



**CITY OF VANCOUVER**  
**INTERNAL AUDIT REPORT**  
***Major Fund Audit – Sewer Utility***

**Distribution:**

Audit Committee Cheryl Nelms – Acting General Manager, Engineering Services  
KPMG Patrice Impey – General Manager, Finance, Risk & Supply Chain  
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Operations  
Jimmy Zammar – Director, Integrated Strategy & Utility Planning

**EXECUTIVE SUMMARY**

**October 11, 2019**

The City's sewer utility processes comply with tax and collection policies and meet all legislative requirements. To strengthen sewer utility operations, management has committed to enhance operational effectiveness and efficiency by improving process documentation, increasing internal controls, addressing potential business continuity risks, expanding meter codes for better analysis, and strengthening meter data input integrity.

The more significant findings and recommendations are:

**E.1 Need for a Long-Term Sewer and Drainage Masterplan**

A long-term master plan (30 to 50 year time horizon) to guide the planning and delivery of services impacting sewers and drainage in the City will help achieve the goals set in the Integrated Rainwater Management Plan and Rain City Strategy.

**E.2 Improve Alignment and Consistency among Policies and By-laws Impacting Sewers and Drainage Services**

Identifying key gaps and opportunities and aligning by-laws and policies impacting the sewer and drainage services will accelerate the pace of deployment of innovative solutions. This will improve planning for programs and projects, enhance processing of development applications and industry capacity, and achieve efficiencies in service delivery.

**E.3 Develop Common Meter Reading Format to Meet Operational Demand**

Streamlining new meter installation and work on older meters to a common reading format will increase accuracy and improve efficiency in the billing process and safeguard the City's reputation.

**E.4 Standardization of Meter Reading Codes and Process Required**

A standardized set of meter reading codes and related processes will reduce conflicting data and results and minimize time-consuming re-validation.

**E.5 Address Limitation of Data Transfer for Metered Reading Data and System issues**

Review and implementation of Tempest system enhancements and automation will improve efficiency and accuracy of Utility Billing work flow.

These and other audit findings and recommendations are contained in the report.

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## A. BACKGROUND

### City's Aging Sewer System

The City's 2,100 km sewer system has a replacement value of over \$6 billion. Two components: sanitary and storm, make up the sewer system. Built initially of combined sewer and storm pipes, new and replacement sewer pipes are now constructed independently. The City's 2019-2022 Capital Plan states sewer mains have been replaced at an annual rate of 0.6 percent of the system during the past 10 years, with approximately 50 percent of the combined sewer system replaced or separated to date.

Under the Liquid Waste and Resource Management Plan by Metro Vancouver and approved by the Ministry of Environment in May 2010, Burnaby, New Westminster and Vancouver will implement plans to prevent combined sewer overflows by 2050.

### Greater Vancouver Sewerage and Drainage District (GVS&DD)

The GVS&DD delivers sanitary waste to Iona island wastewater treatment plant. Combined Sewer Overflows (CSOs) can occur in which the combined sewer and storm system can overflow into receiving waters during periods of heavy rainfall.

### Funding

1. Sanitary system is funded via sewer user rates based on water consumption;
2. Storm system is funded by general property taxes; and
3. Investments in system expansion due to growth are funded by a Utilities Development Cost Levy (UDCL).

The costs of running the City's system include:

1. the levy paid to Metro Vancouver (GVS&DD) for sewage treatment; and
2. capital and operating costs to maintain, upgrade, expand and improve the City's sewer system.

Sanitary sewer user fees and public sewer connection fees are reviewed annually by Council to establish the following year's rates. Engineering Sewer Utility Branch provides an annual Administration Report that describes:

1. the Utility's progress in meeting its strategic objectives;
2. sewage service plans for the upcoming year; and
3. recommended sewer rates and connection fees in the coming year.

Key drivers of the annual sewage user fees and rates are:

1. treatment costs paid to Metro Vancouver (GVS&DD); and
2. debt costs associated with the Sewers Capital Plan.

#### Major software systems supporting the City's Sewer System

Sensus – AMR (Automatic Meter Reading) facilitates the automatic collection of reading, consumption, diagnostic and status data from water devices and updates the central database, Tempest (Utilities), for analysis and billing.

