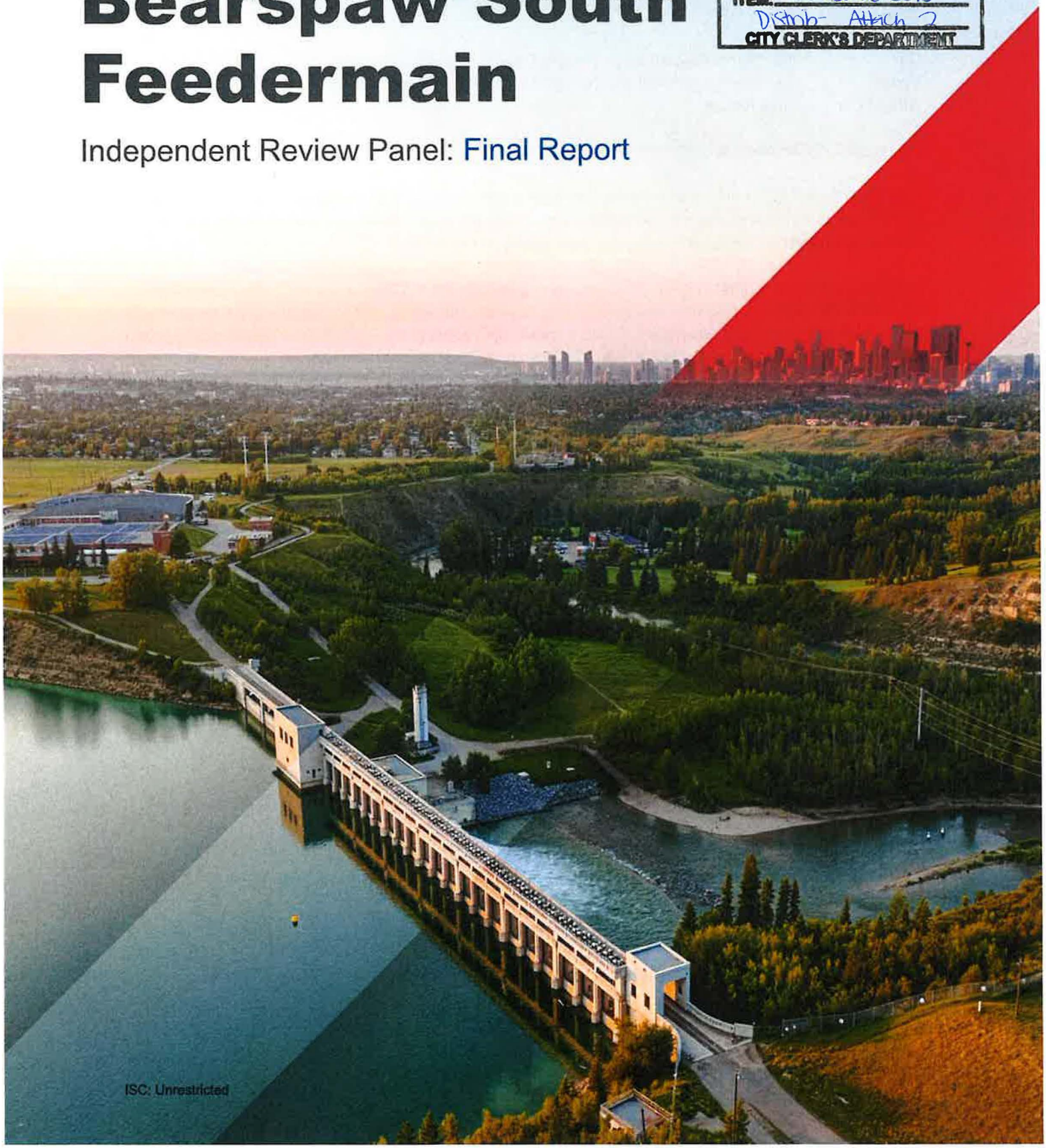
C2026-0045
Attachment 2

01.06.2026

Bearspaw South Feedermain

Independent Review Panel: Final Report



January 6, 2026

The City of Calgary
800 Macleod Trail SE
Calgary, T2G 5E6

To: The City of Calgary Mayor, Council, and Administration
From: The Bearspaw South Feedermain Independent Review Panel
Subject: Final Report

Dear Council & Administration,

This Final Report fulfills the Panel's mandate to examine the Bearspaw South Feedermain (BPSFM) failure that occurred on June 5, 2024, determining root causes and recommending changes to ensure that the water system will be reliable, affordable and sustainable in the future.

Over the past nine months, the Panel has engaged extensively with Water Utility staff, City Administration, and external experts, conducting detailed document reviews, interviews, and workshops to understand both the immediate causes and the systemic factors contributing to the incident. This Final Report builds on the previously submitted High Priority Action Report (submitted October 15, 2025), the Interim Report (presented October 21, 23 and 24, 2025) and the AECOM Technical Memo (submitted December 15, 2025), and provides a comprehensive set of interdependent recommendations, with a clear path forward to strengthen the Water Utility's risk and asset integrity processes, management and governance.

The Panel's recommendations center around three key actions: embedding comprehensive risk and asset integrity processes across the Water Utility, creating a dedicated Water Utility department, and establishing independent expert oversight through a Water Utility Oversight Board. Together, these reforms will address the gaps that exist today and ensure the safe and reliable water supply for the City of Calgary and area.

The recent December 30, 2025 BPSFM failure is currently under investigation by the City and was not part of the Panel's scope. While this report was written prior to that event, the Panel believes that the recommendations remain relevant.

It has been a privilege to contribute to this important work on behalf of Calgarians.

With respect,

Siegfried W. Kiefer,
Chair

Michael J. Crothers,
Vice Chair

Gordon M. Engbloom

Nancy F. Foster

Bob B. Kerr

Stephen Stanley

Bearspaw South Feedermain Independent Review Panel: Final Report

Date of Issue:
January 6, 2026

Prepared for:
The City of Calgary
Calgary, Alberta

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Acknowledgements

This report constitutes a systems-level management review focusing on organizational structures, processes, and decision-making practices with respect to the Water Utility since 2004 with the purpose of supporting utility resilience. It was conducted only to inform the Panel's recommendations, and must not be used or relied upon for any other purpose.

This report does not constitute legal or engineering advice and is not a substitute for such advice with respect to any statement or recommendation in this report, or with respect to the implementation of any recommendation in this report.

In undertaking its work, the Panel has engaged with many parties, including City staff, stakeholders, and external parties with experience in water utilities. This engagement included field visits, interviews, workshops, and submissions. On a pro bono basis, BCG provided supporting research, workshop facilitation, and document preparation. Lori Kerr, City of Calgary, Senior Corporate Liaison, facilitated our continuous contact with City employees and document research. Holly Wennerstrom was our administrative assistant.

To all of you, we thank all participants for their engagement, openness, and commitment to our efforts.

The Panel is responsible for the Final Report.

Summary

The City of Calgary (The City's) water system is one of the largest and most complex in Canada, serving more than 1.8 million residents of the Calgary Metropolitan Area including Airdrie and Chestermere[1]. Like many water utilities, it faces the dual pressures of managing aging infrastructure and serving a growing population. These long-standing challenges came to a head in June 2024, when the Bearspaw South Feedermain (BPSFM[2]) failure exposed systemic gaps in how the Water Utility manages critical infrastructure.

The failure of a section of the BPSFM forced city-wide water restrictions that lasted for nearly four months. During this period, The City was narrowly able to maintain essential service levels by relying heavily on the Glenmore Water Treatment Plant (GMWTP).[3] Had the same failure occurred during periods of reduced river flow in winter or in a drought period, or if the equipment at GMWTP had failed, the BPSFM outage could have resulted in serious widespread service interruptions and public health impacts, including boil water advisories.[4]

The risk of a failure in the Prestressed Concrete Cylinder Pipe (PCCP) portion of the BPSFM was first identified two decades earlier, following a similar rupture on the same type of pipe at the McKnight Feedermain in 2004. Subsequent studies and assessments repeatedly confirmed the risk to the BPSFM. Despite repeated identification of this risk, the City prioritized other critical needs and initiatives, repeatedly deferring BPSFM inspection, monitoring, and risk mitigation. This deferral was a function of underestimated likelihood of failure, not appreciating the significant impact of a failure, emphasis on other priorities and occasional periods of operating budget constraints. This pattern, which persisted over two decades, across multiple leadership teams and organizational structures, reflects systemic gaps in the Water Utility's approach to managing critical infrastructure.

The Panel has traced these gaps to external pressures, risk and asset integrity processes, ineffective management, and a lack of effective governance oversight.

1. **External Pressures:** The BPSFM failure occurred in the context of nationwide underinvestment in aging utility infrastructure and rapid population growth. Across Canada, capital investment in utilities has stagnated, leaving roughly 27% of Canadian water transmission mains in need of repair.[5] This underinvestment, combined with population growth, required utilities to manage competing priorities for asset renewal and system expansion. In Calgary, these pressures were particularly acute due to rapid population growth (a 70% increase since 2000[6]) and higher asset capital and maintenance costs (due to low population density, resulting in a large relative asset base). These external pressures exacerbated the risk and integrity challenges that ultimately affected the BPSFM.

2. **Risk & Asset Integrity Processes:** The City's Water Utility processes were not sufficiently robust to manage a complex system of this nature, especially one with challenging external pressures. The BPSFM, which carries up to approximately 60% of Calgary's potable water, was repeatedly recognized as a high consequence risk but deprioritized due to its perceived low likelihood of failure, which caused

[1] StatsCanada
[2] A Glossary is provided at the end of the report
[3] Interviews with Water Utility Staff
[4] Analysis Provided by Water Utility in Response to Panel Information Request
[5] Stats Canada 2022 Canada's Core Public Infrastructure Survey
[6] Alberta Government Regional Dashboards – City of Calgary Population

resources to be directed to other priorities.[7] Inspection recommendations made in 2017, 2020, and 2022 were deferred or redirected, with unclear escalation accountability and timelines.[8] In addition, the Water Utility lacked traditional planning safeguards required for critical infrastructure: the last Asset Management Plan (AMP) was issued in 2017[9] (with limited follow-up) and no Integrated Resource Plan (IRP) exists, leaving the system without coordinated, long-term renewal and redundancy planning.

3. **Management:** These process gaps persisted over two decades within an environment of unclear accountability and a culture of risk tolerance and decision deferral. These gaps exist within today's organization structure, wherein the Water Utility is split across multiple City departments leaving no single leader accountable for end-to-end outcomes. The first person with full visibility across the Water Utility is the CAO, who also oversees more than 60 other portfolios.[10] In the absence of a single accountable executive, decisions were often delayed or deprioritized, compounded by a consensus-driven culture that normalized deferral of action on critical issues. Limited financial transparency was another contributor to these gaps in accountability. Despite its large scale (2026 capital budget $1.1 billion and operating budget of $380 million)[11] and Council's mandate to be self-funded entirely through user rates and levies, the Water Utility operates without segmented financial statements. This results in limited line of sight to the Water Utility's true financial performance and restricts the ability to directly link revenues and expenditures to service outcomes, ultimately contributing to a lack of accountability.

4. **Governance:** These gaps persisted across multiple management teams, successive Councils, and organization structures, in part because Council lacked the visibility and expert support to provide effective oversight. Reporting to Council was periodic and high-level, providing limited transparency into operational and risk performance. Council also had limited access to the independent technical expertise required to provide oversight to management and evaluate complex trade-offs between service, cost, and reliability. As a result, many critical decisions were never surfaced to Council (i.e., changes to system redundancy standards that carried major implications for system reliability) and those that did (i.e., shift in rate structure) were made without the expert scrutiny typical of a regulated critical infrastructure utility, further contributing to a lack of accountability.

The combined effect of these factors created a set of conditions that left the Calgary water system increasingly exposed to reliability risks. In response, the Panel has developed:

- Urgent recommendations to maintain the BPSFM and provide redundancy for drinking water supply
- Near-term recommendations to address the systemic root causes and ensure the entire water system for the City is reliable, sustainable and affordable in the future

Urgent Recommendations

The Panel closely examined reports prepared for the City that detailed the physical cause of the BPSFM failure, its present condition, and the water network capabilities. A High Priority Action Report (HPAR) was issued by the Panel on October 15, 2025 which highlighted the Water Utility's inability to meet Average Daily Demand[12] when either BPSFM or the Bearspaw Water Treatment Plant (BPWTP) were out of service, and recommended acceleration of projects to address these single points of failure. Current project timelines leave the water system in a precarious condition for an unacceptably prolonged period.

