meter supply contract and meter reading contract have historically been fulfilled by different parties.

2. Issue a Request for Quotation (RFQ) to specific meter manufacturers whose meters are compatible with the selected reading system. Compatibility is the critical item here. Although some meters claim to be compatible with other manufacturer's reading systems, there can be integration challenges. Specific details on integration with a chosen list of meters can be included as part of the reading system RFP and evaluation in order to minimize this risk. Based on recent experience, we suggest considering this latter procurement approach.

8.0 SUMMARY

8.1 Product Line Overview

Overall, Sensus appears to offer the most comprehensive metering product line that best suits the City's needs. However, we suggest seeking clarification regarding the future of the SRII meter as Sensus continues to promote the polymer body small diameter meters. We also suggest meeting with the new Sensus distributor (KTI Limited) to confirm that the City will receive a high level of local customer and technical support.

Neptune also offers meters that would serve the City well (particularly the T-10 with E-Coder register). They also provide local customer and technical support comparable to that of Sensus. The only question is regarding the City's position with respect to compound meters, making up the large diameter component of Neptune's product line. Again, confirmation of the preferred AMR/AMI reading system will clarify this item.

Elster has undergone several changes over recent years, in terms of metering technologies as well as organizationally. Other Vancouver Island municipalities (Tofino, Courtenay, Port Alberni) are using the Elster SM700 and evoQ4 meters. We suggest contacting these municipalities to seek first-hand feedback regarding the performance of these meters, and equally as important, the availability and quality of support.

The product line offered by Master Meter is somewhat limited and the meters do not appear to offer any significant advantages over other manufacturer's meters with respect to the City's needs. The Octave meter seems well suited to specialized applications such as zone metering or process mechanical uses (such as the Hytec water conditioning systems). In fact, there is a 4-20 mA output option for the Octave for these types of applications. By seeking feedback from others who have installed this meter (or by piloting this meter) the City will be in a better position to assess its ability to meet their metering needs.

Badger's product line is comprised of compound meters for large diameter and fire service applications. This raises questions regarding maintenance requirements and AMR/AMI compatibility. For small diameter meters, the City should consider contacting Vancouver and Surrey to seek feedback regarding the Recordall meters. The provision of local customer and technical support also warrants confirmation.

8.2 Next Steps

This memo outlines metering products that are considered well suited for the City's needs (as well as those that are not). Although some specific meter makes / models are recommended, the evaluation does not specifically recommend a single manufacturer's product line or a single metering product for each size range. This is because of the influence that the selected reading system will have on compatible meters.

Technical Memo #5 will provide an evaluation of reading technologies and recommend which reading systems the City should consider. As discussed in Section 7.0, we recommend that the City conduct a competitive RFP process to select a reading system. Once the reading system has been selected, approved water meters (that are compatible with the selected reading system and meet the City's needs) can be confirmed. Procurement for meter supply could then be completed by means of an RFQ or similar process.

Appendix A

Water Meter Evaluation Matrix

WATER METER EVALUATION MATRIX

Small Diameter Meters

Water Meter	Materials & Dimensions				Approvals			Performance Specifications			Features				O&M	Cost	Local Considerations	
Make / Model	Size Range (mm)	Meter Type	Maincase Material	Lay Length (mm)	AWWA Standard	NSF 61 Annex F/G Compliant	FM / UL	Normal Operating Range @ 100% Accuracy (m^3/h)	Low Flow Registration @ 95% Accuracy (m^3/h)	Pressure Loss @ High End of Normal Operating Range (kPa)	Data Logging Capability	AMR / AMI Compatibility	Power	Test Port	Spare Parts	Price Point (Supply Cost)	Local Support	Western Canada Municipal Applications
Neptune T-10 (E-Coder R900i Register)	16 - 50	Positive Displacement (Nutating Disc)	Lead Free, High Copper Alloy	16mm = 191 50mm = 432	C700	Yes	None	16mm = 0.11 to 4.5 50mm = 0.57 to 36.3	16mm = 0.03 50mm = 0.23	16mm = 55 @ 4.5 m^3/hr 50mm = 69 @ 36.3 m^3/hr	96 days of hourly consumption	R900i (migratable, unlicensed) R450i (fixed network only, licensed)	Lithium Battery with Capacitor (20 Year Warranty)	N/A	Field Replaceable: - Register - Measuring Element - Frost Plate	Mid	Local Neptune Representative (Mike Middlemass) Local Distributor (Fred Surridge Ltd)	City of Richmond City of Langley City of Kamloops City of Maple Ridge City of Fort St. John
Sensus SR II (Electronic Register)	16 - 25	Positive Displacement (Oscillating Piston)	Low Lead Bronze Alloy	16mm = 191 25mm = 273	C700	Yes	None	16mm = 0.25 to 4.5 25mm = 0.7 to 11	16mm = 0.06 25mm = 0.15	16mm = 48 @ 4.5 m^3/hr 25mm = 50 @ 11 m^3/hr	None	520R / 510R (non-migratable, unlicensed) 520M / 510 M (migratable, licensed)	Lithium Battery (20 Year Warranty)	N/A	Field Replaceable: - Register - Measuring Element - Frost Plate	Mid	Local Distributor (KTI Limited)	City of Surrey City of Burnaby City of Vancouver City of Abbotsford
Sensus accuSTREAM (Electronic Register)	16 - 25	Positive Displacement (Oscillating Piston)	Polymer Composite	16mm = 191 25mm = 273	C710	Yes	None	16mm = 0.25 to 4.5 25mm = 0.7 to 11	16mm = 0.06 25mm = 0.15	16mm = 85 @ 4.5 m^3/hr 25mm = 90 @ 11 m^3/hr	None	520R / 510R (non-migratable, unlicensed) 520M / 510 M (migratable, licensed)	Lithium Battery (20 Year Warranty)	N/A	Field Replaceable: - Register	Low	Local Distributor (KTI Limited)	No substantial meter populations as of yet.
Sensus iPERL	16 - 25	Electromagnetic	Thermal Plastic	16mm = 191 25mm = 273	C700 C710	Yes	UL Listed Model Available	16mm = 0.025 to 5.7 25mm = 0.09 to 12.5	16mm = 0.007 25mm = 0.025	16mm = 60 @ 5.7 m^3/hr 25mm = 53 @ 12.5 m^3/hr	38 days of hourly consumption	520R / 510R (non-migratable, unlicensed) 520M / 510 M (migratable, licensed)	Lithium Battery (20 Year Warranty)	N/A	No Field Replaceable Components (must change out entire meter)	High	Local Distributor (KTI Limited)	City of Surrey City of Port Coquitlam City of Pitt Meadows City of Castlegar
Elster SM700	16 - 25	Fluidic Oscillator	Copper Alloy	16mm = 191 25mm = 273	C713	Yes	None	16mm = 0.2 to 4.5 25mm = 0.7 to 11.4	16mm = 0.03 25mm = 0.08	16mm = 60 @ 4.5 m^3/hr	None	Elster meters are often coupled with Itron AMR/AMI technology.	Lithium Thionyl Chloride Battery (20 Year Warranty)	N/A	No Field Replaceable Components (must change out entire meter)	Mid	Canada Wide Elster Representative (Chris Jay) Local Distributor (Andrew Sheret)	City of Port Alberni District of Tofino City of Courtenay Township of Langley
Master Meter PD	16 - 50	Positive Displacement (Oscillating Piston)	Bronze Alloy	16mm = 191 50mm = 432	C700	Yes	None	16mm = 0.23 to 4.5 50mm = 1.8 to 36.3	16mm = 0.06 50mm = 0.23	16mm = 45 @ 4.5 m^3/hr 50mm = 74 @ 36.3 m^3/hr	4,000 point data logging ability (down to 1 minute intervals) with 3G Register	3G Register provides drive-by AMR capability. Allegro end-point is migratable to fixed-base.	Thionyl Lithium Chloride Battery (20 Year Warranty)	N/A	Field Replaceable: - Register - Measuring Element - Frost Plate	Mid	Canada Wide Representative (Rob Derer) Vancouver Island Distributor (Four Star Waterworks)	Clearbrook Waterworks District Some customers on Vancouver Island
Badger Recordall	16 - 50	Positive Displacement (Nutating Disc)	Bronze Alloy or Polymer	16mm = 191 50mm = 432	C700 C710	Yes	None	16mm = 0.11 to 4.5 50mm = 0.57 to 39	16mm = 0.06 50mm = 0.34	16mm = 34 @ 4.5 m^3/hr 50mm = 65 @ 39 m^3/hr	None	Classic, Migratable, Fixed Network, and Cellular Endpoints Available	Lithium Thionyl Chloride Battery (20 Year Warranty)	N/A	Field Replaceable: - Register - Measuring Element - Frost Plate	Low	Local Distributor (EMCO)	City of Vancouver City of Surrey