Tempest (Utilities) – COV's central database houses meter, reading, consumption, account, billing and financial reporting information. Tempest (Utilities) runs various processes such as the reading capture of accounts each cycle, the export of data that Sensus will use in its automated reading process, the import of reading data and the billing creation itself. Tempest also has different parameters that can be set to act as controls in supporting the analysis and reasonability of consumption data so that corrective actions can be taken prior to billing.

Hansen – a Computerized Maintenance Management System used in Engineering primarily for water, storm water, streets, sewers, physical plant, inventory, GIS and a comprehensive asset management and work order management system.

### **B. SCOPE**

The scope of the audit includes assessment of whether:

1. Sewage Utility tax is properly collected, used and applied towards City's administered "Sewage Utility" account;
2. The City's Sewage Utility programs and processes are in compliance with government legislations and established City policies and procedures;
3. The City manages its sewerage and watercourse system with the objective of meeting current and expected future demand; and
4. Effectiveness, efficiency and economy of management's processes and controls of the Sewage Utility.

Our work included interviewing staff, examining and reviewing records to provide reasonable independent assurance that the existing internal controls and business processes relating to the above scope are adequate and effective.

The audit is not designed to detect fraud. Accordingly there should be no such reliance.

### **C. CONCLUSION**

The City's sewer utility processes comply with tax and collection policies and meet all legislative requirements. To strengthen sewer utility operations, management has committed to enhance operational effectiveness and efficiency by improving process documentation, increasing internal controls, addressing potential business continuity risks, expanding meter codes for better analysis, and strengthening meter data input integrity.

Findings and recommendations have been discussed with appropriate management and responses incorporated in this report.

### **D. RISK ANALYSIS**

The potential significant risks considered if controls were not in place are:

- Health and safety of residents are affected;
- Sewer operations are not run efficiently or effectively (Engineering Services 2017-2020 Strategic Plan – Goal # 2);
- Environment is not protected;
- Emergency plan not effective, not tested and lack of business continuity planning;
- Non-compliance to legislations and industry standard; and
- Inadequate capital infrastructure and asset management (Engineering Services 2017-2020 Strategic goal #10) to meet the demand from future growth of the City.

## **E. AUDIT ISSUES, RECOMMENDATIONS AND MANAGEMENT RESPONSES**

### **E.1 Need for a Long-Term Sewer and Drainage Masterplan (30 to 50-year time horizon)**

To deliver on the goals the City set in the Integrated Rainwater Management Plan and Rain City Strategy, meet regulatory obligations, and to respond to social and environmental challenges, there is a need for a long-term master plan to guide the planning and delivery of services impacting sewers and drainage in the City.

Such a plan would be aligned with Metro Vancouver's long-range regional plans, as well as anticipate and meet regulatory needs over the coming decades. The master plan would establish financial and capital strategies for sewers and drainage, as well as partnerships and collaboration with third parties and other levels of government. Currently, the capital plans that govern sewer and drainage investments are high-level guiding statements in the current ILWRMP (Integrated Liquid Waste and Resource Management Plan) and the high-level 10-year asset renewal outlook for Engineering that informs the four-year capital plan.

#### **Recommendation**

**E.1 The General Manager of Engineering should scope, resource, and initiate a long-range sewer and drainage master planning effort that builds on the direction set in the Rain City Strategy and other relevant regional and corporate plans. This work should start by June 30, 2020.**

#### ***Management Response:***

*Please check one:*

☒ Agree with the findings

☐ Disagree with the findings

*Please check one:*

☒ Agree with the recommendations

☐ Disagree with the recommendations

*Management Action Plan:*

***We will address this recommendation by the due date.***

### **E.2 Improve Alignment and Consistency among Policies and By-laws Impacting Sewers and Drainage Services**

Sewers, drainage, coastal and inland flood planning and management, right-of-way, levels of service, and water quality services, among others, are impacted by a wide range of city-wide policies and by-laws. Several departments within the City are affected (notably Engineering and its multiple divisions, Development Building & Licensing - DBL, Planning Urban Design and

Sustainability - PDS, and Real Estate & Facilities Management - REFM), as well as the Park Board and third party agencies including Metro Vancouver.