[7] 2015 Linear Infrastructure Criticality Assessment, Calgary Water Network AMP Final 2017; 2018-05-5 AM WT TAMP Draft
[8] 2017 Tactical Asset Management Plan, 2019 Feedermain Inspection Program Technical Memo, 2021 Water Long Range Plan
[9] Calgary Water Network AMP Final 2017; 2018-05-5 AM WT TAMP Draft V2
[10] City of Calgary Organizational Chart
[11] City of Calgary Website – Proposed 2026 Budget
[12] Analysis Provided by Water Utility in Response to Panel Information Request

In addition, the Panel engaged experts at AECOM[13] to study the present condition of the PCCP portion of BPSFM and provide recommendations. Its report concludes that while the repair program undertaken after the rupture in June of 2024 stabilized the BPSFM, the pipe has continued to deteriorate, and several measures should immediately be taken to address the serious vulnerabilities of the feedermain. The frequency of wire breaks experienced in the 6 km PCCP portion of BPSFM between Bearspaw Water Treatment plant and Shaganappi pump station is approximately six times that observed in similar industry programs. Risk screening criteria must include not only wire breaks, but segment specific conditions on static head, soil composition, ground cover, and electromagnetic casing inspection data. The BPSFM is highly vulnerable to future failures, including new pressure transients that put strain on the weakened segments of pipe. The Panel strongly advises that the City respond with a crisis mindset to safeguard the water supply.

To minimize the period that this vital infrastructure is exposed to outage, more focused resourcing is needed. The Panel recommends that a task force of contracted and City experts be established immediately to address the risk of failure for specific weakened pipe segments, make proactive repairs and reinforcements, prepare detailed emergency response plans, install transient pressure monitors and deploy rigorous procedures and training to prevent sudden changes in system pressure. We propose contingency planning to manage multiple successive BPSFM breaks while reservoirs are at low winter levels, such as permission to reduce Glenmore Reservoir outflows, temporary surface lines and alternate water routings.

Furthermore, the Panel strongly recommends the acceleration of the steel pipe duplication of the PCCP portion of the BPSFM identified in HPAR be completed in 12-14 months, using emergency procurement procedures and leveraging private sector expertise. It is recognized that execution is complicated by roads and residential development, and that the priority must be on safety as well as innovation and not as much on cost in order to achieve an aggressive timeline. The steel pipe installation is the most important short-term action to safeguard the reliable supply of water to Calgarians.

Near-Term Recommendations

To address the underlying causes of the BPSFM failure, the Panel recommends the Water Utility strengthen and formalize risk and asset integrity processes to align with best practice for critical infrastructure and to ensure that critical risks are identified, monitored, and mitigated in a timely and transparent manner. Given the Water Utility's history of advancing other priorities while deferring action on high-consequence risks such as BPSFM, these process reforms must be reinforced by changes in management accountability and Water Utility oversight. Accordingly, the Panel recommends the establishment of a dedicated expert Water Utility management team, and an independent expert oversight board to provide Council and management with credible, technically informed advice.

Recommendation 1: Strengthen Risk Management and Asset Integrity Processes

The Panel's first recommendation is organized into three components:

a) Establish a consistent, utility-wide framework for identifying, prioritizing, and escalating risks. The Water Utility should hire a qualified risk expert to develop a standardized risk assessment framework with clear root cause investigation protocols and escalation processes, ensuring that high-consequence risks receive senior management review. This framework should be supported by a centralized risk register that provides an organization-wide view of well-defined critical risks, enhancing accountability, and preventing material issues from being overlooked or managed in isolation.

[13] AECOM report was commissioned by Panel and is dated December 15, 2025

b) Update and enhance AMPs for all major infrastructure assets, so they can serve as the operational backbone for long-term reliability linking asset condition, performance, and risk to clear maintenance and investment priorities. The AMPs should be re-evaluated every three years to dynamically account for new condition and reliability assessments, and must have clear actions, owners, and timelines to ensure accountability and follow-through.
c) Develop a long-term IRP to identify the scope and timing of major projects to maintain reliability, meet growth, manage costs, and mitigate long-term risks over a 20-to-30-year horizon. This plan should ensure that all critical assets are considered within a coordinated strategy that links investment decisions to service outcomes and accountability.

The Panel believes that these risk and asset integrity changes must be reinforced by management accountability and governance oversight. Ultimately, the Panel recommends a model wherein the Water Utility would become a separate legal entity wholly owned by The City, governed by an independent expert Board of Directors, and maintaining public accountability through City ownership. However, the Panel also recognizes that the Water Utility is currently advancing several major initiatives, including implementation of several critical reliability and capacity projects. To maintain momentum on these priorities, the Panel acknowledges the need to minimize organizational disruption in the near-term. As a result, the Panel does not recommend immediately shifting the Water Utility to a corporation. Instead, as a pragmatic first step, the Panel recommends The City consolidate core utility functions into one department under a single accountable executive and introduce independent, expert advisory oversight through a Water Utility Oversight Board (WUOB).

Recommendation 2: Establish a Dedicated Utility Department with Segmented Financial Statements

The Panel recommends that the City establish a dedicated Water Utility department, led by a Chief Operating Officer (COO) of Water Services reporting to the CAO and accountable for end-to-end performance across service, cost, and reliability. This structure should consolidate all core functions including Operations & Maintenance, Technical Services, Quality Assurance, Planning and Regulatory, Risk and Health, Safety and Environment. This reform reflects the reality that critical infrastructure management requires complex trade-offs that cannot be made effectively in a fragmented organizational structure with unclear decision ownership. This shift should be complemented by the creation of segmented Water Utility financial statements, allowing the City to more clearly link spending to performance and make well-informed, long-term investment decisions that strengthen the reliability and resilience of the water system.

Recommendation 3: Establish an Independent Expert Water Utility Oversight Board

Further, this dedicated department should be complemented by an independent expert oversight board of five members, to be known as the WUOB. The WUOB would operate independently from Water Utility management, giving Council expert advice on system reliability, major capital investments, and risk mitigation with a focus on long-term sustainable performance. In addition, the WUOB would be a resource for the Water Utility leadership team, bringing technical, financial, and regulatory expertise to strengthen the rigor of decision-making across the Water Utility. This level of independent expertise is common for critical infrastructure and its unique challenges, including distinct financial requirements (as a regulated utility), provision of an essential service that is core to public health, multi-decade planning horizons, and highly technical content. The WUOB will be independent of the potential politicization of decision-making which can be misaligned with the long-range planning and funding needed for the Water Utility.

These recommendations are interdependent, and their success depends on a deliberate and sustained shift in organizational culture. The City's Water Utility must evolve toward a long-term, risk-based critical-infrastructure mindset – one that reflects the scale, complexity, and public importance of the system it manages.

Together, the Panel's recommendations address the systemic gaps that led to the BPSFM failure, supporting a shift to a culture of accountability and proactive risk management that is essential for effective stewardship of critical infrastructure. The Panel expects that these reforms can be largely implemented within the next 12 months. The Panel strongly advises a mindset of "chronic unease", acting with urgency to address the risks and gaps that we have reported. The first step is to strike a search committee using recruitment firms to source candidates for the COO role in the Water Utility and the Chair of the Water Utility Oversight Board.

Context

On the 5th of June 2024, the BPSFM failed, causing a major water supply disruption and triggering city-wide restrictions that lasted nearly four months, with Stage 4 restrictions in place for almost two months.[14] During this period, the City was narrowly able to maintain Typical Day Demand (TDD) – the minimum threshold required to sustain essential service levels – by relying heavily on the Glenmore Water Treatment Plant (GMWTP).[15] Had the same failure occurred during periods of low river flow in winter or in a drought period, or if the equipment at GMWTP had failed, Calgary may have been unable to meet TDD, potentially resulting in widespread service interruptions and public health impacts including boil water advisories.[16] The event highlighted the need for greater accountability and proactive risk management in the City's approach to critical infrastructure and services for Calgarians and the region.

In response, the City commissioned the BPSFM Independent Review Panel to complete an independent comprehensive review of the root causes of the rupture and make recommendations to prevent recurrence. Additional details on the Panel's mandate can be found in Appendix B.

The Panel's review also included some evaluation of the broader watershed factors. While not directly relevant to the BPSFM failure, they are important for future planning and long-term resilience of The City's water system. A summary of these findings is included in Appendix C.

While the Panel's assessment has primarily focused on the potable water system as it is most relevant to the BPSFM failure, analysis conducted on the wastewater and stormwater service lines resulted in similar conclusions. Accordingly, the Panel's recommendations encompass utility-wide reforms intended to strengthen processes, structures, and governance across the entire Water Utility. Additional details on the Panel's evaluation of wastewater and stormwater services can be found in Appendix D.

This Final Report is the culmination of more than nine months of research, analysis, and engagement. Over this period, the Panel conducted more than 50 interviews and 10 workshops with over 90 City staff, external consultants, and subject-matter experts. The panel also visited the Calgary Water Centre, Emergency Operations Centre, BPWTP, GWTP, Shaganappi pump station, and Bonnybrook WWTP. The findings and recommendations are intended to support Council and City Administration in strengthening the water system, ensuring it meets the goals of providing safe, reliable, and affordable water services to Calgary and surrounding regions.

[14] APEGA, Report to the APEGA Practice Review Board, Practice Review of the City of Calgary (Permit #4428) Bearspaw South Feedermain Rupture, May 7, 2025
[15] Interviews with Water Utility Staff
[16] Analysis Provided by Water Utility in Response to Panel Information Request

Critical Infrastructure Management

The Water Utility is unique among City services due to its scale, complexity, and criticality of the services it provides. As a result, there are unique challenges involved in the management of this critical infrastructure that are relevant to consider. This section will introduce these factors, as they are central to understanding the BPSFM failure and the recommendations for strengthening governance, financial management, risk management and expert oversight.

The scale of The City's water system places it among the City's most significant public assets, requiring a 'critical infrastructure management approach' that is distinct from other City services.

- The Water Utility is uniquely large across city departments, with a 2026 capital budget of approximately $1.1 billion (approximately 30% of the City's total budget) and operating budget of approximately $380 million.[17] In addition, it is municipally owned and is mandated by Council to be self-funded through user rates and levies rather than property taxes. Taken together, this scale and distinct legal structure means that the Water Utility must be managed with rigorous financial safeguards, transparency, and accountability.
- The Water Utility is the sole provider of an essential service that is core to public health, meaning it must maintain continuous, stable, reliable operations, with little margin for error and a strong emphasis on accountability and a low risk tolerance.
- The Water Utility assets have life spans of 40 to 50 years or longer, requiring coordinated, long-term planning to maintain reliability, support population growth, manage watershed supply, and ensure affordability. These planning horizons far exceed the timelines of most municipal decisions and extend well beyond the 4-year cycle for elections of Council.
- The Water Utility assets are also technically complex, including large networks of deeply buried pipelines, high-pressure pumping systems, biological and chemical treatment processes, high-voltage electrical systems, and advanced process control technology. Operating and maintaining such infrastructure demands highly trained and certified technical staff. Calgary's 300 m variance in topography and over 30 pressure zones are unique challenges in design and operability.[18]

Given their scale, criticality, longevity and complexity, water utilities require proactive and long-term asset planning, supported by timely implementation of measures that strengthen reliability, manage costs, and build resilience and reinforce accountability. One foundational tool is the use of Asset Management Plans (AMPs): a structured process for managing infrastructure assets to minimize lifecycle costs while reliably delivering desired service levels. AMPs must be integrated into regular risk management and planning processes, allowing them to directly inform annual budgets, maintenance schedules, inspection planning, and capital investment decisions. In this way, they serve as essential tools for prioritizing infrastructure spending, operational planning and ensuring accountability for outcomes.

Drawing on AMPs as key inputs, critical infrastructure utilities must also develop system-wide Integrated Resource Plans (IRPs): a long-range strategy tool that typically spans 20 to 30 years and is used to effectively manage both aging assets and system growth at the lowest long-term cost. An IRP considers long-term system-wide factors – such as population growth, water supply constraints, economic pressures, and regulatory change – to define an overarching strategy for infrastructure renewal, capacity expansion, financial sustainability, and accountability. A best-practice IRP defines how all components of the water system must evolve together to meet future expectations, informing major capital investments (i.e., where

[17] City of Calgary Website – Proposed Budget 2026
[18] City of Calgary Website – Water Pressure Summary

and when to expand capacity and build redundancy) and ensuring that operational, financial, and engineering functions are aligned with long-term strategic cost, service and reliability objectives.

In addition to AMPs and IRPs, critical infrastructure must also maintain robust rate-setting processes that ensure transparency, cost recovery, and accountability. These processes translate the long-term strategies in the IRP and AMPs into the financial framework that funds ongoing operations and investment. Through cost-of-service reviews, the utility demonstrates that its planned expenditures are prudent, its revenues sufficient to sustain reliable service, and its prices fair and based on actual cost. This financial discipline is fundamental to maintaining public trust, financial integrity and accountability – ensuring that customers receive safe, reliable water service while the utility remains financially self-sustaining over the long term.

These strategic planning and risk management tools must be supplemented by decision-making mechanisms that keep long-term, system-wide consideration, governance, and oversight at the forefront. To effectively balance cost, service, and reliability trade-offs, most critical infrastructure utilities engage independent expert bodies that are not unduly influenced by short-termism or operational pressures. Equally important, decision-making must be informed by expert insight and deep technical capability across the leadership team to ensure that critical decisions align with best practice. Finally, a resilient Water Utility must maintain sufficient redundancy and operational safeguards to absorb shocks and sustain continuous service in the face of system failures or emergencies.