WATER METER EVALUATION MATRIX

Large Diameter Meters

Water Meter	Materials & Dimensions				Approvals			Performance Specifications			Features				O&M	Cost	Local Considerations	
Make / Model	Size Range (mm)	Meter Type	Maincase Material	Lay Length (mm)	AWWA Standard	NSF 61 Annex F/G Compliant	FM / UL	Normal Operating Range @ 100% Accuracy (m^3/h)	Low Flow Registration @ 95% Accuracy (m^3/h)	Pressure Loss @ High End of Normal Operating Range (kPa)	Data Logging Capability	AMR / AMI Compatibility	Power	Test Port	Spare Parts	Price Point (Supply Cost)	Local Support	Western Canada Municipal Applications
Neptune TRU/FLO (E-Coder R900i Register)	50 - 150	Turbine + Positive Displacement (Nutating Disc)	Lead Free, High Copper Alloy	50mm = 387 150mm = 610 (Excl. Strainer)	C702	Yes	None	50mm = 0.11 to 45 150mm = 0.34 to 454	50mm = 0.03 150mm = 0.17	50mm = 57 @ 45 m^3/hr 150mm = 55 @ 318 m^3/hr * * pressure loss at upper flow range not published	96 days of hourly consumption	R900i (migratable, unlicensed) R450i (fixed network only, licensed)	Lithium Battery with Capacitor (20 Year Warranty)	Yes	Field Replaceable: - Registers - Unitized Measuring Element (UME)	Mid	Local Neptune Representative (Mike Middlemass) Local Distributor (Fred Surridge Ltd)	City of Richmond City of Maple Ridge City of Coquitlam District of West Vancouver City of North Vancouver
Sensus OMNI C^2	38 - 250	Floating Ball Impeller	Epoxy Coated Ductile Iron	38mm = 330 250mm = 1,045 (Incl. Strainer)	C701 C702 Class II	Yes	None	38mm = 0.11 to 45 250mm = 1.1 to 908	38mm = 0.06 250mm = 0.8	38mm = 83 @ 45 m^3/hr 250mm = 31 @ 908 m^3/hr	31 days of hourly consumption	520R / 510R (non-migratable, unlicensed) 520M / 510 M (migratable, licensed)	Lithium Battery (10 Year Warranty)	Yes	Field Replaceable: - Register - Measuring Chamber	Mid	Local Distributor (KTI Limited)	City of Surrey City of Pitt Meadows City of Coquitlam City of New Westminster
Sensus OMNI T^2	38 - 250	Floating Ball Impeller	Epoxy Coated Ductile Iron	38mm = 330 250mm = 1,045 (Incl. Strainer)	C701 Class II	Yes	None	38mm = 0.28 to 45 250mm = 1.4 to 1,249	38mm = 0.17 250mm = 1.1	38mm = 83 @ 45 m^3/hr 250mm = 52 @ 1,249 m^3/hr	31 days of hourly consumption	520R / 510R (non-migratable, unlicensed) 520M / 510 M (migratable, licensed)	Lithium Battery (10 Year Warranty)	Yes	Field Replaceable: - Register - Measuring Chamber	Low	Local Distributor (KTI Limited)	City of Coquitlam City of Port Coquitlam
Elster evoQ4	38 - 300	Magnetic	Poly-lined Stainless Steel	38mm = 330 300mm = 500	N/A	Yes	None	38mm = 0.5 300mm = 14.8 to 1,249	38mm = 0.11 300mm = 7.3	Similar to losses through water service connection.	None	Elster meters are often coupled with Itron AMR/AMI technology.	Lithium Battery (10 Year Warranty)	No	No Field Replaceable Components (10 Year Design Life)	Low	Canada Wide Elster Representative (Chris Jay) Local Distributor (Andrew Sheret)	District of Tofino Township of Langley
ABB AquaMaster 3	50 - 600	Magnetic	Poly-lined Stainless Steel	50mm = 200	N/A	Yes	None	50mm (AC) = 6.6 50mm (DC) = 10.56	50mm (AC) = 0.28 50mm (DC) = 0.16	Similar to losses through water service connection.	30 days of hourly consumption	Elster meters are often coupled with Itron AMR/AMI technology.	AC power provides best accuracy. (5 year battery available)	No	Field Replaceable: - Battery	High	Now distributed by Metercor in Western Canada	Township of Langley City of Vancouver City of Abbotsford
Master Meter Octave	50 - 300	Ultrasonic	Epoxy Coated Ductile Iron or Stainless Steel	50mm = 432 300mm = 508	C750	Yes	FM Approved	50mm = 0.12 to 57 300mm = 3.12 to 1,249	50mm = 0.06 300mm = 1.8	50mm = 9 @57 m^3/hr 300mm = 20 @ 1,249 m^3/hr	4,000 point data logging ability (down to 1 minute intervals) with 3G Register	3G Register provides drive-by AMR capability. Allegro end-point is migratable to fixed-base.	Thionyl Lithium Chloride Battery (10 Year Warranty)	No	Field Replaceable: - Output Module	High	Canada Wide Representative (Rob Derer) Vancouver Island Distributor (Four Star Waterworks)	Used for flow pacing Hytec water conditioning systems in BC. Some pilot installations
Badger Recordall Compound Series	50 - 150	Turbine + Positive Displacement (Nutating Disc)	Bronze Alloy	50mm = 387 150mm = 610 (Excl. Strainer)	C702	Yes	None	50mm = 0.1 to 45 150mm = 0.17 to 454	50mm = 0.06 150mm = 0.09	50mm = 52 @ 45m^3/hr 150mm = 97 @ 454m^3/hr	None	Classic, Migratable, Fixed Network, and Cellular Endpoints Available	Lithium Thionyl Chloride Battery (20 Year Warranty)	Yes	Field Replaceable - Registers - Measuring Chambers	Low	Local Distributor (EMCO)	City of Vancouver