There is a need for improved alignment and consistency among by-laws and policies across the City, especially in the areas of integrated water resource management. Examples are sewer, drainage, coastal food management, groundwater; at site and district levels, and city-wide, as well as areas of resilience and emerging risk. Such improvements will accelerate the pace of deployment of innovative solutions, improve planning for programs and projects, processing of development applications and industry capacity, and achieve efficiencies in service delivery.

Examples include:

- Clauses and sections that concern management of water across property lines, treatment and reuse, and definitions;
- Policies concerning enforcement and annual permitting;
- Identification of jurisdictional/financial instruments available opportunities, e.g. storm water utility, associated by-law and fees, etc.

## **Recommendation**

**E.2 The General Manager of Engineering should identify key gaps and opportunities in alignment among by-laws and policies impacting the sewer and drainage services, along with a roadmap for implementation of improvements.**

**This should be completed by June 30, 2020.**

### ***Management Response:***

*Please check one:*

☒ Agree with the findings

☐ Disagree with the findings

*Please check one:*

☒ Agree with the recommendations

☐ Disagree with the recommendations

*Management Action Plan:*

***We will address this recommendation by the due date.***

## **E.3 Common Meter Reading Format to Meet Operational Demands**

City's Bylaw 4848 Schedule D requires water to be billed in "units" of 100 cubic feet. Older water meters use a different measurement scale and require manual modifications to the meters. If this is done incorrectly it would cause wrong meter readings and subsequent billings.

### **Problems Encountered**

When the water meters are uploaded through the City's automatic drive by, these modification errors are difficult and time consuming to detect and trouble shoot. Utility Billing reported that the City had to refund \$16,000 to one overbilled residential customer and to back-bill a commercial property for over \$40,000.

### **New Meters and Current Process**

All new water meters installed since this summer in the City transmit their consumption in cubic feet. This method does not require any modification to the meter and provides accurate reading information that can be used to assist with leak detection.

### **Issue**

Many of the City's existing meters cannot be cost effectively converted to this new method of meter reading resolution so Engineering operates two different meter reading resolution types in the system. Even though the quality control process put in place last summer have been effective at identifying clerical errors and preventing erroneous water bills from being sent to customers; continue streamlining of new meter installation process and work on older meters could reduce clerical errors, time spent investigating errors, and overall risk to the City.

## **Recommendation**

**E.3 The Director of Water & Sewers – Design, Construction & Operations should work with Financial Services on enhancing the common meter data process that will minimize reading and billing errors to safeguard the City's reputation. This joint review should start as soon as possible or before March 31, 2020.**

### ***Management Response:***

*Please check one:*

☒ Agree with the findings

☐ Disagree with the findings

*Please check one:*

☒ Agree with the recommendations

☐ Disagree with the recommendations

*Management Action Plan:*

***We will address this recommendation by the due date.***

## **E.4 Standardization of Reading Codes and Process Required**

Where exceptions occur, such as high or low meter readings, incorrect decimal places for the meter size, wrong meter type install data etc., manual readings and checks are required and referred back to field staff. As they are supported by different people this sometimes produces further different reading results or codes. There are very few reading codes and they are designed for use by Engineering to advise on meter conditions and not to support billing purpose. This causes delay since additional efforts are required to interpret data for billing.

Expanding and standardizing the reading codes and definitions would reduce conflicting data and results, eliminating some exceptions that need validation, and also assist the Clerks in the meter shop and Utility Billing to interpret results generated in the field.

### **E.4.1 Recommendation**

**The Director of Water & Sewers – Design, Construction & Operations should collaborate with the Associate Director of Financial Services to expand and standardize the set of processes and reading codes that will provide specific descriptions of meter data and meet the requirements of both teams. This should start as soon as possible or by March 31, 2020 to minimize the current workflow disruptions.**

### ***Management Response:***

*Please check one:*

☒ Agree with the findings

☐ Disagree with the findings

*Please check one:*

☒ Agree with the recommendations

☐ Disagree with the recommendations

*Management Action Plan:*

***The Associate Director, Revenue Services will work with the Director of Waters & Sewers –***

***Design, Construction & Operations to expand and standardize the reading codes.***

#### **E.5 Address Limitation of Data Transfer for Metered Reading Data and System issues**

Automation for the initial meter reading data from Sensus (Meter Shop) to Tempest (Utility) Billing was implemented approximately six years ago to support an electronic import/export process. Data is uploaded to the Tempest system and then manually analyzed by the Utility Billing staff.