For more information on the rationale for and structure of regulated utilities, see Appendix E.

Water Utility Background

The City of Calgary's Water Utility is one of the largest and most complex in Canada. It provides potable water, wastewater, and stormwater services to more than 1.8 million residents of the Calgary Metropolitan Area[19], supported by an integrated network of over 16,000 kilometres of pipe.[20] The City's Water Utility also supplies water and wastewater services to Airdrie, Chestermere, Strathmore, Tsuut'ina Nation and parts of Rockyview County. The system draws water from the BPWTP, which is on the Bow River, and GMWTP, which is on the Elbow River, and delivers an average of roughly 350 litres per person per day.[21] The Water Utility is a critical municipal enterprise – its 2026 capital budget exceeds $1 billion (approximately 30% of the City total) and annual operating costs of $380 million placing it among the largest public utilities in the country.

The BPSFM is a key feedermain within this network, carrying up to 60% of The City's potable water. It is 10.8 km long and consists of the following segments: 1.6 km of 1950 mm diameter AWWA C200 steel pipe; 5.9 km of 1950 mm diameter AWWA C301 Prestressed Concrete Cylinder Pipe (PCCP); and 3.23 km of 1500 mm diameter AWWA C301 PCCP. The 5.9 km 1950 mm PCCP portion of the feedermain is where the 2024 break occurred. The BPSFM was built in 1975 using PCCP[22] However, subsequent experience demonstrated that PCCP manufactured in the mid-1970s[23] – factors that made it susceptible to corrosion when exposed to chemically aggressive soil conditions.

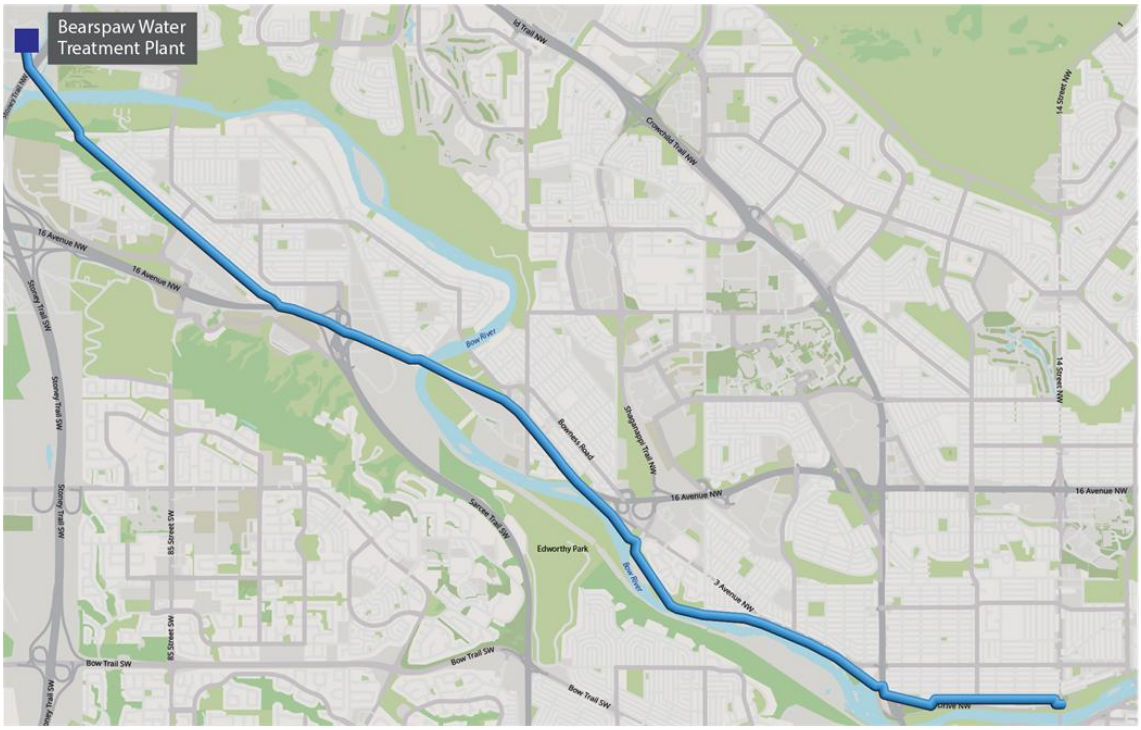


Exhibit 1: *Map of BPSFM*

[19] StatsCanada
[20] City of Calgary Website – Waterworks City Planning
[21] City of Calgary Website – Calgary's Water Efficiency Plan
[22] APEGA, Report to the APEGA Practice Review Board, Practice Review of the City of Calgary (Permit #4428) Bearspaw South Feedermain Rupture, May 7, 2025
[23] ASCE Pipelines 2012, "Beyond the Wires, A Sustainable Approach to PCCP Pipe Management"

To provide context for the Panel's findings, the following section outlines the historical evolution of Calgary's Water Utility.

2000–2010: Efficiency Gains and Deferred Investment

From 2000 to 2010, The City's Water Utility experienced a stable environment as population growth of approximately 25%[24] was more than offset by a 30% reduction in per-capita water use.[25] These efficiency gains – in-part driven by the 2005 Water Efficiency Plan – provided a favourable environment, easing pressure on system volumetric capacity even as Calgary grew.

Over this time framework, there were no water or wastewater offsite levies, but only stormwater levies.[26] As a result, the Water Utility had become over reliant on debt financing to fund growth projects and subsequently entered the next decade in a weakened financial position.[27]

The period was punctuated in 2004 by the McKnight Feedermain rupture, a PCCP failure, which underscored the material's vulnerability and prompted the Water Utility to initiate an integrity management program for large diameter feedermains.

2010–2020: Fiscal Recovery and Reduced Resilience

Between 2010 and 2020, Calgary's population growth slowed slightly to 20%[28] while efficiency gains plateaued, resulting in increased aggregate system demand.[29] In 2011, an internal review identified financial stress in the Water Utility resulting from rising debt caused by the previous decade's offsite levy allocation.[30] In response, the City re-established water offsite levies, gradually stabilizing the Water Utility's funding base and rebuilding reserves through the mid-2010s.[31] The Water Utility's fiscal recovery was hampered starting in 2017 when an economic slowdown sharply reduced development activity and associated offsite levies, again creating a funding shortfall. The Water Utility eventually returned to its target sustainable reserve level of 120 days of operating costs in 2022.[32]

This uneven fiscal recovery coincided with a period of weakening system resilience as the Water Utility was repeatedly asked to "do more with less". Within this timeframe, the Water Utility implemented major changes in design-day standards – the Water Utility's minimum performance target in the event of a critical asset failure. In 2011, the Water Utility reduced its design day standard with redundancy from Average Day Demand (ADD), to Typical Day Demand (TDD), which is roughly 8% lower.[33] This shift aligned with cost-containment goals as less capital was required to meet a lower redundancy standard. In 2019, concerns that TDD standard was too low led to discussions to set a higher standard, culminating in 2021 with the adoption of ADD as the minimum design day standard.[34] Meeting this new standard required significant capital investment, with many of the associated projects still under development today.

[24] Alberta Government Regional Dashboards – City of Calgary Population
[25] City of Calgary Website – per Capita Water Use Dashboard
[26] Interviews with Water Utility Staff
[27] 2011 Utilities Financial Plan
[28] Alberta Government Regional Dashboards – City of Calgary Population
[29] City of Calgary Website – per Capita Water Use Dashboard
[30] Interviews with Water Utility Staff
[31] Offsite Levy Background Report
[32] Interviews with Water Utility Staff
[33] Calculated from data provided by the Water Utility
[34] 2021 Water Long Range Plan Volume 2; 2019 Water Long Range Plan

2020–2024: Rapid Growth and Renewed Strain

From 2020 to 2024, Calgary's population grew by approximately 15% in just four years – a pace equivalent to about 45% over a decade[35]. Again, with negligible efficiency improvement, this population growth drove aggregate system demand. The implications of aging infrastructure and deferred maintenance and asset integrity investment also became more apparent in this time horizon. Leak rates rose from 17% in 2015 to 22% in 2024, compared with an estimated industry median of 12%.[36] In addition, in 2023 the Water Utility's operating and maintenance costs averaged $13,200 per kilometre of pipe – well above the national median of $9,350 per kilometre. These indicators underscore a system under mounting strain.

This vulnerability materialized in June 2024, when the BPSFM failed catastrophically due to mortar damage allowing corrosion of the prestressed wires resulting in their failure.[37] The mechanism mirrored the 2004 McKnight rupture, though driven by different soil chemistry.

This historical overview demonstrates how the resilience of Calgary's Water Utility has steadily eroded, as successive cycles of shifting priorities, fiscal constraint, deferred investment, and fragmented planning left critical assets operating with reduced redundancy and limited margin for error. Only twice over this twenty-year period did the Water Utility spend its budgeted capital, chronically underinvesting and deferring important projects that could have increased the resilience of the system to outages.

[35] Alberta Government Regional Dashboards – City of Calgary Population
[36] AECOM Water Use and Water Loss Third Party Review
[37] APEGA, Report to the APEGA Practice Review Board, Practice Review of the City of Calgary (Permit #4428) Bearspaw South Feedermain Rupture, May 7, 2025, Bearspaw South Feeder Main Pipe Investigation Findings IP2024-1237 December 11, 2024, Associated Engineering Forensic Investigation into the Bearspaw South Feedermain Rupture, November 2024

Factors Contributing to BPSFM Failure

The risks that ultimately caused the BPSFM failure were identified twenty years prior during internal assessments that were conducted in response to the 2004 McKnight Feedermain failure. These assessments had concluded that the PCCP portion of the BPSFM was vulnerable due to its age, design, and material composition and posed a significant risk to system integrity. Repeated internal reviews, external studies, and condition assessments confirmed the BPSFM's vulnerability. Other utilities across North America experienced similar PCCP failures, and many of them undertook mitigation programs and efforts. In Calgary, however, risk response mechanisms were not triggered and BPSFM vulnerabilities were not addressed, underscoring systemic gaps within The City's approach to critical infrastructure management.

To evaluate these factors the Panel conducted a structured analysis examining four layers of causation:

1. **External pressures**: First, the Panel examined the broader context in which the BPSFM failure occurred, specifically, the external conditions that shaped the City's decision-making environment and influenced the prioritization of work across the Water Utility.

2. **Risk and asset integrity processes**: The Panel then turned to the most direct layer of causation: the Water Utility's risk and asset integrity processes, investigating how an identified risk was not adequately evaluated or escalated.

3. **Management and organizational model**: The Panel analyzed the management and organizational context, including the clarity of risk ownership and accountability, decision-making processes, and the Water Utility's culture regarding risk tolerance and prioritization.

4. **Governance oversight**: Finally, the Panel assessed the governance structures responsible for providing strategic direction, financial management, independent challenge, and assurance over the Water Utility's performance and risk management. This included examining the tools Council is equipped with to evaluate cost, service, and reliability trade-offs.

These layers of causation are interconnected. Challenging external pressures could not be effectively addressed due to the absence of proactive risk and asset integrity processes capable of identifying, monitoring, and mitigating critical infrastructure risks. These process gaps persisted within a management environment characterized by unclear accountability and elevated risk tolerance while governance structures lacked the rigor to introduce informed and expert oversight.