CITY OF NANAIMO

WATER METER EVALUATION MATRIX

URBAN systems

Fire Service Meters

Water Meter	Materials & Dimensions				Approvals			Performance Specifications			Features				O&M	Cost	Local Considerations	
Make / Model	Size Range (mm)	Meter Type	Maincase Material	Lay Length (mm)	AWWA Standard	NSF 61 Annex F/G Compliant	FM / UL	Normal Operating Range @ 100% Accuracy (m^3/h)	Low Flow Registration @ 95% Accuracy (m^3/h)	Pressure Loss @ High End of Normal Operating Range (kPa)	Data Logging Capability	AMR / AMI Compatibility	Power	Test Port	Spare Parts	Price Point (Supply Cost)	Local Support	Western Canada Municipal Applications
Neptune HP Protectus III (E-Coder R900i Register)	100 - 250	Turbine + Positive Displacement (Nutating Disc)	Epoxy Coated Steel + Lead Free, High Copper Alloy (Stainless Steel Model Available)	100mm = 838 250mm = 1,727 (incl. Strainer)	C703	Yes	FM Approved UL Listed	100mm = 0.17 to 273 250mm = 0.45 to 1,476	100mm = 0.09 250mm = 0.23	100mm = 80 @ 273 m^3/hr 250mm = 90 @ 1,476 m^3/hr	96 days of hourly consumption	R900i (migratable, unlicensed) R450i (fixed network only, licensed)	Lithium Battery with Capacitor (20 Year Warranty)	Yes	Field Replaceable: - Registers - Unitized Measuring Element (UME) - PD Meter	High	Local Neptune Representative (Mike Middlemass) Local Distributor (Fred Surridge Ltd)	City of Richmond City of Maple Ridge City of Coquitlam District of West Vancouver City of North Vancouver
Neptune HP Fire Service Turbine (E-Coder R900i Register)	75 - 250	Turbine	Lead Free, High Copper Alloy Meter + SS Strainer	75mm = 664 250mm = 1,422 (Incl. Strainer)	C703	Yes	FM Approved UL Listed	75mm = 1.14 to 102 250mm = 11.36 to 1,476	75mm = 0.7 250mm = 0.9	75mm = 75 @ 102 m^3/hr 250mm = 75 @ 1,476 m^3/hr	96 days of hourly consumption	R900i (migratable, unlicensed) R450i (fixed network only, licensed)	Lithium Battery with Capacitor (20 Year Warranty)	No	Field Replaceable: - Register - Unitized Measuring Element (UME)	Mid	Local Neptune Representative (Mike Middlemass) Local Distributor (Fred Surridge Ltd)	Typically used in industrial applications.
Sensus OMNI F^2	100 - 250	Floating Ball Impeller	Epoxy Coated Ductile Iron	100mm = 838 250mm = 1,727 (Incl. Strainer)	C703 Class II	Yes	FM Approved UL Listed	100mm = 0.34 to 227 250mm = 1.1 to 1,249	100mm = 0.06 250mm = 0.8	100mm = 44 @ 227 m^3/hr 250mm = 48 @ 1,249 m^3/hr	31 days of hourly consumption	520R / 510R (non-migratable, unlicensed) 520M / 510 M (migratable, licensed)	Lithium Battery (10 Year Warranty)	Yes	Field Replaceable: - Register - Measuring Chamber	High	Local Distributor (KTI Limited)	City of Surrey City of Vancouver
Elster evoQ4 Fire Service Meter	75 - 200	Magnetic	Poly-lined Stainless Steel	75mm = 305 200mm = 508	N/A	Yes	FM Approved UL Listed	75mm = 0.5 to 125 200mm = 3.6 to 795	75mm = .014 200mm = 1.8	Similar to losses through water service connection	None	Elster meters are often coupled with Itron AMR/AMI technology.	Lithium Battery (10 Year Warranty)	No	No Field Replaceable Components (10 Year Design Life)	Low	Canada Wide Elster Representative (Chris Jay) Local Distributor (Andrew Sheret)	New product.
Badger Recordall FSM	75 - 250	Turbine	Epoxy Coated Ductile Iron	75mm = 670 250mm = 1,121 (Incl. Strainer)	C703 Class II	Yes	FM Approved UL Listed	75mm = 1.36 to 125 250mm = 11.35 to 1,590	75mm = 0.9 250mm = 9	75mm = 69 @ 125 m3/hr 250mm = 76 @ 1,590 m3/hr	None	Classic, Migratable, Fixed Network, and Cellular Endpoints Available	Lithium Thionyl Chloride Battery (20 Year Warranty)	Yes	Field Replaceable - Registers - Measuring Chambers	Mid	Local Distributor (EMCO)	City of Vancouver

CITY OF NANAIMO
THE HARBOUR CITY

TECHNICAL MEMO 5

READING SYSTEM EVALUATION BUSINESS CASE

URBAN systems

550 – 1090 Homer Street
Vancouver, BC V6B 2W9
Contact: Jacob Scissons, P.Eng.
T: 604.235.1701
jscissons@urbansystems.ca

urbansystems.ca

Report to:

City of Nanaimo
411 Dunsmuir Street
Nanaimo, BC
V9R 5J6

Attn: Doris Fournier, P.Eng., Manager of Municipal Infrastructure

Prepared by:

Urban Systems
550 – 1090 Homer Street
Vancouver, BC
V6B 2W9

October 2, 2017

Jacob Scissons, P.Eng.
Project Engineer

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1.0 INTRODUCTION

This technical memorandum is part of a series of five business cases to inform the development of a Water Metering Strategy for the City of Nanaimo (the City).

The purpose of this business case is to evaluate alternate meter reading systems that are available in the BC market and identify systems that are best suited to meet the needs of the City.

2.0 RADIO READ SYSTEMS

2.1 Radio Technology

Radio read technologies have been developed to make data collection more efficient and to address issues such as difficult access and safety. More sophisticated radio read systems also provide additional data to allow utilities to manage certain aspects of the water system. There are basically three types of radio read systems available for water meters:

- Walk-By (which utilize a handheld device to collect the reads);
- Drive-By (which utilize a computer operated data collection unit within a vehicle); and
- Fixed-Base (which utilize tower-mounted data collectors to obtain reads and transmit them directly to the utility office).

All of the above reading systems require some form of radio frequency (RF) transmitter located at each meter location (end-points). The end-point can be integrated into the meter / register or be a separate device connected to the meter. Most of the radio end-points have enhanced capabilities that allow interval data collection, leak detection, reverse flow, and tamper alarms. In larger deployments, end-points comprise the most costly piece of the radio read system.

2.2 AMR vs AMI

Automated Meter Reading (AMR)

Generally, this is any system that collects the read data electronically, with minimal interaction from utility personnel, and formats the data for entry / upload into a billing system. Systems included in this category include touch read, and radio read walk-by or drive-by.

Advanced Metering Infrastructure (AMI)

AMI describes fixed-base systems that collect readings automatically without human interaction. These systems utilize collectors mounted on towers or buildings to gather the meter information and re-transmit directly to the utility offices. Software is used to analyse and disseminate the meter data into useful reports. Some AMI systems may also have the capability to operate equipment such as shut-off valves remotely from the utility offices.