Tempest can accept the entire file at each upload during the reading period. If subsequent and/or multiple reading data are needed the entire 'revised file' must be uploaded to replace the original file. This is cumbersome and delays the billing process as there are many late meter-reading changes.

Approximately 1,000 subsequent reading entries following the initial import to Tempest need to be reviewed manually in each billing period. They represent reading exceptions such as high and low check results, missed readings, inquiries and vacant check results which produce reading estimates and overrides.

A Tempest enhancement would allow reading exceptions to be made to the current period through an upload. This eliminates having to create additional manual reading entries for each account.

According to the Utility Billing staff and based on the current volume of exceptions, such an enhancement could provide a potential savings of up to 80 hours (250 hours annualized) of work being performed at the Clerk IV level for each billing period. If this savings could be realized, it could shorten the reading to billing period by a maximum of 5 business days enabling a more efficient data flow in the volume of exceptions, and enhance reading data accuracy.

#### **Recommendation**

**E.5.1 The Associate Director of Financial Services should conduct a cost-benefit analysis of enhancing the Tempest system automation in improving efficiency and accuracy of the work flow in Utility Billing. This should be initiated by April 30, 2020.**

##### ***Management Response:***

*Please check one:*

☒ Agree with the findings

☐ Disagree with the findings

*Please check one:*

☒ Agree with the recommendations

☐ Disagree with the recommendations

*Management Action Plan:*

***A cost benefit analysis of enhancing the Tempest system will be performed.***

#### **E.6 Revisit Critical Function in Engineering Data Collection**

The clerk supporting the Meter Shop and Utility Billing is responsible for work orders, account and meter data entry in the Hansen system. This clerk also re-validates account information that are detected as erroneous (exceptions) and returned by Utility Billing after upload to Tempest.

The current situation is that only one clerk handles all meter transactions (water and sewer

utilities). The input data come from many sources and, at times, the data are inaccurate. This clerk creates work orders and supports front line and back end queries (e.g. 311, Utility Billing, vacancy home checks, meter identifications, high or low meter readings etc.). There is a high business continuity risk if the clerk is unavailable as large backlog causes delays, adds workload and downstream billing problems.

Management should review the role of this critical function to ensure appropriate staff, training and knowledge are utilized to perform data validation prior to submission to Utility Billing.

## **Recommendation**

### **E.6.1 The Director of Water & Sewers – Design, Construction & Operations should:**

- a) Provide training for and enhance technical analysis by the meter shop staff to reduce data returned from Utility Billing for further validation;**
- b) Develop and incorporate a reporting process at the meter shop to detect, identify and assist with minimizing these exceptions;**
- c) Implement ongoing work flow controls and improvements in the meter shop to streamline meter reading cycle; and**
- d) Assess the long-term requirements of this position for the Water Program.**

**This should be started by December 31, 2019**

#### ***Management Response:***

*Please check one:*

☒ Agree with the findings

☐ Disagree with the findings

*Please check one:*

☒ Agree with the recommendations

☐ Disagree with the recommendations

*Management Action Plan:*

***We will address this recommendation by the due date.***

### **E.7 Track Incremental Costs due to Congested Right of Way for better Budgeting**

Existing and new hydro, gas, telecommunications, and fibre optic utilities throughout the metro area increased the workload to upgrade and replace water and sewer utility constructions.

When opening up a street to replace water or sewer line, or separating storm and sewer pipes, added design and construction work is required to work around other “utilities right-of-ways” being affected. An example would be the trenches have to be dug deeper or routes detoured to accommodate other utility service lines.

The City is burdened with incremental costs to work around existing utilities and in congested right of ways versus design and constructing in unhindered service corridors. This increases project costs and unit cost calculations per kilometer of utility line and impacts the long-term replacement/installations being built. The City needs to start collecting data that can support these added expenses. Engineering should track these costs and work with Finance to incorporate this in its annual and long range water and sewer budgets.