BPSFM integrity risk first identified two decades before 2024 failure

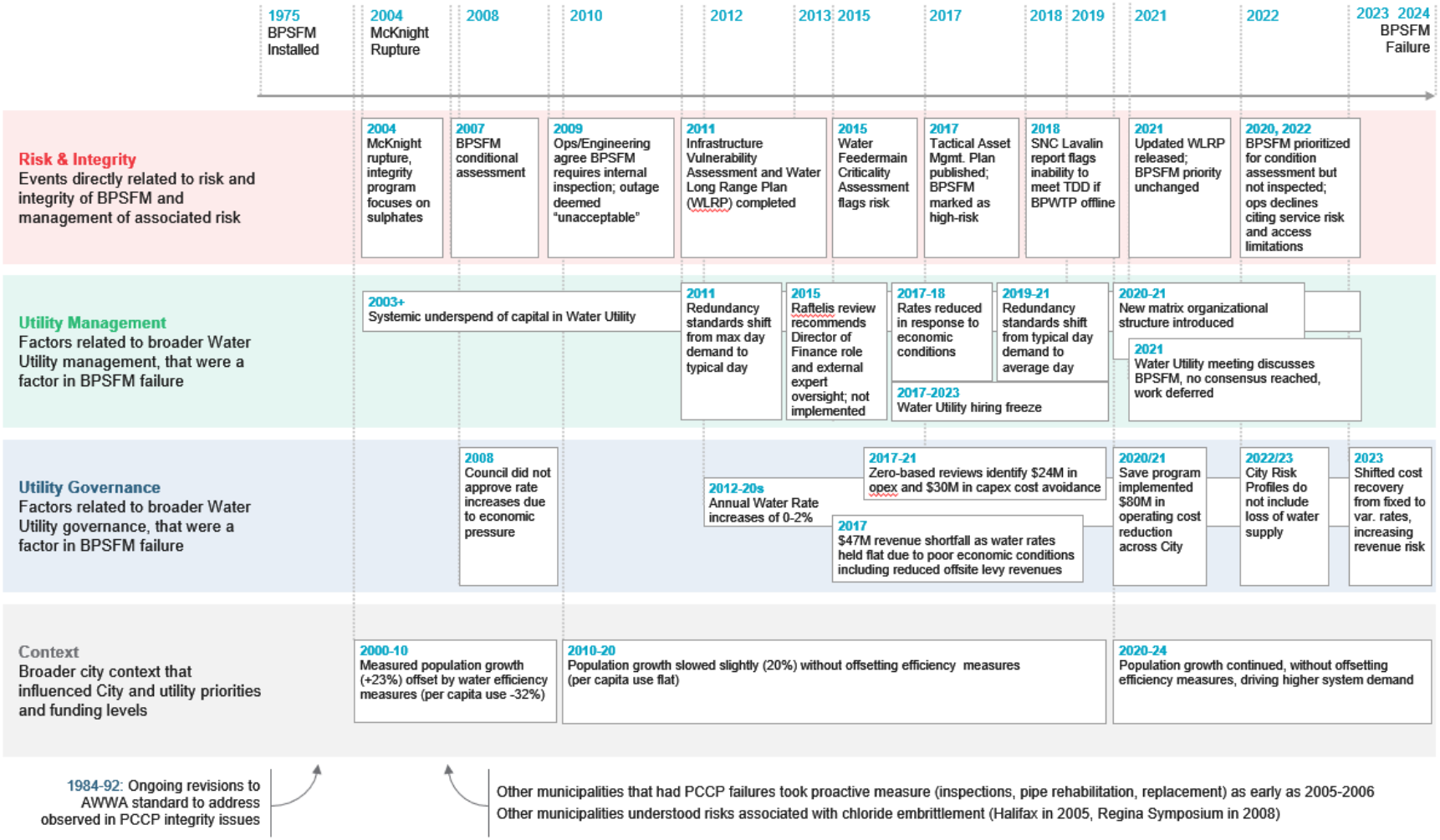


Exhibit 2: *Timeline of Key Inspections & Assessments related to BPSFM*

1. External Pressures Strained Water Utility Capacity and Decision-Making

Across Canada, capital investment in utilities has stagnated, resulting in widespread infrastructure deterioration. Rapid population growth across the country has further strained municipal utilities, forcing them to balance competing capital priorities. In such environments, asset integrity programs often struggle to secure consistent funding amid more immediate service demands. This is illustrated by the fact that approximately 27% of Canadian water transmission mains require repair.[38]

This trend is also borne out by recent history. The same summer as the BPSFM failure, a major PCCP feedermain in Montréal ruptured under similar conditions – failing well before the end of its expected service life, and prompting a city-wide boil-water advisory for one day before temporary service was restored.[39,40] Another similar situation followed shortly after when Hamilton identified a significant leak in its largest feedermain due to PCCP corrosion. Hamilton's system was designed with a parallel line which allowed service to continue uninterrupted throughout the repair period.[41]

Calgary's situation is particularly acute. It has been the fastest-growing major city in Canada, expanding by more than approximately 70% since 2000[42], and is expected to continue outpacing national averages. In addition, it remains a low-density municipality, resulting in more kilometres of pipe per resident than any other large Canadian peer city. These factors have stretched capacity and added maintenance and asset integrity costs for the Water Utility.

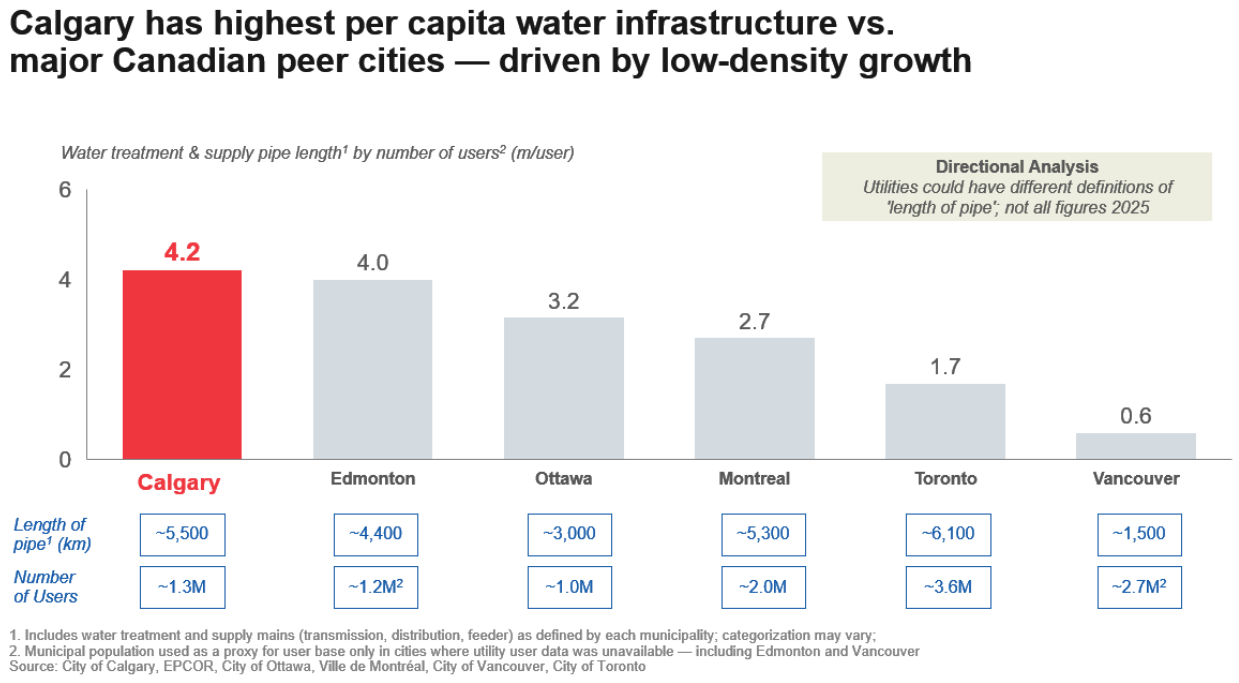


Exhibit 3: *Calgary Water Treatment & Supply Pipe Length per User vs Peers*

[38] Stats Canada 2022 Canada's Core Public Infrastructure Survey
[39] Global News, Montreal water main that burst among city's most 'vulnerable' pipes, officials say, August 19, 2024
[40] City News, Geyser; in Montreal after major water main break floods streets and homes near Jacques-Carier Bridge, August 16, 2024
[41] Global News, Hamilton's largest water main 'failing,' shares same part seen in Calgary, Montreal bursts, October 2, 2024
[42] Alberta Government Regional Dashboards – City of Calgary Population

2. Gaps in Risk & Asset Integrity Processes Directly Led to BPSFM Failure

Robust risk and asset integrity processes are fundamental to managing critical infrastructure systems, especially those with aging assets and facing rapid growth. The Panel found that Calgary's processes for identifying, monitoring, and mitigating risk contained material gaps relative to best practice, and that key planning tools such as AMPs and the IRP were outdated or ineffectively applied.

Key Gaps Identified:

A. *Risk prioritization frameworks undervalued high-consequence failures***.** The City's risk assessment approach emphasized likelihood over consequence, deprioritizing low-probability but high-impact events like feedermain failures.[43] This approach often resulted in significant risks, such as a BPSFM failure, receiving insufficient attention or follow-through and remaining largely absent from long-term planning and investment decisions. For example, after the 2004 McKnight rupture, asset integrity programs focused on sulphate-related corrosion but not on chlorides, which can also promote corrosion.[44] In the case of the BPSFM, the Water Utility also deprioritized the risk due to the belief that chlorides and sulphates would not be present in material quantities in the well drained gravel-based soils where the feedermain was located. The 2015 Linear Infrastructure Criticality Assessment categorized BPSFM as 'low priority' for these reasons without substantiating inspection evidence.[45] In addition, emerging threats to reliability such as new road de-icing chemicals and their corrosive impacts were not identified or mitigated. The Panel also observed a broader weakness in the Water Utility's risk management maturity, with enterprise-level processes remaining largely qualitative and not meeting the Water Utility's self-defined targets for consistency and capability.[46] Ultimately, this gap in risk assessment frameworks increased the likelihood of failure over time, as high consequence risks remained uninvestigated and unmitigated.

B. *Analysis of Water Utility incidents failed to identify systemic issues.* The Panel also identified a lack of enterprise-wide root cause investigation, review, and organizational learning. Incidents were typically analyzed narrowly, and lessons – both internal and external – were not effectively acted upon. For example, no root cause analysis of the BPSFM failure examined organizational, systemic, or human factors.[47] Similarly, the June 2023 Boil Water Advisory After Action Report related to another incident did not assess the systemic or human dimensions of the incident, despite it being triggered by a pipeline strike.[48] Other After Action Reports show comparable gaps, focusing mainly on technical or immediate causes. At present, root cause analyses are conducted for Occupational Health and Safety (OH&S) incidents. We did not observe other departments consistently utilizing root cause analysis to provide high-quality actionable findings that prevent recurrence.

C. *Unclear escalation pathways processes hindered action and decision-making*. The limitations in the City's risk prioritization system were compounded by a lack of effective defined escalation protocols. When risks were identified, there was no consistent mechanism or timeline to escalate concerns, resolve disagreements, or assign ownership for follow-through, resulting in a pattern of deferral, where known risks were not adequately monitored or mitigated.[49] For example, the BPSFM was designated for inspection in 2017, 2020, and 2022, yet no inspections occurred as requests for planned outages

[43] Interviews with Water Utility Staff
[44] Various Reports in the Water Utility
[45] 2015 Linear Infrastructure Criticality Assessment
[46] Internal 2024 Risk Maturity Report issued December 2024
[47] Bearspaw South Feedermain Pipe Investigation Findings – City of Calgary, Forensic Investigation into the Bearspaw South Feedermain Rupture – Associated Engineering,
[48] After Action Report, June 1, 2023 to June 4, 2024, Boil Water Advisory Report
[49] Various Reports in the Water Utility

for inspection were repeatedly redirected or delayed.[50] Senior leadership was not positioned to address these delays, as risks were aggregated into broad corporate categories, making major risks indistinguishable at the executive level.[51] As a result, water-supply integrity did not appear as a top-tier concern in either the 2022 or 2024 Principal Risk Reports for the City.[52]

D. *Insufficient long-term planning made the system less resilient and failure more impactful.* The City's Water Utility faced a large number of high consequence risks due to limited system redundancy and insufficient asset planning. This occurred due to out-of-date AMPs (the last tactical asset management plan was issued in 2017)[53], and the absence of a consistent framework to integrate information from AMPs into critical decision-making or planning processes. Approximately two thirds of the recommendations from the 2017 AMP were not actioned.[54] This represents a clear deviation from best practice, where AMPs are treated as living documents – regularly refreshed with the latest inspection data and risk assessments to guide ongoing decision-making.[55]

   These issues were further compounded by the absence of an IRP, linking capital investment to city growth, asset conditions, risk evaluation, and external pressures. For instance, the BPSFM has no redundancy, despite redundancy risks being well known for decades. This is not unique to the BPSFM; the BPWTP, for instance, shares critical process equipment between two treatment trains which creates a single-point vulnerability that could disable the entire plant, and more than half of the City's potable water treatment capacity.[56] The lack of redundancy is demonstrated by comparing Calgary's PCCP outage to similar outages in Montreal and Hamilton, where service was restored in both cases in less than two days. In Calgary's case, the absence of planning tools and system buffers like redundancy left the City with limited options when failure occurred, increasing the severity, duration, and impact of the BPSFM failure.

3. Water Utility Management Structure Undermined Risk Management & Asset Integrity Management

The persistence of risk and asset integrity gaps over two decades reflects deeper organizational challenges related to the clarity of accountability and culture. The Panel found that fragmented leadership structures, a consensus-driven culture and inconsistent management rigor contributed to gaps in performance.