2.3 Migration

Migration refers to the ability to upgrade the reading system with minimal infrastructure replacement. Most manufacturers offer systems that are fully migratable from walk-by to drive-by to fixed-base. The key to migratable systems is the radio end-point. The cost to install end-points at every meter within the service area can be significant. If upgrading the data collector component of the reading system required replacing all end-points, it would not be feasible in most cases. The intent of migratable systems is to avoid this issue by making the end-points compatible with the walk-by, drive-by, and fixed-base reading systems. This means that upgrading the system only requires replacing the reading / data collection devices.

It is also possible to phase the migration path. Suppose a utility currently uses a drive-by radio read system. A single fixed-base collector could be installed for a specific portion of the service area while the remainder of the meter population continues to be read using the drive-by system. Additional fixed-base collectors could be added as budget allowed, eventually eliminating the need for the drive-by system.

2.4 Compatibility

All manufacturers' encoded meter registers can be read with a touch read system. Radio read systems are more complex. Most manufacturers' radio read systems will work with other manufacturers' meters; however, the radio end-point and the system used to read it are proprietary. This means that the reading system and end-point need to be from the same manufacturer; however, the water meter may be from a different manufacturer. This is an important consideration as there is significant investment required to purchase and install the radio end-points, not to mention the cost of the data collection hardware, software, and training.

2.5 One-Way vs Two-Way Communication

As discussed above, radio read systems are used to collect reads from the various meter end-points. However, some more advanced systems also provide the ability to remotely re-program all or specific end-points. For example, two-way systems allow the utility to remotely collect a special read at midnight on the date that a specific property changes ownership. Another example may involve temporarily changing the read interval from hourly to every 15 minutes to collect more thorough water use data.

Systems that only communicate information from the meter end-point to the reading systems' data collector(s) are referred to as ***one-way***. Systems that also allow for communication from the reading system to the meter end-points are referred to as ***two-way***.

2.6 Radio Frequency Licencing

Industry Canada has jurisdiction over radio licencing. Whether a radio transmitter requires licencing depends on the RF frequency and output power of the device. Many systems operate in the unlicenced frequency band between 902 and 928 MHz. This unlicenced band is shared with many other consumer products, such as cordless phones, wireless remotes, garage door openers, etc. and can be subject to interference. Licenced frequencies are less prone to interference from other sources.

As most of the manufacturers are based in the United States, the Federal Communications Commission (FCC) rules tend to govern the technology and design for products sold in the Canadian marketplace. This creates some unique challenges when it comes to licencing in Canada. There is some inconsistency in the application of the licencing rules across Canada, however it seems that this has been resolved as several local municipalities have obtained licences for their meter reading systems.

Unlicenced systems typically use less power, which limits their range. Taking fixed-base systems as an example, an unlicenced system would generally require more data collectors than a higher powered licenced system. When considering a high power system, annual licencing fees should be considered in the life cycle cost analysis.

2.7 Interface Software

Meter Data Management (MDM) software is used to compile the read and operational data and package it in a format that can be uploaded to the utility billing or system management program (ie. Tempest).

The utility should plan on several days of training for multiple staff members. Success will depend on staffs' ability to understand and operate the software. Having more than one trained operator will provide internal support and address time-off issues. Some software packages provide customer engagement options such as web portals that allow customers to login and review their usage information.

Another consideration is how seamlessly the MDM software will interface with the existing billing software. If changes are required to the billing system, what and who needs to be involved, and at what expense? Does it vary depending on the chosen vendor and will they offset the costs of making the required modifications?

If a fixed-base system is an option now or for future consideration, a review of the MDM software is a recommended starting point to establish which features and specifications are important to the utility. This should involve all stakeholder departments.

3.0 READING SYSTEMS TO BE EVALUATED

3.1 Nanaimo's Goals and Objectives

We understand that the City is interested in a radio read system that would most likely utilize walk-by or drive-by technology at first. The ability to migrate to a fixed-base system in the future (potentially in phases) is a desirable option to the City. With respect to infrastructure systems, we understand that the City values robustness, operational simplicity, demonstrated performance, and quality support.

3.2 Short-Listed Systems

The evaluation considers reading systems from the manufacturers listed below.

- Neptune
- Sensus
- Itron
- Master Meter

These manufacturers were identified based on several factors including availability and quality of local support, types of systems offered, and demonstrated performance. For example, Badger offers a variety of different reading systems, however there are no known BC applications for these systems. Another example is the Aclara reading system, which was not included in the evaluation since it is strictly for fixed-base applications and does not provide walk-by or drive-by capabilities.

The other reading systems available in North America do not appear to provide any advantages over the locally supported systems that are included in the evaluation.

4.0 EVALUATION CRITERIA

The evaluation of the various reading systems includes the criteria listed below. A detailed evaluation matrix is included in **Appendix A**, which provides pertinent information regarding each of these criteria for each system.

Details

- System Type – walk-by, drive-by, or fixed-base.
- Power Requirements – how the data collectors are powered.
- Radio Licencing Requirements – whether the system operates in the licenced of unlicenced band.
- One-Way vs Two-Way Communication – indicates the communication features of the system.

Features

- Migration Capabilities – the ability to migrate from walk-by, to drive-by, to fixed-base.
- Compatibility with Alternate Meters – the ability to connect radio end-points to other manufacturers' meters.
- Interface Software – the capabilities of the meter data management software.

Local Considerations

- Local Support – the availability and quality of local support.
- Municipal Applications in Western Canada – examples of other utilities using the technologies.

5.0 MANUFACTURER OVERVIEW

Each manufacturer has taken a slightly different approach to their meter reading systems. In some cases the technology is influenced by radio licencing requirements. Other manufacturers have focused on compatibility or migration potential. A brief summary of each manufacturer's products is provided below.

5.1 Neptune

Neptune offers two distinctly different reading systems. The R900 system is unlicenced, provides one-way communication, and is fully migratable from walk-by to drive-by to fixed-base. The R450 system operates in the licenced frequency band and offers two-way communication. The R450 system is strictly for fixed-base applications; there is no migration path.

The R900 system has seen several improvements over recent years. For Neptune meters, the Enhanced E-Coder) R900i was developed, which is a combined encoded register and radio end-point. A more recent advancement is the Enhanced R900 MIU (meter interface unit), which was developed for use on other manufacturers' meters. In addition to collecting and transmitting reads from a competitor's meter, the Enhanced R900 MIU provides full intelligence including data logging, leak detection, reserve flow detection, etc.

The Neptune N_SIGHT host software is available for the R900 and R450 systems. The software provides consumption and operational data analysis capabilities. A number of stock reports and graphical templates are available, but the system also allows utilities to create customized outputs. Several municipalities in BC use Neptune N_SIGHT software in conjunction with Tempest and feedback suggests that the interface between these programs works well.

5.2 Sensus

Sensus' walk-by, drive-by, and fixed-base reading systems all operate in the licenced frequency band. They do not offer an unlicenced reading system. With the exception of the drive-by Vehicle Gateway Basestation, all of the reading systems provide two-way communication.

The new version of the Sensus AutoRead handheld device features an integrated GPS unit. The older AutoRead 5500 series devices rely on an externally connected GPS unit, which can be cumbersome.