## **Recommendation**

**E.7.1 The Director of Water & Sewers – Design, Construction & Operations should determine processes and procedures to track these incremental costs in efforts to quantify and recoup, where applicable, these costs. This should be initiated by**

December 31, 2020.

**Management Response:**

*Please check one:*

☒ Agree with the findings

☐ Disagree with the findings

*Please check one:*

☒ Agree with the recommendations

☐ Disagree with the recommendations

*Management Action Plan:*

***We will address this recommendation by the due date.***

**E.8 Need to Formalize Plans for Management of Emerging Assets**

Engineering is considering designing and/or building a number of new or emerging sewer or drainage services, green infrastructure, or similar assets. Examples include underground assets such as telecom ducts, green assets such as raingardens, swales and storm water tree trenches, coastal flood prevention structures such as ditches, dikes, and floodable spaces, technology-enabled assets such as emerging technology infrastructure (utility monitoring equipment, SCADA, 5G, EV charging infrastructure), data and other intangible assets, etc.

These assets vary in cost, complexity, lifespan, and level of maintenance needed to maintain level of service and desired performance. Currently these assets are managed in an ad-hoc manner with varying levels of success. There are also unclear or informal assumptions in relation to asset stewardship obligations, funding, and lifecycle management needs.

**Recommendation**

**E.8.1 The General Manager of Engineering should develop asset management plans for emerging assets. The plans should include grouping of these assets and agreement on accountabilities, roles and responsibilities. Specific considerations and integral to these plans are:**

- mapping and tracking of these assets;
- condition assessment and lifecycle management plans;
- financial and management strategy to maintain state of good repair; and
- stewardship and levels of service.

**This should be scoped, documented in a project charter, and started by June 30, 2020.**

**Management Response:**

*Please check one:*

☒ Agree with the findings

☐ Disagree with the findings

*Please check one:*

☒ Agree with the recommendations

☐ Disagree with the recommendations

*Management Action Plan:*

***We will address this recommendation by the due date.***

**F. OTHER OBSERVATIONS**

**F.1 City Inter-departmental Utility Charges**

Currently REFM manages payment of utility provider billing for electricity, natural gas, steam, and district energy for all City departments. Water and sewer charges are billed directly to City owned facilities and tenants by the Engineering department where water metering is in place.

#### Tenant Sewer Utility Charges

Many City and Park Board (PB) owned facilities and tenants have not historically been billed by the Engineering department for water or sewage charges and do have water meters in place. Tenants in PB and Real Estate Services (RES) are responsible for their utility costs and where tenants have separate utility metering they are paying directly for their full utility costs.

#### Real Estate Services Tenants

For RES tenants that occupy buildings that have shared utility services the City is paying the utility costs and RES is generally recovering utility costs through gross leases, but would like to add utility sub-metering to more accurately allocate utility costs to tenants.

#### Park Board Tenants

For PB tenants that occupy facilities that have shared utility services, some facilities have sub meters which REFM uses to bill the tenants. Other PB tenants on shared utilities without sub metering, or at facilities that are not being billed for water and sewage costs, are being undercharged or not paying any utility costs even though lease agreements state tenants are responsible.

PB Commercial Operations and Planning & Development staff have identified some PB sites where utility recoveries are applicable but not being recovered or recovered fully. It is anticipated tenants will dispute usage when asked to pay when in past they have not as their sites are not sub metered.

#### Initiative by Park Board and REFM to Fully Recover Utility Costs

In a pilot project between REFM Energy & Utilities, Real Estate Services and Park Board Commercial Operations/Planning & Development, 16 PB sites were identified where sub metering would provide the data to support energy and water usage charges. An effort to install sub-meters at these sites has been initiated to find a third party metering contractor to install and manage sub meters and bill utility costs directly to tenants. Once the payback and benefits are established from these sites PB and REFM can continue expanding the project to recover all tenant hydro, water and sewage charges.

#### Current Status and Actions Taken by Park Board and REFM

REFM has secured funding sources, prepared a detailed scope of work, and submitted the project to Procurement. They are waiting on Procurement to assign a buyer to the project, prepare the tender documents, and issue the tender.

Once the work of installing the meters to obtain data that can substantiate charges to tenants for their water usage, it will support the City's levies on the tenants' water usage and enhance water conservation at those locations.