Key Gaps Identified

A. *The absence of clear lines of accountability and an executive with end-to-end oversight of the Water Utility contributed to the risk and asset integrity process gaps.* While the Panel recognizes that accountability and system-wide alignment issues existed prior to 2021, these issues were exacerbated by the restructuring which was completed in 2022. Following the restructuring, management of the Water Utility became fragmented across multiple teams, with no single owner responsible for end-to-end outcomes. Core Water Utility functions were split across several branches under both the Chief Operating Officer (COO) and the Chief Administrative Officer (CAO). As a result, the first individual with full visibility of all Utility functions is the CAO, who is responsible for over 60 portfolios across the administration.[57] With no dedicated, single executive accountable for system-wide performance, key decisions were made at mid-level management with limited executive oversight, increasing exposure

[50] 2017 Tactical Asset Management Plan, 2019 Feedermain Inspection Program Technical Memo, 2021 Water Long Range Plan
[51] Interviews with Water Utility Staff and The City's Risk Profile at Year-End 2024 Report
[52] 2022 and 2024 Year-end Principal Corporate Risk Reports
[53] Water Network AMP Final 2017; 2018-05-5 AM WT TAMP Draft V2
[54] Analysis Provided by Water Utility in Response to Panel Information Request
[55] American Water Works Association; ISO55000; Comparative Analysis Conducted by Panel
[56] Analysis Provided by Water Utility in Response to Panel Information Request
[57] City of Calgary Organizational Chart

to enterprise risks and reducing the likelihood that issues were considered with a system-wide perspective. For example, the target timeline to restore BPSFM redundancy was extended from five to ten years, with limited documented trade-off analysis or escalation to senior leadership.[58]

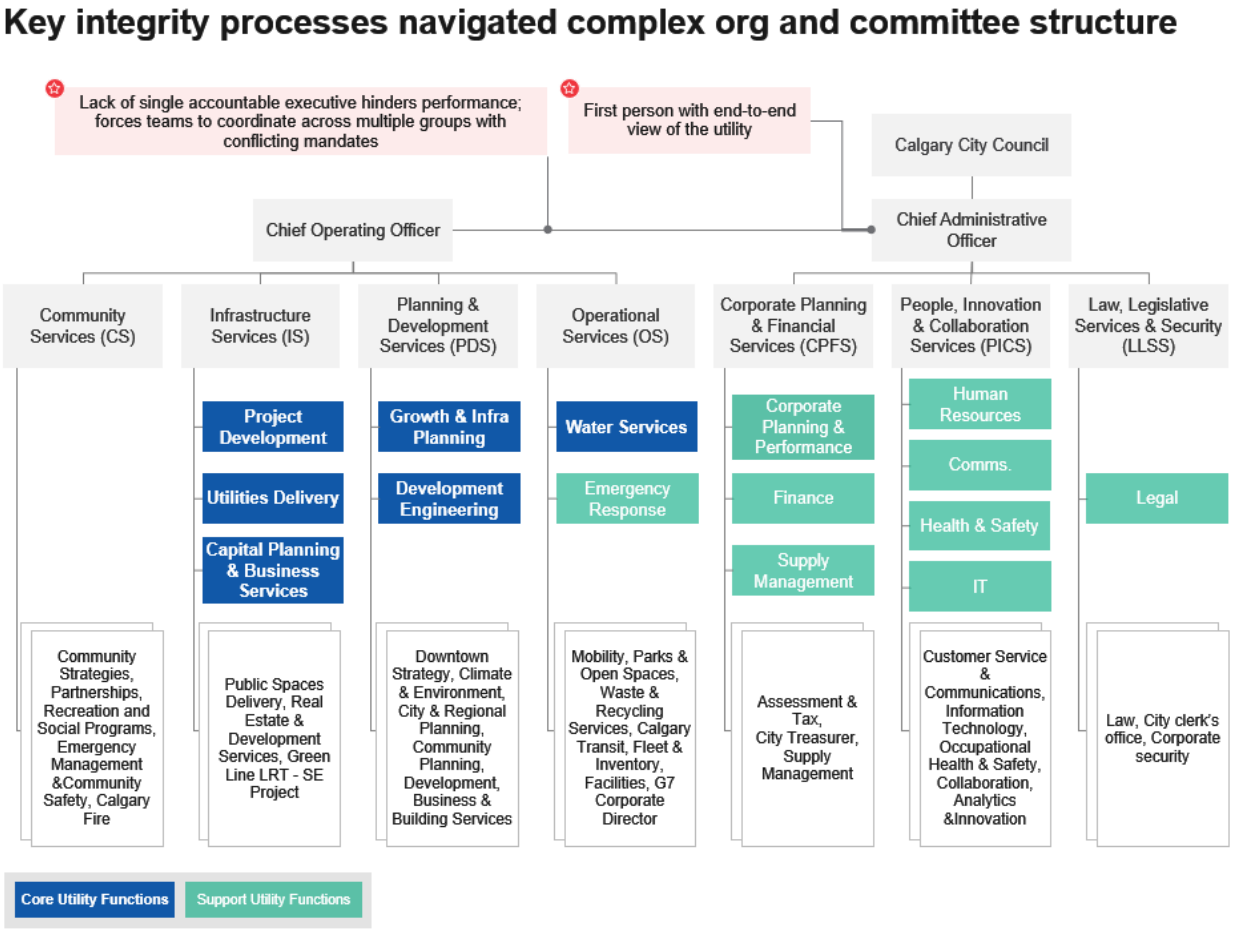


Exhibit 4: *Current Organizational Structure (2020-21 Restructuring Onwards)*

B. *Consensus-based decision-making contributed to a culture of deferral and high-risk tolerance.* The City's management culture prioritized consensus over escalation, which led to critical decisions being delayed or unresolved.[59] For example, requests to inspect the BPSFM in 2017, 2020, and 2022 were repeatedly deferred, delaying monitoring of a high consequence risk.[60] This environment allowed material vulnerabilities to persist without timely intervention, creating a culture of high-risk tolerance and decision deferral. Improvements such as the North Calgary Water Servicing Strategy were first proposed in the 2011 Water Long Range Plan but did not proceed to preliminary design until 2022 and began construction in 2025.[61]

C. *The Water Utility lacked management rigor and was slow to implement corrective action when the Water Utility did not meet its targets.* The Water Utility's lack of accountability and consensus-driven culture limited its ability to systematically monitor progress and initiate timely interventions. For

[58] Interviews with Water Utility Staff
[59] Interviews with Water Utility Staff
[60] 2017 Tactical Asset Management Plan, 2019 Feedermain Inspection Program Technical Memo, 2021 Water Long Range Plan
[61] North Options Handover for Prelim Design V2

example, leak rates have risen from 17% in 2015 to 22% in 2024 (vs. the survey average of approximately 12%), with limited corrective action since 2019.[62] The City could have implemented water loss mitigation methods from other municipalities at a higher pace, such as more extensive metering, proactive copper service replacements, and advanced flow and pressure monitoring. Another example is the Water Utility's limited response to benchmarking that found operating and maintenance costs were above the Canadian average. Capital program adherence has been poor, as the Utility only achieved (within 5%) its planned annual capital targets twice between 2003 to 2024.[63]

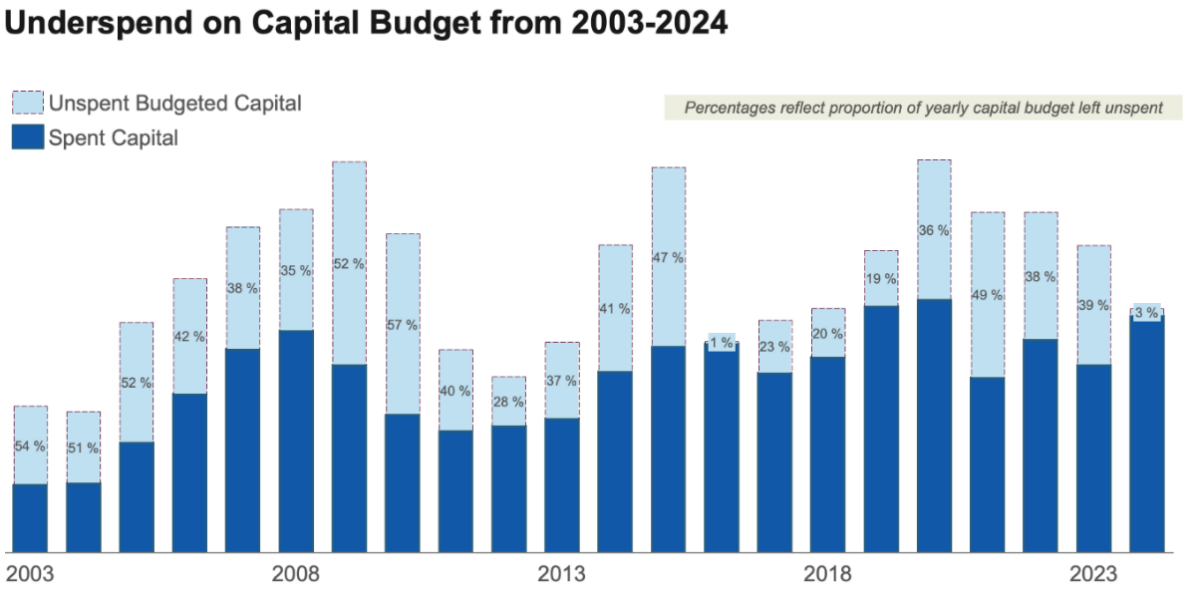


Exhibit 5: *The Water Utility's Underspend on Capital Budget 2003-2024*

4. Lack of Governance Hindered Council's Ability to Challenge the Water Utility

The prolonged deferral of action on known BPSFM risks, spanning two decades and multiple management teams and structures, indicates systemic gaps in the Water Utility oversight. The Panel found that Council was unable to play an effective oversight role due to limited visibility and the absence of independent expertise, leaving Council with insufficient insight into Water Utility operations and risk.

Key Gaps Identified

A. *A lack of financial rigor impaired the ability to steward capital and align resource allocation with risk.* The City's Water Utility did not maintain segmented financial statements. This limited Council's ability to assess how capital was spent, whether reinvestment was adequate, and how well resource allocation aligned with system risk. A 2015 review by Raftelis Financial Consultants recommended establishing a dedicated Director of Finance and Administration in the Water Utility to improve financial transparency as well as an independent oversight body to enforce executive accountability.[64] These recommendations were never implemented, and systemic gaps persisted, leading to financial underperformance of the Water Utility. For example, for most of the past two decades, the Water Utility's sustainability reserve has been below its target, which was set at 120 days of operating costs in 2018.[65] In fact, reserves for the potable water service fell to 20 to 25 day range after the BPSFM failure and are

[62] AECOM Water Use and Water Loss Third Party Review, Interviews with Water Utility Staff
[63] Analysis Provided by Water Utility in Response to Panel Information Request
[64] Raftelis Financial Review (draft report), 2015
[65] Interviews with Water Utility Staff

forecast to remain there until 2030.[66] Until this most recent shortfall due to the BPSFM failure, much of the shortfall over the past two decades relates to Offsite Levies. Despite this sustained shortfall, the City has continued to receive annual dividend payments from the Water Utility, including in 2024.[67] This is inconsistent with best practice which ties dividend payments to financial performance, allowing the reduction of dividends to restore reserve health in a reasonable time. In the City's case, dividend payments were not reduced and that constrained the Water Utility's ability to restore reserves to target levels.

B. *Council had limited visibility over Water Utility performance and decision-making.* In addition, Council lacked comprehensive visibility into water system performance, finances, and risks due to a lack of reporting rigor. The City's Water Utility reporting to Council has been done on an ad-hoc and high-level basis with no specified schedule or mandate.[68] In contrast, the majority of other major Canadian cities enforce scheduled recurring reports on an annual or quarterly basis with comprehensive performance, financial, and risk exposure coverage. The Panel would point to Toronto Water, Metro Vancouver Water and EPCOR as strong examples of rigorous and transparent reporting. This gap in detailed reporting left Council unable to effectively challenge or evaluate management decisions, especially those involving cost, service, and reliability tradeoffs. For example, system redundancy standards shifted from ADD to TDD in 2011, and back to ADD in 2021, but were not brought forward for review.[69] This type of decision would typically be escalated to senior stakeholders as it carries major implications for infrastructure integrity, capital planning, and service outcomes.

C. *The Water Utility lacked an independent oversight body with the expertise needed to strengthen long-term planning and decision-making.* Given the unique factors associated with critical infrastructure, it is common for utilities to have expert advisory support. The City's governance model provided no mechanism for this support. One example where an independent expert oversight body with clear authority could have added value was in 2022, when the Water Utility faced public pressure to address rate affordability. In response, the Water Utility re-ordered its rate setting priorities, putting rate stability ahead of revenue sufficiency and shifting revenue mix from fixed to variable.[70] Unfortunately, the BPSFM failure in 2024 meant that water demand was reduced due to restrictions and so was the associated variable revenue, causing revenues to be lower than forecast and driving a financial shortfall. In a water utility, where about 85% of its costs are fixed, introducing more risk through a rate design that increases exposure to variable revenue should have been reviewed by an expert oversight body and addressed with the most senior Water Utility leadership. This rate design situation demonstrates how, in the absence of an independent expert body to strengthen long-term planning, decisions are more likely to reflect short-term pressures.

Taken together, these systemic gaps explain how the Water Utility was not positioned to prevent the BPSFM failure, despite having known about this risk for over twenty years. Gaps in risk and asset integrity processes persisted within an organization with limited accountability, inconsistent management rigor and insufficient informed expert oversight. Collectively, these gaps contributed to a risk-tolerant culture across the Water Utility.