The new M series radio end-points provide a migration path from walk-by to drive-by to fixed-base. The older R and RA series radio end-points are compatible with the Sensus walk-by (AutoRead) and drive-by (Vehicle Gateway Basestation), but are not supported by the fixed-base (FlexNet) system. We understand that the R and RA series radio end-points will be discontinued in the near future.

Sensus has released a new version of meter data management software called Essential Water Analytics. This is an alternative to Sensus Logic providing a less complex platform for utilities focused on processing read data as opposed to extensive analysis of operational data. There are multiple local examples of municipalities that use Tempest coupled with Sensus software for processing meter reads and data. The City has first-hand experience with respect to this.

5.3 Itron

The Itron reading systems all operate at unlicenced frequencies while providing two-way communication. The 100W radio end-points are fully migratable from walk-by to drive-by to fixed-base. Itron is phasing out the older 60W radios end-points, which do not provide a complete migration path.

Itron is somewhat unique from the other manufacturers included in this assessment since they do not produce water meters. This provides additional incentive for their reading systems to be compatible with other manufacturers' meters. Itron has seen success in several municipalities where the meter population is comprised of products from various manufacturers.

For the walk-by and drive-by reading systems, Itron has introduced the Field Collection System (FCS) meter data management software to replace the previous MV-RS software. The FCS software is based on Microsoft Windows and is geared for easy integration with third party billing systems such as Tempest. For the fixed-base 100W reading system, Itron Network Software is used for meter data management. An optional adder to this software is the Water Analytics package, which provides enhanced data analysis capabilities.

5.4 Master Meter

Master Meter has recently expanded their meter reading product line with the release of the Allegro fixed-base system. The Allegro system operates in the licenced frequency band and provides two-way communication. The Allegro radio end-point provides a fully migratable solution from walk-by to drive-by to fixed-base and is compatible with other manufacturers' meters.

The Master Meter 3G handheld (walk-by) and mobile (drive-by) reading systems also provide two-way communication, but operate at unlicenced frequencies. When equipped with 3G XTR radio end-points (as opposed to the Allegro radios) the migration path is limited to drive-by.

Master Meter will be releasing a new technology referred to as MasterLinx Mobile Reading System, which utilizes a Panasonic tablet to collect reads and data. We understand that this tablet-based technology provides the full benefit of the drive-by laptop in a more portable and user-friendly device. It appears that this product will serve as a walk-by / drive-by hybrid device.

Master Meter has also introduced a new meter data management software. The Harmony platform uses Microsoft Cloud technology, which is somewhat unique from other manufacturers' systems that store data on local servers. For utilities that prefer to use a local server (as opposed to the Cloud), the MasterLinx Enterprise management software is still offered and supported by Master Meter.

6.0 SUMMARY

All of the manufacturers included in this assessment offer a reading system that is fully migratable to fixed-base and compatible with other manufacturers' meters. These systems are listed below:

- Neptune R900;
- Sensus (with M series end-points);
- Itron (with 100W end-points); and
- Master Meter Allegro.

That being said, there are several key differences with respect to output power, radio frequency, communication, meter data management software, local support, and demonstrated performance. These factors may or may not impact the systems' ability to meet the City's meter reading goals and objectives. The following questions are considered.

- ***Does it matter if the system is licenced or unlicenced if it provides the appropriate capabilities and performance?***

  The answer to this question is not so much about whether the system is licenced or not. It is more a function of the cost and range of the radios and data collectors. This impacts both the capital costs and annual operating costs for the metering system. The cost-benefit could be assessed with further information from the manufacturers (provided via an RFP process).

- ***Is two-way communication with the radio end-points desired by the City?***

  Based on discussions with the City, two-way communication is not considered a critical feature for the reading system.

- ***Other than processing reads, what analytical features should the meter data management software offer?***

  We understand that the most important feature of the meter data management software is a seamless interface with Tempest. In addition to generating read reports, the City would like the ability to access operational data such as leaks and reverse flows. However, software packages that offer enhanced analysis modules, cloud based data storage, or customer web portals are not considered a necessity.

- ***What services will the manufacturer need to provide and how important is it that they be provided locally?***

  The City recognizes that customer and technical support for software is generally provided remotely via phone or internet access to experts. The manufacturers' local representatives are trained to assist with troubleshooting water meters, and to a certain extent radios and reading devices. However, they tend to rely on their internal experts for complex electronic or software issues. This suggests that locally available support is of limited value for the reading system and interface software. It is significantly more helpful for metering infrastructure.

- ***Is the City open to new technologies or systems? Or is there a level of comfort associated with systems that have proven performance and reliability demonstrated through local examples?***

  There is always a risk associated with being the first to implement new technologies. The metering industry has seen several changes over recent years with many manufacturers marketing new reading systems. We understand that this City is more comfortable with technologies where reliability (ie. battery life) and performance (ie. complete read collection) have been demonstrated. Systems that are being utilized by other municipalities or private utilities in Western Canada would provide a familiar example for the City to review.

Based on the City's feedback regarding the above questions, it appears that there is flexibility surrounding radio licencing, communication, and software. However, demonstrated performance and reliability of both the reading system and manufacturer is of high value to the City. Accordingly, the short-listed reading systems are refined as follows:

- Neptune R900;
- Sensus (with M series end-points); and
- Itron (with 100W end-points).

The Master Meter Allegro reading system is yet to be deployed in Canada and is limited to approximately 35,000 end-points in the United States. The uptake to date for this product is not considered sufficient to assess the system's reliability or performance, and thus it is not short-listed.

The short-listed reading systems are compatible with the recommended water meters identified in Technical Memo #4, which are generally comprised of Neptune and Sensus products.

7.0 NEXT STEPS

As discussed in Technical Memo #4, a competitive Request for Proposal (RFP) process can be an effective means of evaluating alternate readings systems and their ability to meet the City's needs. The evaluation criteria of the RFP can be customized to align with the City's overall metering drivers as well as the specific requirements for the reading system. The manufacturers / vendors can in turn propose a solution that is specifically tailored to the City's needs, future goals, service area, topography, etc. Potential evaluation criteria are provided below:

- Ability to Interface with Tempest

  This is considered table stakes and should be demonstrated by the vendors by citing examples of municipalities that utilize their meter data management software in conjunction with Tempest.

- Compatibility with Alternate Meters

  The vendor could be required to list the specific makes and models of water meters that are compatible with their reading system. It may also be prudent to seek clarification regarding radio compatibility with compound meters, specifically the Neptune products recommended in Technical Memo #4.

- System Integrity

  For this category the vendor should indicate the range for their walk-by, drive-by, and fixed-base data collectors coupled with the read reliability (percentage of reads received at maximum range). Installation requirements for the radio end-points should also be identified for both inside and pit applications. The vendor could also be required to cite examples of demonstrated battery life. Completion of a propagation (radio path) study may not be necessary if the City does not envision having a fixed-base system in the near future.

- System Features

  The capabilities of the system should be demonstrated and confirmed by the vendor. Promotional literature often speaks to features such as "reverse flow detection", however, what does this actually mean? There is a big difference between a net reverse flow over a one hour period vs a 15 minute period. The vendors could be asked to provide further detail with respect to features that are of high importance to the City.