[66] Interviews with Water Utility Staff
[67] Interviews with Water Utility Staff
[68] Interviews with Water Utility Staff
[69] Interviews with Water Utility Staff. 2011 WLRP and 2021 WLRP.
[70] Interviews with Water Utility Staff

Residual Systemic Risks

As this report has demonstrated, the vulnerabilities that led to the 2024 BPSFM failure are not isolated to a single asset, but rather the effect of compounding gaps over time. As a result, The City's water system continues to face several points of failure where the loss of a major critical asset could prevent the City from meeting its ADD redundancy standard. Under current plans, several of these risks will persist well into the next decade. The BPSFM failure should be viewed as an indicator of a broader set of residual and systemic risks that have accumulated over time and exist to this day.

Risk 1 – BPSFM

The BPSFM remains the most significant single point of failure in the City's water system.

Following the 2024 BPSFM failure, The City implemented several risk mitigation measures, including soil testing and line pressure management to reduce long-term deterioration risks, and acoustic fibre optic (AFO) monitoring to detect wire breaks in real-time.[71] While helpful, these actions do not comprehensively address the single-point-of-failure risk. Studies show that AFO monitoring (the City's primary safeguard) is limited to detecting wire breaks, which account for only half of PCCP failures with known causes.[72] Peer utilities have responded to similar challenges with more comprehensive programs, combining acoustic monitoring with regular electromagnetic inspections, robotic and visual camera assessments, and condition-based pipe replacement or relining.[73]

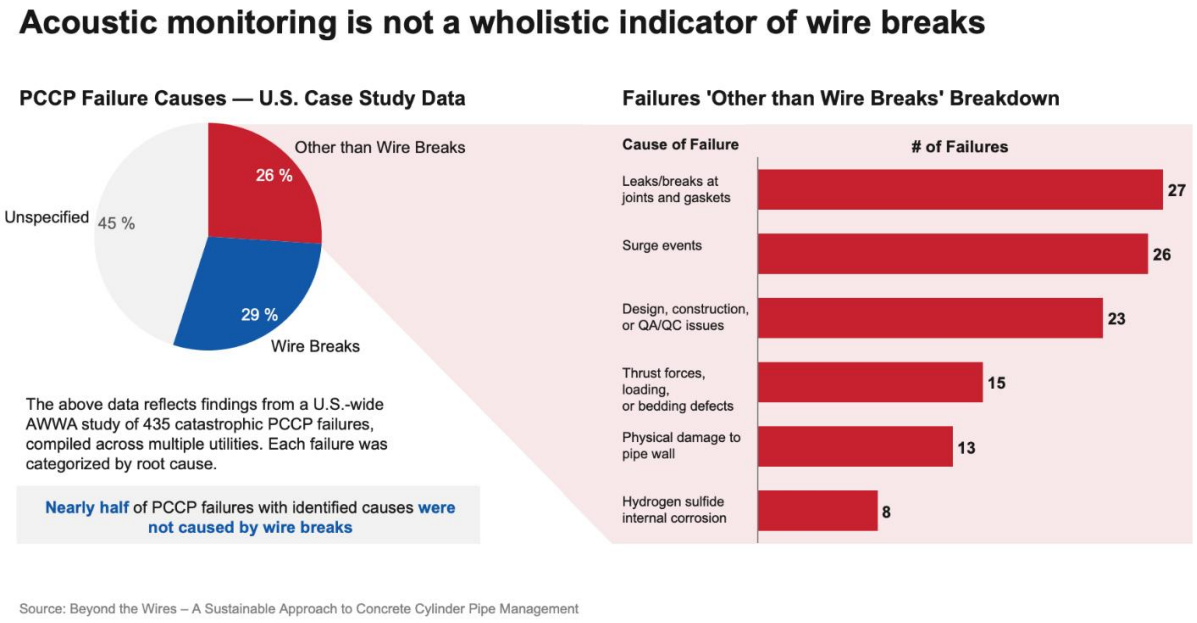


Exhibit 6: *Case studies and statistics of PCCP failures not captured by acoustic monitoring.*

As part of its investigation, the Panel commissioned AECOM, a PCCP expert, to evaluate the BPSFM and associated risks. This analysis has validated Panel concerns. While the BPSFM has stabilized following 29 repairs after the initial rupture of June 2024, its ongoing deterioration is evidenced by continued wire breaks

[71] Interviews with Water Utility Staff
[72] ASCE Pipelines 2012, "Beyond the Wires, A Sustainable Approach to PCCP Pipe Management"
[73] ASCE Pipelines 2012, "Beyond the Wires, A Sustainable Approach to PCCP Pipe Management"

and longitudinal exterior cracks from construction methods or historic overpressure events that allow water ingress leading to wire corrosion.

Data from the City acoustic monitoring shows that the number of wire breaks in the 6 km section of 1950 mm diameter PCCP portion of BPSFM is approximately six times that of industry experience. AECOM's report also noted that approximately 20 weakened pipe segments have more than 25 wire breaks, with an elevated probability of failure. AECOM has also advised that the current City guideline for repair of 26-50 wire breaks per 4 metre segment is overly generic, and that weakened segments urgently need to be analyzed for their risk of rupture based on specific location, exposure to chlorides and sulphates in the soil, ground cover, static pressure, and electromagnetic (EM) casing inspection data. EM anomalies are an indicator of elevated risk even in segments with fewer wire breaks.

Although there are still approximately 20 pipes that fall into the City guideline for repair, no additional repairs have been completed since the original 29 repairs were done. This highlights that the City's risk tolerance has been too high for critical infrastructure. In its current state, the BPSFM is highly vulnerable to future catastrophic failures including new pressure transients that put strain on the weakened segments of pipe.[74]

As discussed, the Water Utility was able to maintain TDD during the BPSFM failure due to favorable summer flows from the Elbow River and high output from the GMWTP. When BPSFM is out of service, the Water Utility relies on supply from GMWTP and two feedermains that go north from BPWTP. If the BPSFM failure occurs in a low river flow period (i.e., winter or summer droughts), if the GMWTP has production issues, or if the north feedermains from BPWTP operate at less than capacity, Calgary could face more severe restrictions, including citywide low-pressure events and potential boil-water advisories. While upcoming upgrades to GMWTP and the new North and South Calgary Water Servicing Projects (NCWS and SCWS) are designed to address additional supply, some may not be fully in service until the early 2030s.

The Panel has conducted high-level modelling to investigate these redundancy concerns. If the GMWTP and the north feedermains from BPWTP operate at nameplate capacity, the City will be able to meet its ADD redundancy standard after 2026 in the case of a BPSFM outage. This analysis, however, fails to account for constraints to GMWTP production.

- Operational Constraints: First, the Panel recognizes operational constraints. While the GMWTP has a current nameplate capacity of 400 MLD, the facility was only able to deliver an output of just under 360 MLD during the 57 days in 2024 when BPSFM was out of service and the system needed all the output available, or approximately 90% of nameplate capacity. This reduced output is the result of difficulty operating equipment that needs servicing when operating at full output for an extended period. While improvements at the GMWTP are scheduled to expand its capacity to a nameplate capacity of 450 MLD by 2027, the sustained operating capacity will still be less. If the same 90% factor from 2024 is applied, this would reduce the sustained output of GMWTP to approximately 400 MLD. The Panel also understands that the two north feedermains from BPWTP operate below nameplate capacity due to system limitations. Recent evidence indicates that those feedermains operate at a combined 135 MLD compared to a nameplate capacity of 170 MLD.
- Environmental Constraints: Further, the Elbow River experiences seasonal low-flow periods. In a winter with very low-flow conditions, the GMWTP could have 30 days of 390 MLD supply available, provided the reservoir was full at the beginning of winter and was drawn down to its minimum allowable level, while meeting downstream flow requirements.

[74] AECOM analysis commissioned by Panel

Assuming GMWTP sustained production of 360 MLD in 2026 and 2027, and 390 MLD 2028 and beyond, the two north feedermains from BPWTP operate at 135 MLD and new facilities are at operational capacity, the Panel finds that the Water Utility cannot meet the ADD redundancy standard throughout the forecast period if BPSFM is out of service.[75] The Panel believes that this supply case does not account for other production constraints, including equipment failures and poorer environmental factors. The Panel also notes that these difficult conditions would prevail for as long as BPSFM is out of service, which could be as little as 10 to 14 days but it could also be considerably longer if the failure occurs in a complex location, such as under the Bow River.

The result of this analysis is that, while the use of nameplate capacities indicates supply will exceed ADD when BPSFM is out of service, sustainable operational capacities do not exceed ADD. This must be a key planning and facility issue to resolve. If additional capacity is required, then either expanding the NCWS, which has an ultimate capacity of 410 MLD, or installing the SCWS facilities could provide sufficient operational capacity.

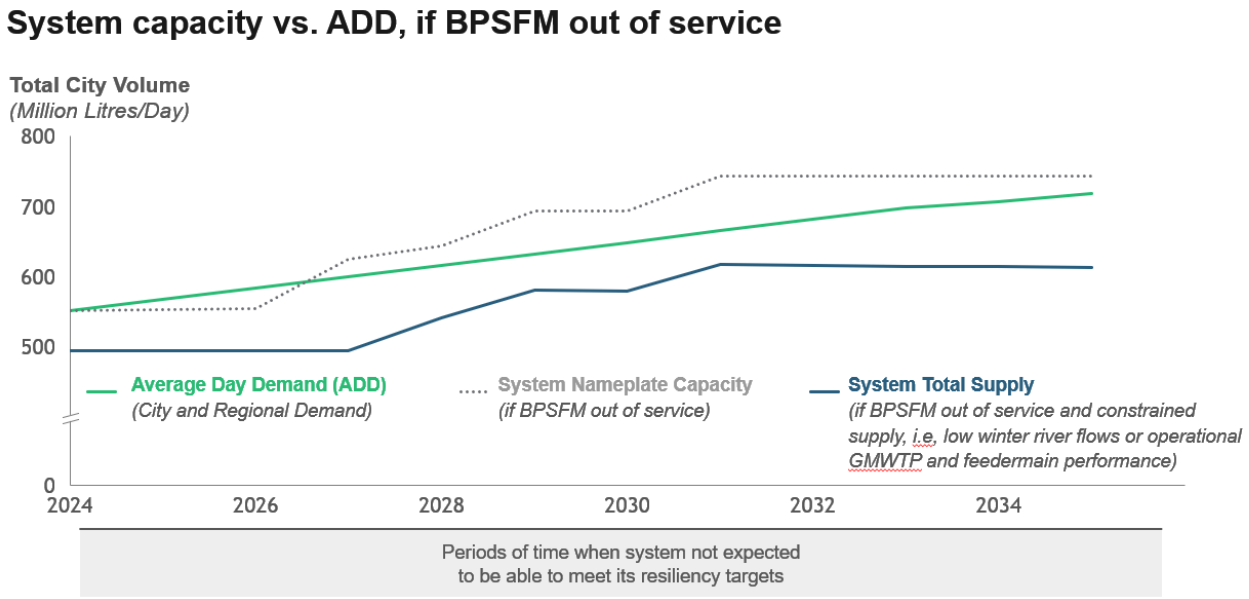


Exhibit 7: *Graph of system capacity vs. ADD over time, if BPSFM out of service*

Risk 2 – BPWTP

The BPWTP is similarly vulnerable as a single point of failure. The plant's two existing trains (Stage 1 and Stage 2) share critical infrastructure components, meaning that a failure in a shared component could disable the entire facility, which accounts for more than half of the City's water treatment capacity.[76] In 2020, the City initiated work to isolate the trains and reduce this exposure. However, these projects are at various stages of completion, with several not yet designed and others dependent on the added capacity provided by Stage 3, which is currently planned for service in 2035.[77] Until the completion of Stage 3, the plant remains susceptible to an outage that could disrupt more than half of Calgary's water treatment capacity. An accidental power outage in the summer of 2025 illustrated this risk, as the entire BPWTP facility went offline for a short period.

[75] Specifically, the NCWS initial phase and the Mountain View Pump Station
[76] Analysis Provided by Water Utility in Response to Panel Information Request
[77] Analysis Provided by Water Utility in Response to Panel Information Request

In particular, the Clarified Water Basin flume at BPWTP is a single conduit with limited isolation capability. While current risk assessment of failure is low, the Panel notes that the condition of the conduit has not been assessed and nor are there emergency procedures in place to act in the event of a failure that would take the entire BPWTP out of service. The project cost to create redundancy for the conduit is estimated to be $4.3 million, but that has not been approved.[78] This is another example of a low likelihood, but severe consequence risk not being proactively managed.

When BPWTP is entirely out of service, only GMWTP can provide water supply to the system. Using the same assumptions for GMWTP capacity as described for Exhibit 7, the Panel concludes that the Water Utility is unable to meet its ADD standard in the case of a BPWTP outage.

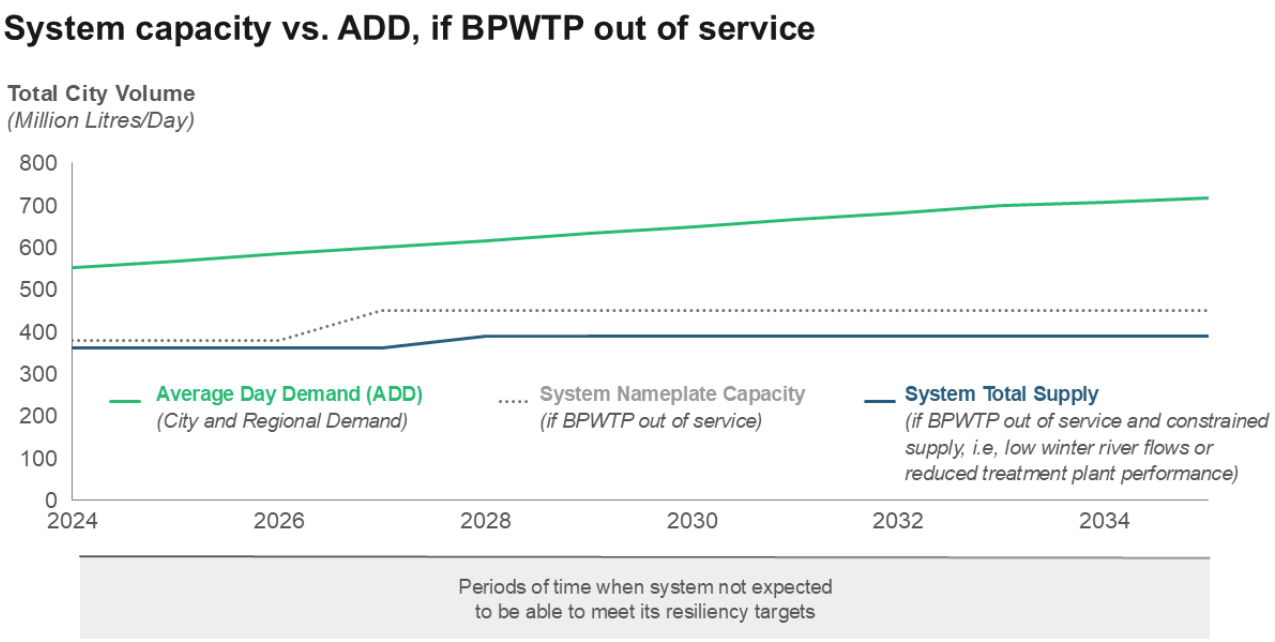


Exhibit 8: *Graph of system capacity vs. ADD over time, if BPWTP out of service*

[78] City of Calgary, Power Point "Part 1: Water Treatment Plant Reliability & Optimization, Slide 10, dated May 22, 2024

Recommendations

The Panel recognizes that, following its High Priority Action Report (HPAR) in October, the City has taken significant steps to act on its immediate recommendations – accelerating priority reliability projects, strengthening inspection programs, and improving cross-functional coordination. The Panel continues to believe that these high priority actions are required and that delivering the identified critical projects on their updated timelines still exposes the City of Calgary to unacceptable levels of catastrophic failures in water supply. This report organized recommendations into 'urgent' meant to address the immediate risk to the BPSFM and 'near-term' meant to address the underlying factors that contributed to the BPSFM failure.

Urgent Recommendations

The Panel believes that four urgent actions are required to respond to the risks to the BPSFM identified by the AECOM investigation.

1. Immediately extend BPSFM condition monitoring and analysis for each 4-metre PCCP segment, accounting for hydrostatic head, soil conditions, ground cover, EM data and evidence of weakening at each location. Based on the analysis, undertake proactive repairs and reinforcement to keep the system in service.
2. Install transient pressure monitors in advance of the present scheduled timeline of mid-2026. This specialized instrumentation is readily available, allowing monitoring of transient pressures events which propagate at a high velocity through a water-filled pipe.
3. Deploy rigorous procedures and training to prevent sudden changes in system pressure, especially given recent senior operator retirements. This includes improved coordination and planning of projects occurring simultaneously on the network, which could lead to pressure swings, and the removal or lock-out of high-speed pumps at the BPWTP to avoid the risk of pressure surges.
4. Conduct emergency planning exercises to improve preparedness and reduce outage times. This approach must consider the specific location and unique risk factors of the segments showing wire elevated breaks - repair types should be classified, and specific procedures and components suitable for both planned and emergency repairs should be prepared proactively.

In support of these priorities, the Panel recommends a task force of experts be established to coordinate the segment risk assessment and accelerate mitigating measures. We also recommend contingency planning to manage multiple successive BPSFM breaks while reservoirs are at low winter levels, such as permission to reduce Glenmore Reservoir outflows, temporary surface lines and alternate water routings.

The City's plan to duplicate the PCCP portion of the 1950 mm diameter BPSFM with steel pipe remains the primary mitigation BPSFM measure. The original project schedule was expected to be fully operational by 2029,[79] leaving the system exposed for several more years. In response to the HPAR, The City has proposed a two-year acceleration. However, given the integrity concerns identified by the AECOM review, the Panel recommends that this timeline is further accelerated to be completed in 12-14 months. While recognizing the challenges to construct in a developed area, the Panel recommends that the City use emergency procurement procedures and assign a dedicated senior project leader with the ability to draw on private sector expertise and specialized contractors to compress schedule without compromising safety. It is crucial to close open design questions in January 2026 to move into execution as quickly as possible.

[79] Analysis Provided by Water Utility in Response to Panel Information Request

In addition, the City has not determined the long-term role of the original PCCP line after the duplication is complete. The Panel recommends that the original line be repaired, including re-lining, once the steel line is installed as a cost-effective way to provide redundancy, ensuring that the steel main is not a single point of failure.

The Panel recognizes these actions will put pressure on near-term budgets. However, given the exposure of The City to potential catastrophic failures in water supply, the Panel strongly believes there is no choice but to proceed with these recommendations.

Near-Term Recommendations

In addition to these actions to directly mitigate residual risk, this report provides a series of recommendations to address the root causes of the BPSFM failure.

The risks identified in this review demonstrate that the City's Water Utility requires meaningful changes across risk and asset integrity processes, management, and governance. In response, the Panel recommends the Water Utility strengthen and formalize risk and asset integrity processes to align with best practice for critical infrastructure and to ensure that critical risks are identified, monitored, and mitigated in a timely and transparent manner. Given the Water Utility's history of advancing other priorities while deferring action on high-consequence risks such as BPSFM, these process reforms must be reinforced by changes in management accountability and Water Utility oversight. In support, the Panel recommends the establishment of a dedicated Water Utility management team with segmented financial statements, and an independent expert board to provide Council and management with credible, technically informed advice.

For clarification, throughout this section, the materials refer to 'best practice'. The Panel defines best practice as an approach that has been proven effective through demonstrated results, makes effective use of time and resources, and is repeatable yet adaptable as conditions change. This section also references third party best practice developed by the American Water Works Association (AWWA) and International Organization for Standardization (ISO).

Recommendation 1: Strengthen Risk Management and Asset Integrity Processes

The Panel recommends that the City's Water Utility strengthen its risk management and asset integrity processes to align with best practice for critical infrastructure, ensuring that risks are consistently identified, monitored, and mitigated in a timely and transparent manner. The Panel's approach to strengthening risk and asset integrity processes is organized into four key components.

1i: Risk and Asset Integrity Evaluation & Escalation

The Panel recommends the City develop and adopt a department-wide approach to risk evaluation and escalation. This entails developing a standardized risk assessment framework that complements the City's Integrated Risk Management Administrative Guideline, appropriately weighs likelihood and consequences and is accompanied by defined time-bound escalation triggers. This would be supported by a centralized risk register that provides a consolidated view of risk level and mitigation timelines/closure across the Water Utility. This approach will also improve visibility for Water Utility staff and leadership, City Administration, WUOB, and City Council, reinforcing accountability and consistency.

The Panel recommends that the City hire a qualified risk expert to design this framework and oversee its integration across all Water Utility functions. This Risk Lead should possess technical expertise in critical infrastructure risk management and report directly to the COO of Water, embedding consistent risk awareness at the executive level. The Framework developed by the Risk Lead should provide well defined

guidance to avoid likelihood bias amongst practitioners. This includes using structured risk assessment methods, basing likelihood on data not perception, defining likelihood clearly, and challenging cognitive bias. The framework should also provide guidance to manage residual risk including evaluating the effectiveness of controls, comparison to risk appetite, confirmation of residual risk strategy, and documentation and communication.

Any risk exceeding a defined consequence threshold (for example, a major system outage) should have hard escalation triggers which initiate formal review by the WUOB, with potential escalation to Council. Both internal and external escalation pathways must be clearly documented and time-boxed, with response timelines aligned to the integrity and reliability of existing safeguards.

Visualizing the risk escalation & closure process

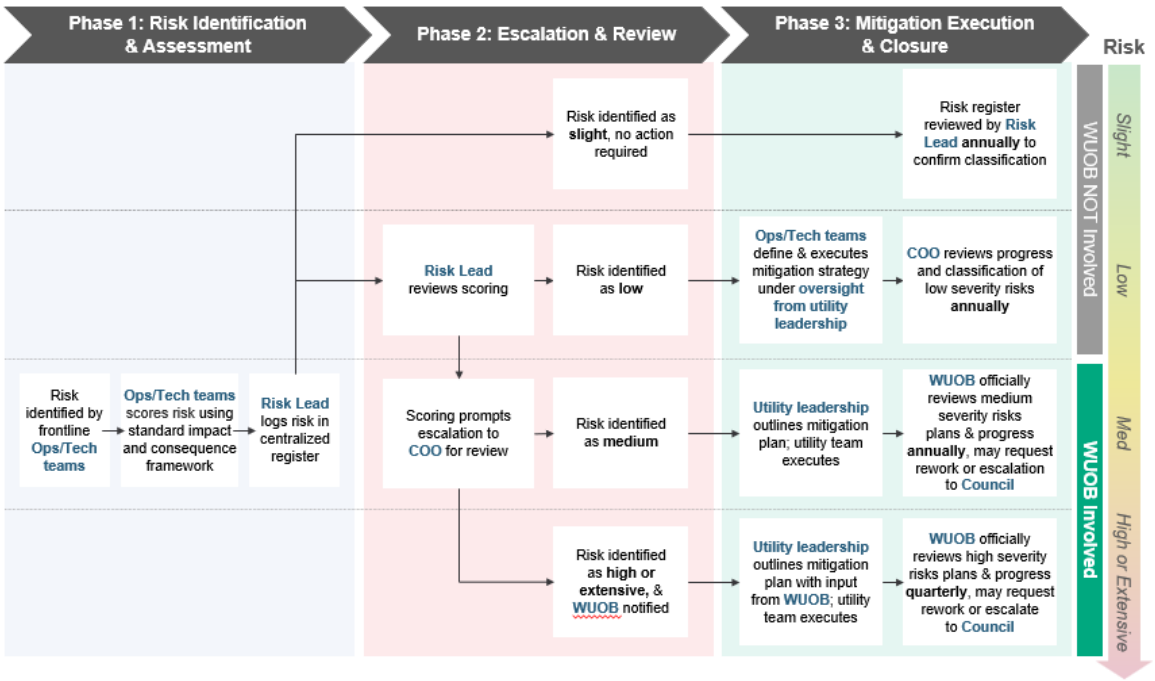


Exhibit 9: *Target Risk Identification & Escalation Process Blueprint*

The Risk Lead should support the maturation of an enterprise-wide root cause analysis (RCA) capability that extends beyond Occupational Health and Safety incidents. RCAs should be required for all high-potential or high-severity events, recurring issues, and significant regulatory incidents.

While day-to-day risk ownership should remain with frontline teams – including Operations & Maintenance and Technical Services – the centralized risk register including residual risk should be overseen and continuously updated by the dedicated Risk Lead. The risk register should form the foundation for structured review meetings where operational leads, the COO of Water and WUOB representatives meet quarterly to review the top 10 to 15 higher risks and associated mitigation actions. In addition, a comprehensive annual review should be held with the City Administration's Executive Leadership Team to confirm alignment with corporate risk tolerance, capital priorities, and oversight expectations. Council should be briefed annually on all higher-risk items, while on an ongoing basis the Risk Lead would liaise directly with the WUOB to ensure that it receives the information necessary to review, challenge, and monitor the Water Utility's mitigation strategies.

Where appropriate, risk assessment and inspection protocols should reference recognized third-party standards to ensure consistency and technical rigor. For example, the *AWWA G300 – Risk and Resilience Management* and *AWWA M77 – Condition Assessment of Water Mains* offers structured methodologies for evaluating likelihood, consequence, and residual risk. In addition, technical standards such as *AWWA C301 – Design and Manufacture of PCCP* establish detailed requirements for assessing pipe integrity, corrosion potential, and failure risk. Aligning the City's practices with these, or similar, recognized third-party standards ensures that risk and asset integrity processes are benchmarked against industry best practice rather than internal precedent.

The Panel recognizes that many of these recommendations are consistent with the City's current Enterprise Risk Management (ERM) framework and related initiatives. As a result, the priority is rigorous implementation and disciplined adherence. The Risk Lead will be critical to support clear accountabilities, active oversight, consistency and timely follow-through.