- Implementation Costs

  This includes the supply cost for the radio end-points, data collectors, and software. As previously discussed, the radio end-points can represent a significant portion of the cost. As an example, for the City's current inventory of approximately 30,000 meters, a $25 difference in end-point cost correlates to $750,000. Requesting pricing for walk-by, drive-by, and fixed-base data collectors is recommended, recognizing that a propagation study would be required to guarantee the number of fixed-base data collectors required for the service area.

- Operating and Service Costs

  This includes costs such as annual radio licence fees, costs associated with servicing data collection devices, software licences, etc. Costs for data hosting and reporting are typically associated with fixed-base systems and may not be relevant for the City at this time.

- Customer and Technical Support

  The vendor should outline the experience of their staff that would be available to assist the City as required. Details regarding access to, and availability of, the customer and technical support should be outlined (ie. operating hours for telephone support). If the City would like the vendor to provide training for the reading system and software, the vendor's proposed training program could be outlined in this section.

The following next steps are recommended with respect to undertaking an RFP process to select a preferred reading system:

1. Confirm the City's requirements as well as "nice to haves" for the meter reading system;
2. Develop the evaluation criteria and assign "points" to each category reflective of the importance to the City;
3. Issue the RFP to the short-listed manufacturers (Neptune, Sensus, and Itron); and
4. Evaluate proposals and select a preferred reading system.

Appendix A

Reading System Evaluation Matrix

CITY OF NANAIMO

READING SYSTEM EVALUATION MATRIX

URBAN systems

System	Details				Features			Local Considerations	
Manufacturer / Model	System Type	Power Requirements	Radio Frequency Licencing Requirements	One-Way vs Two-Way Communication	Migration Capabilities	Compatibility with Alternate Meters	Interface Software	Local Support	Western Canada Municipal Applications
Neptune									
Trimble Nomad Handheld Data Collector with Neptune R900 Belt Clip Receiver	Walk-By	Battery Power (10+ hrs)	Unlicenced	One-Way					Over 180 municipalities in BC and Alberta
Neptune MRX920 Mobile Data Collector (with Laptop Computer)	Drive-By	12V DC Vehicle Power Source	Unlicenced	One-Way	Neptune R900i radios are fully migratable to the R900 fixed-base system	Neptune R900 Meter Interface Units (MIUs) are compatible with Sensus, Elster, Master Meter, and Badger encoded registers.	Neptune N_SIGHT R900 host software provides enhanced data analysis and management features.	Local Neptune Representative (Mike Middlemass) Telephone Support via Call Centre at Neptune Factory in Alabama Canada-Wide Support from Systems Implementation Specialists Data hosting services provided by Neptune's Mississauga office.	District of West Vancouver District of North Vancouver City of Kamloops District of West Kelowna City of Grand Forks
Neptune R900 Gateway v3 Data Collector	Fixed-Base	AC Powered with 8 hr Battery Backup or Solar Powered with 3 day Battery Backup	Unlicenced	One-Way					The City of Richmond is migrating to the Neptune R900 fixed-base system.
Neptune R450 Data Collector	Fixed-Base	AC Powered with UPS Battery Backup	Licenced	Two-Way	Neptune R450i radios are not migratable and are strictly for the R450 fixed-base system.	Neptune R450 Meter Interface Units (MIUs) are compatible with Sensus, Elster, Master Meter, and Badger encoded registers.	Neptune N_SIGHT R450 host software provides enhanced data analysis and management features, specifically tailored for the fixed-base system.		No current systems in BC.
Sensus									
Sensus AutoRead Handheld 5500 Series	Walk-By	Battery Power (12+ hrs)	Licenced	Two-Way					Multiple municipalities and private utilities in BC and Alberta.
Sensus Vehicle Gateway Basestation (with Laptop Computer)	Drive-By	12V DC Vehicle Power Source	Licenced	One-Way	Sensus M series radios are fully migratable to fixed-base. Sensus R and RA series radios are supported by the walk-by and drive-by reading systems, but not the FlexNet fixed-base system.	Sensus radios are compatible with Neptune, Elster, Master Meter, and Badger encoded registers.	Sensus Logic provides enhanced data analysis and management features.	Canada-wide support provided by KTI (based out of Mississauga, ON). Data hosting services provided at Sensus' Toronto office.	City of Vancouver City of Pitt Meadows Comox Valley Regional District City of Duncan
Sensus FlexNet	Fixed-Base	AC Powered with 8 hr Battery Backup	Licenced	Two-Way					City of Medicine Hat City of Leduc Strathcona County No current systems in BC.

CITY OF NANAIMO

READING SYSTEM EVALUATION MATRIX

URBAN systems

System	Details				Features			Local Considerations	
Manufacturer / Model	**System Type**	**Power Requirements**	**Radio Frequency Licencing Requirements**	**One-Way vs Two-Way Communication**	**Migration Capabilities**	**Compatibility with Alternate Meters**	**Interface Software**	**Local Support**	**Western Canada Municipal Applications**
Itron									
Itron FC300	Walk-By	Battery Power	Unlicenced	Two-Way	Itron 100W radios are fully migratable to fixed-base. Itron 60W radios are migratable to drive-by, but are not supported by the 100W fixed-base system.	Itron 100W radios are compatible with Neptune, Sensus, Elster, Master Meter, and Badger encoded registers. Itron 60W radios require a specific model for each meter manufacturer. The 60W radios are being phased out.	Itron FCS software is used for walk-by and drive-by systems	Canada-Wide Representative (Paul Doucet) Telephone support is available from Itron's office located in Spokane, Washington. Data hosting services provided by Itron's Toronto office	Township of Langley City of Penticton City of Port Alberni District of Tofino
Itron Mobile Collector Lite (with FC300)	Drive-By	12V DC Vehicle Power Source	Unlicenced	Two-Way					City of Penticton District of Tofino Alberni-Clayoquot Regional District
Itron MC3 (with Laptop Computer)	Drive-By	12V DC Vehicle Power Source	Unlicenced	Two-Way					City of Courtenay
Itron 100W	Fixed-Base	AC Powered with 8 hr Battery Backup	Unlicenced	Two-Way			For the fixed-base 100W system, Itron Network software is used. Water Analytics is an optional software that provides additional enhanced features.		No current systems in BC. (The City of Abbotsford uses the Itron 200W fixed-base system, which has been discontinued.)
Master Meter									
Master Meter 3G Handheld	Walk-By	Battery Power (40+ hrs)	Unlicenced	Two-Way	Master Meter Allegro radios are fully migratable to fixed-base. Master Meter 3G XTR radios are migratable to drive-by, but need to be upgraded for the Allegro fixed-base system	Master Meter Allegro and 3G XTR radios are compatible with Neptune, Sensus, Elster, and Badger encoded registers.	Master Meter Harmony data management and analysis software provides a Microsoft Cloud-based platform with an optional customer web portal. The MasterLinx Enterprise management software is also still available.	Canada Wide Representative (Rob Derer) Vancouver Island Distributor (Four Star Waterworks)	Several customers in Alberta.
Master Meter 3G Mobile	Drive-By	12V DC Vehicle Power Source	Unlicenced	Two-Way					Several customers in Alberta.
Master Meter Allegro	Fixed-Base	AC Powered	Licensed	Two-Way					No current systems in Canada.

APPENDIX B

PROCUREMENT SUMMARY

Table B.1 Procurement Summary

Service	Service Provider Options			Current Service Provider	Recommended Service Provider
	City	Consultant	Vendor		
Advisory	X	X		City with Consultant Support	Maintain current practice.
Meter Design		X		Consultant retained by Developer or Property Owner	Maintain current practice.
Product Supply			X	New Installations: Vendor Purchased through Developer (75mm and larger) or City (50mm and smaller) Replacements: Vendor purchased by City (all sizes)	Maintain current practice.
Product Installation	X		X	New Installations: City (50mm and smaller) or Vendor retained by Developer (75mm and larger) Replacements: City (all sizes)	Maintain current practice, except consider contracting out service if replacement program exceeds City capacity.

URBAN systems

Service	Service Provider Options			Current Service Provider	Recommended Service Provider
	City	Consultant	Vendor		
Contract Administration	X			City	If contracting out meter replacements, consider consultant support if sufficient City capacity doesn't exist.
Product Maintenance	X			City	Maintain current practice.
Meter Reading	X			City	Maintain current practice.
Data Hosting	X		X	City	Maintain current practice, unless fixed-base radio read system is pursued, then consider vendor hosting at least for initial number of years while City becomes familiar with new system.
Billing	X			City	Maintain current practice.
Meter Testing	X		X	City or Vendor	Review City capacity and determine if expanding City meter testing capabilities makes sense.
Public Education and Outreach	X			City	Maintain current practice, unless City capacity is limited or expanded extensive program for short duration is considered.

APPENDIX C

METER TESTING SUMMARY

The best way to determine a meter's performance is by testing. Testing (especially for large sizes), can be a laborious process and should only be undertaken if results are collected and tracked in a testing database. The database can identify trends that can help determine replacement criteria for the different meter types.

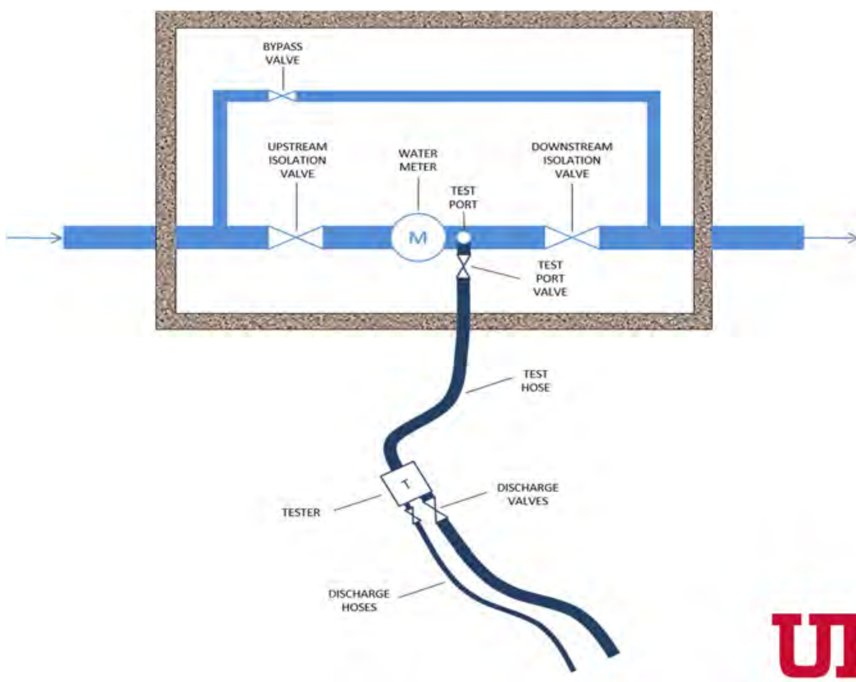
There are three common methods of testing a meter, which are largely a function of the meter size:

- Bench Testing (generally for 25mm or smaller meters)
- Field Testing (generally for 38mm to 50mm meters)
- In-Situ Testing (generally for 75mm or larger meters)

Bench testing involves removing the meter from service and taking it to a test facility. A replacement meter is typically installed (regardless of whether the test passes or fails). Bench testing is preferred when there are large numbers of smaller meters to be tested at one time or where field conditions do not permit in-situ or field testing. Bench testing is typically completed on a group of small meters (25mm or less) and the results are used to draw key conclusions about the accuracy of a larger of group of meters.

Field testing meters is typically completed on medium sized meters (38-50mm) that are not able to be tested in-situ. The field test requires the meter to be briefly taken out of service, tested on a truck-mounted field testing equipment and then re-installed (assuming it passes the test). If the test fails, the meter may be changed out for a new one right away or could be scheduled for replacement at a later date.

In-situ testing is typically completed on larger meters (75mm or greater) given the high cost to take the meter out of service. This test procedure involves directing water through the meter, through a test port, and into a testing device where the volume of water is measured and compared to set of pass/fail criteria. This test can be completed without disrupting service to the customer and is time effective. In order to undertake this test, the meter must have a bypass, test port, downstream isolation valve, and a discharge location as illustrated in the figure below.



URBAN systems

AWWA M6 “Water Meters – Selection, Installation, Testing, and Maintenance” does not provide specific meter testing interval recommendations but summarizes the intervals used by various jurisdictions across the USA. For meters 25mm and smaller the range is 4 to 15 years between tests, for meters 38mm-75mm the range is 2 to 10 years, and for 100mm and larger tests are completed every 1 to 10 years. For illustrative purposes if we select a 10 year interval for meters 25mm and less, 5 years for meters 37mm and larger the following table summarizes the annual meter testing that would apply for Nanaimo:

Table C.1 AWWA Meter Testing Illustration

Meter Size	Quantity	Tests Per Year	Approximate Cost Per Test	Approximate Annual Budget
19mm-25mm	23,529	235 (10%)	$160*	$37,600
38mm-50mm	920	18 (20%)	$175*	$3,150
75mm	94	19 (20%)	$375**	$7,125
100mm	70	14 (20%)	$375**	$5,250
150mm	121	24 (20%)	$375**	$9,000
200mm	17	3 (20%)	$375**	$1,125
250mm	6	1 (20%)	$375**	$375
Unknown	26	TBD		
Source Meters	2	2 (100%)	TBD	

*Assuming remove, test, and reinstall; ** Assuming test in place.

Section:	**Engineering and Public Works**	**11**
Subsection:	**Water Supply and Distribution**	**5600**
Title:	**Water Metering Policy**	**03**

POLICY

This policy is intended to formalize drinking water metering direction so that the vision and goals of the City, as articulated in the Official Community Plan (OCP), can be realized. This Policy is relevant to the City, as the owner and operator of the water supply, treatment and distribution system, and to residents and businesses as the consumers of water.

REASON FOR POLICY:

For the development of strategies, plans, and standards for water metering within the City of Nanaimo so that users, developers and staff have clear vision of metering requirements and drinking water life cycle.

AUTHORITY TO ACT

The authority for this Policy is provided by "Waterworks Rate and Regulation Bylaw 2006 No. 7004". All aspects of water metering within the City shall be conducted in accordance with applicable legislation.

DEFINITIONS:

American Water Works Association (AWWA)	The American Water Works Association is the largest non-profit, scientific, and educational association dedicated to managing and treating water. They publish standards and best practices used throughout North America for the design, installation, and operations and maintenance of water systems. The BC Water and Waste Association (BCWWA) is the local chapter of the AWWA.
Infrastructure Leakage Index (ILI)	A commonly used benchmark for Water Audits that identifies the ratio between Real Losses and the theoretical lowest amount of losses based on current technologies. An ILI of 1.0 means that the community has reached the theoretical lowest level of losses based on technology available.
Real Losses	The annual volume of water lost through all types of leaks and breaks before the customers' water meters.
Water Audit	An examination of records to trace and account for the flows of water from the source of supply, through the distribution system, and into customer properties.

1 RESPONSIBILTIES

1.1 Council is responsible for:

1.1.1 Adopting this Water Metering Policy and future updates;

1.1.2 Allocation of resources to meet the objectives of this Policy;

1.1.3 Providing high level oversight of the delivery of the organization's Water Metering Strategy; and,

1.1.4 Ensuring that organizational resources are appropriately utilized to address the organization's strategic plans and priorities.

1.2 The Chief Administrative Officer has overall responsibility for:

1.2.1 Reporting to Council and updating the community regularly on the status, effectiveness, and performance of work related to the implementation of this Water Metering Policy; and,

1.2.2 Considering and incorporating responsible water use and conservation in all other corporate plans (e.g. Strategic Plans).

1.3 The Director of Engineering and Public Works is responsible for:

1.3.1 Initiating the development of water use and conservation strategies, plans and procedures in conjunction with the management team;

1.3.2 Reviewing the Water Metering Strategy and Water Audit;

1.3.3 Reviewing water use characteristics and updating the Water Metering Strategy and Water Audits;

1.3.4 Completing meter calibration and testing and replacement as necessary;

1.3.5 Communicating with the public regarding water use, leak detection, and disruptions from replacement or upgrades of water infrastructure;

1.3.6 Conducting ongoing reviews and implementing changes to realize efficiencies in operations and maintenance practices;

1.3.7 In concert with Finance, accurately recording water consumption by user classification, e.g., single family residential, commercial, and industrial; and,

1.3.8 In concert with Finance reviewing water rates to ensure that the City is following full cost recovery.

2 OBJECTIVE

To ensure adequate provision of potable water is made in line with the City's commitments for both today and future generations by:

2.1 Ensuring the City meets all legislative requirements for water provision;

2.2 Maintaining assets in the most natural, energy-efficient, and reliable manner that cost the least to operate over the life cycle of the asset;

2.3 Ensuring that the City's services and infrastructure are provided in a sustainable manner to all users within the City;

2.4 Continuously working to reduce water consumption rates through education and other water conservation strategies;

2.5 Regularly tracking water use characteristics so that the effectiveness of water conservation initiatives can be measured and excess use can be identified and responses put into place to eliminate this excess use where practical;

2.6 Avoiding the need to oversize infrastructure based on water wastage or excessive water demands; and,

2.7 Minimizing the City's ecological footprint as measured by dependence on the South Nanaimo River Watershed and all its embedded energy costs to treat and convey this water.

2.8 Adopting a principle of continuous improvement in the City's water operations.

3 POLICY

3.1 Background

Council's vision and goal for the community which are outlined in the OCP include implementing wise water use and conservation practices.

3.2 Water Stewardship

3.2.1 Water usage will reflect industry best practices and place Nanaimo as a leader in water stewardship by:

3.2.1.1 Targeting a 10% reduction in per capita water use per decade;

3.2.1.2 Targeting a reduction in Real Losses by 10% by 2020 from 2013;

3.2.1.3 Maintaining a target Infrastructure Leakage Index of 2.5 or lower;

3.2.1.4 Completing an updated Water Audit and at least once every 5-10 years; and,

3.2.1.5 Ensuring that water demand forecasting is accurate and allows for effective prediction of water needs.

3.2.2 Water rates are equitable to all customers by ensuring that:

3.2.2.1 100% of connected properties are metered;

3.2.2.2 Customers receiving City water are billed at equitable rates;

3.2.2.3 Rates are reviewed and updated at least once every 5 years;

3.2.2.4 Rates provide adequate funds for system operations as well as infrastructure renewal, replacement, and upgrading; and,

3.2.2.5 Growth pays its appropriate share of costs for capital system improvements.

3.2.3 The public within the City of Nanaimo are aware of the value of water, gauged by:

3.2.3.1 Responses to regular customer surveys completed by the City and demonstration of a high level of support for current water rates and a good knowledge of the City water system;

3.2.3.2 Customers demonstrating a voluntary willingness to conserve water; and,

3.2.3.3 The effectiveness of water consumption information and water bills used as a tool to communicate with customers.

3.3 Water Metering

3.3.1 Water meters economically capture the majority of water use:

3.3.1.1 Where practical, meters are located at property line;

3.3.1.2 Where practical, domestic and fire services are separated at property line so that meters most accurately capture low flows; and

3.3.1.3 Meters are sized using AWWA best practices to avoid oversizing meters.

3.3.2 Water metering and reading technology is chosen to support the City's goals for water efficiency in a cost effective manner:

3.3.2.1 A reading system is selected based on criteria outlined in the Water Metering Strategy;

3.3.2.2 Up to a maximum of three (3) meter manufacturers are chosen to supply City meters based on criteria outlined in the Water Metering Strategy;

3.3.2.3 New meter technologies may be evaluated through a 2 year pilot program in order to demonstrate ability to meet performance criteria and compatibility requirements as outlined in the Water Metering Strategy; and,

3.3.2.4 Systems and processes are in place to effectively capture and use the data collected from the water meters in order to improve water efficiency.

4 SCOPE

This Policy applies to all City of Nanaimo activities related to water metering.

5 **REVIEW DATE**

This Policy has a life of 5 years.

Date:	201X-XXX-XX	Approved by:	Council / In Camera Council
1. Amendment Date:		Approved by:	

2018 Annual Strategic Directions for the Engineering & Public Works Committee

Item 1:

How does it relate to the following?

Strategic Plan Update 2016-2019	Adopted Plans and Documents	Programs
▪	▪	▪

Item 2:

How does it relate to the following?

Strategic Plan Update 2016-2019	Adopted Plans and Documents	Programs
▪	▪	▪

Item 3:

How does it relate to the following?

Strategic Plan Update 2016-2019	Adopted Plans and Documents	Programs
▪	▪	▪

Item 4:

How does it relate to the following?

Strategic Plan Update 2016-2019	Adopted Plans and Documents	Programs
▪	▪	▪

Item 5:

How does it relate to the following?

Strategic Plan Update 2016-2019	Adopted Plans and Documents	Programs
▪	▪	▪

City of Nanaimo

PUBLIC WORKS AND ENGINEERING COMMITTEE KEY DATE CALENDAR – 2018

Committee meetings are held in the boardroom on the first floor of the Service and Resource Centre Building at 411 Dunsmuir Street unless otherwise stated.

Committee	Start Time	End Time	Day of the Month
Public Works and Engineering Committee	4:30 p.m.	6:30 p.m.	2nd Wednesday

January 1 .... New Year's Day
January 10 .... Public Works and Engineering Committee

April 2 .... Easter Monday
April 11 .... Public Works and Engineering Committee
April 13-15 .... AVICC-Convention – Victoria

July 2 .... Canada Day Stat
July 11 .... Public Works and Engineering Committee

October 8 .... Thanksgiving Day
October 10 .... Public Works and Engineering Committee