1ii: Asset Management Planning

The Panel recommends that the City strengthen and adhere to its Asset Management Planning process, including infrastructure-specific AMPs and a centralized asset management database. AMPs should be refreshed for all major infrastructure classes, serving as a single source of truth for asset condition and outlining risk-informed inspection schedules for each asset. This will allow AMPs to function as proactive management tools rather than static reference documents, enabling a consistent, risk-informed inspection program ensures that emerging issues are detected early, reducing the likelihood of sudden failures. Major risks identified during inspections should feed directly into the risk register, while the system-wide view of risk in the register is used to adjust future inspection priorities. Together, this creates a closed loop between asset condition, risk assessment, and action. AMPs will also form a core input to the Integrated Resource Plan (IRP), which in turn informs capital planning and project sequencing.

The AMPs should include an inventory of asset age and condition, identification of critical equipment through network analysis, risk-based monitoring and inspection plans, strategies for preventive, predictive, and reactive maintenance, and key performance indicators to track system performance against required service standards. Each AMP must also address how the asset plan manages future growth needs, minimizes risk, and meets or exceeds regulatory requirements.

Water Utility AMPs should function as living documents, updated whenever new condition data or inspection results become available. Comprehensive updates should be conducted every three years reflecting changing requirements such as demand growth or unexpected failures. Technical Services should own and be accountable for the development and ongoing maintenance of the AMPs, while Operations & Maintenance supports execution by carrying out the investigations, inspections, and actions identified in each plan. Annual progress reports should be provided to the WUOB outlining completion of action items, residual risk to critical assets, and potential service consequences.

Consistent with the principles of ISO 55000, the City should embed these AMPs within a structured asset management system that emphasizes lifecycle planning, traceability, and continuous improvement. The centralized asset management database should be supported by dedicated asset management software capable of developing predictive models that estimate asset health and probability of failure. The City's existing Oracle Water Asset Management system provides a suitable foundation but should be enhanced to incorporate predictive analytics and asset health modeling.

1iii: Integrated Resource Planning

The Panel recommends that the City develop a living IRP to translate risk register outputs, AMP insights, service level targets, and Calgary's Municipal Development Plan into long-term Water Utility capital priorities. The IRP should outline these priorities over a 20- to 30-year horizon, identifying where and when major investments are needed to maintain reliability, meet growth, manage costs, and mitigate long-term risks. This includes a comprehensive understanding of water supply constraints and projections of availability in a range of scenarios. The IRP will ground investment priorities in a comprehensive understanding of system-wide risks and infrastructure needs, ensuring proactive infrastructure management. By serving as a single reference point for planning and investment, the IRP will align priorities across functions leading to greater long-term system resilience.

The IRP should be refreshed every five years and include clearly defined investment pathways aligned with system risk. Each update should be reviewed by Council and the WUOB and formally aligned with long-term rate forecasts and service level targets. The IRP should guide leadership in prioritizing investments, aligning decisions across teams, and reinforcing a consistent, long-term planning culture.

To ensure meaningful prioritization, the IRP should be grounded in a clearly defined risk tolerance framework – that is, an explicit articulation of what constitutes an "*acceptable outage*" under low-flow conditions, and the corresponding level of service the City commits to maintain. This redundancy standard should form the foundation for all investment planning, allowing the Water Utility to work backward from an agreed risk tolerance threshold to determine the level of capacity and renewal required. Embedding this principle within the IRP will ensure that infrastructure decisions are driven by a transparent and measurable definition of risk, rather than by historical convention or fiscal constraint.

1iv: Economic Regulation

The Panel recommends strengthening the Water Utility's economic regulation framework so that long-term plans - such as AMPs & IRP - translate directly into transparent, cost-based water rates. Economic regulation ensures the Water Utility has a stable and predictable revenue foundation to maintain reliability, renew aging assets, and meet growth requirements, while ensuring water service rates are just and reasonable.[80]

Today, the Water Utility determines its revenue requirement using a cash-based approach and relies on a confidential internal rates model to estimate future costs and revenues. A consultant prepares a confidential Cost of Service (COS) study that allocates the revenue requirement among customer classes, and a small internal group determines rate design. Gaps in this process were highlighted by the 2023 change in rate structure, which increased cost recovery through variable rates. When water consumption fell during the BPSFM incident, this shift exposed the Utility to lower-than-forecast revenue, highlighting the risks of a rate design not firmly grounded in service cost and system needs. The Water Utility operates within a Performance-Based Regulation (PBR) environment, requiring a rate case every four years, with the next cycle beginning in 2027.

To support modern governance and strengthen public accountability, the Panel recommends that future rate cases — including the 2027 application — be filed publicly, supported by a non-confidential COS study, and reviewed by the WUOB. This will ensure that revenue requirements, cost allocations, and rate-design decisions receive transparent, expert scrutiny. A more robust economic regulation process will improve

[80] Just relates to rates being legal; for example, that they are not unduly discriminatory. Reasonable relates to rates being based on costs that reflect cost causation.

alignment between rates, long-term infrastructure needs, and risk management. It will also create a clearer link between planned lifecycle investments identified in the AMPs and IRP and the revenue required to fund them, supporting sustained system reliability and affordability.

The Panel further recommends expanded disclosure so that key components of the current rates model become public, improving transparency, consistency, and accountability. Any changes in rate design that affect revenue — such as those implemented beginning in 2023 — should be approved by the COO of the Water Utility in collaboration with the City's CFO before being included in a rate case.

Finally, the Panel recommends that the Water Utility transition from a cash-based approach to a "utility approach" for its accounting. This method is widely used by major utilities and public regulatory bodies and will be required as the City transitions to an MCC structure, as financial institutions rely on utility-approach financial statements when assessing credit. While AWWA guidance indicates no difference in total revenue requirement between the two methods, the City should review potential differences arising from Canadian accounting conventions.[81]

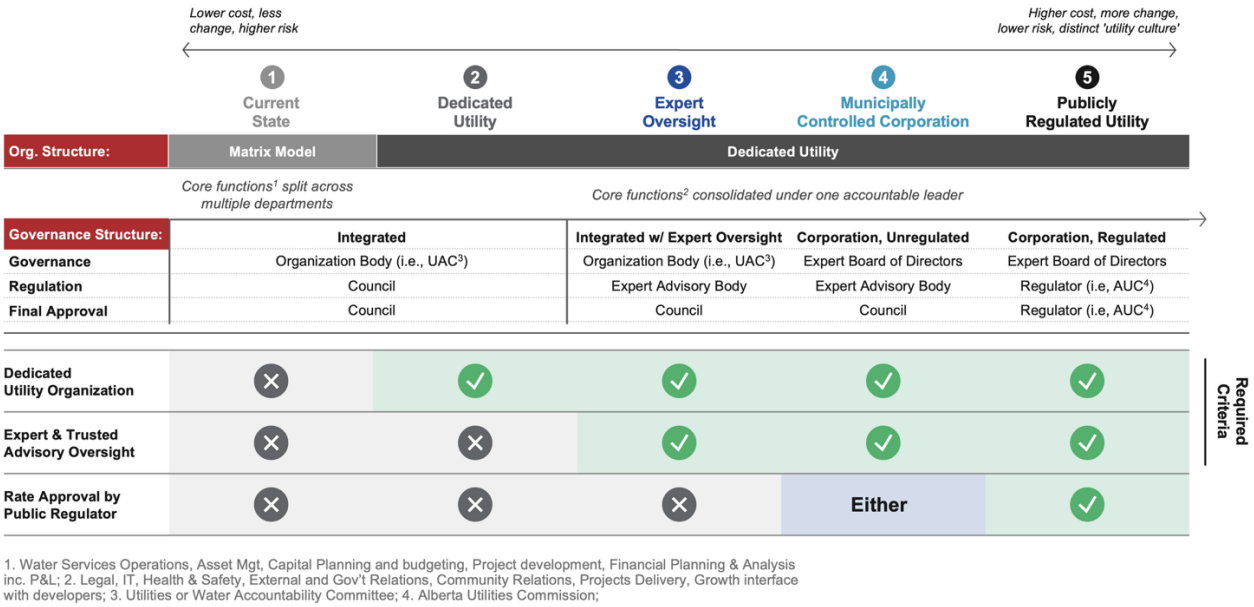
See Appendix F for details on risk and asset integrity implementation including common risk management pitfalls and how to address them, key components of a proactive risk culture, sample RACI map for risk management, and best-practice guidance on AMPs and IRPs.

Organizational & Governance Reset

The Panel found that the Water Utility organizational and governance model contributed to systemic risk gaps. To understand how other municipalities structure and govern their water utilities, the Panel reviewed the spectrum of options across major Canadian water utilities. The exhibit below outlines five models, ranging from Calgary's current state to publicly regulated utilities. Calgary is an outlier in this landscape and is unusual amongst its peers with core functions split across departments, no segmented financial statements, and with only the CAO accountable for end-to-end performance while providing oversight to approximately 60 other departments. By contrast, most other major Canadian cities operate within a dedicated utility model (Category 2, 3, 4, 5), with many incorporating expert advisor oversight (Category 3, 4, 5), and some introducing formal regulator oversight (Category 5).

[81] AWWA Manual M 30001 7th Edition, page 17 (pdf 38)

Spectrum of organizational and governance across Canadian water utilities



1. Water Services Operations, Asset Mgt, Capital Planning and budgeting, Project development, Financial Planning & Analysis inc. P&L; 2. Legal, IT, Health & Safety, External and Gov't Relations, Community Relations, Projects Delivery, Growth interface with developers; 3. Utilities or Water Accountability Committee; 4. Alberta Utilities Commission;

Exhibit 10: *Summary of Different Governance & Organization Models*

The Panel believes that the Municipally Controlled Corporation (MCC) model, similar to EPCOR in Edmonton, represents the most suitable long-term structure for Calgary. Under this approach, the Water Utility would become a separate legal entity wholly owned by the City, governed by an independent expert Board of Directors and managed with the discipline of a critical infrastructure utility, while maintaining public accountability through City ownership. Moreover, the MCC model brings the added benefit of a standalone Water Utility balance sheet, meaning its debt would no longer be on the City's balance sheet.

The MCC model provides the structural reset required for a utility of Calgary's size and complexity, embedding two safeguards essential to managing critical infrastructure effectively:

(A) Establishing a dedicated Water Utility organization with standalone financial statements and a clearly accountable executive leader; and,

(B) Implementing expert and trusted advisory oversight through an independent Board of Directors mandated to ensure prudent management and long-term Utility resilience.

Together, these safeguards embed accountability and oversight in the Water Utility's governance, ensuring they endure as institutional responsibilities.

This organizational shift is essential because Calgary's current fragmented structure deviates from best practice and materially limits the effective management of one of the City's most critical and capital-intensive services. A dedicated Water Utility organization would provide clear end-to-end operational visibility and integration, both of which are foundational to effective system-wide risk and asset integrity management.

However, organizational reform alone is not sufficient. Critical system risks in the Water Utility have persisted through multiple organization structures, illustrating the need for independent oversight to drive accountability. The Panel believes that this oversight will be most durable in the MCC model, as a distinct expert Board of Directors will be empowered and positioned to steer long-term critical infrastructure decisions. As a result, the Panel recommends that the transition to an MCC model occur within the current

Council's term, as this structure provides the durability and independence required to manage a utility of Calgary's scale and complexity.

The Panel also recognizes that the Water Utility is currently advancing several major initiatives, including implementation of HPAR and BPSFM recommendations and delivery of critical reliability and capacity projects. To maintain momentum on these priorities, the Panel acknowledges the need to minimize organizational disruption in the near-term. As a pragmatic first step, the Panel recommends the City adopt an Expert Oversight model, which consolidates core Water Utility functions under a single accountable executive and introduces independent, expert advisory oversight through the WUOB. This model provides many of the benefits of an MCC – clear accountability, professional challenge, and transparent reporting – while allowing sufficient time to achieve full corporate transition, as the Water Utility remains within the City's administrative structure.

The recommendations in this report therefore focus on this near-term governance shift, which will strengthen accountability, build readiness for an MCC transition, and ensure that immediate risks to Calgary's water system are effectively managed.

Recommendation 2: Establish a Dedicated Water Utility Department with Segmented Financial Statements

The Panel recommends establishing a dedicated Water Utility department responsible for all core water functions. This structure would create a single accountable executive, the Chief Operating Officer (COO) of Water, empowered and accountable to make timely decisions for the water network. To complement this integration, segmented Water Utility financial statements must be established to provide transparency into financial performance and support effective decision-making. The proposed structure eliminates fragmentation in decision making, enables more effective coordination and risk oversight, and clarifies chain of command. This challenges the Water Utility's culture of risk deferral and tolerance. In addition, segmented financial statements improve financial visibility and enable more robust decision-making by linking capital allocation directly to reliability, cost, and service outcomes.

Under the proposed model, a COO will lead a single, dedicated Water Utility Department, supported directly by all core water functions, as illustrated in the exhibit below. Functional support from existing City teams can continue for consistency and effectiveness, without duplication.

Within the proposed structure, each functional group has a distinct reporting relationship designed to balance operational accountability with the advantages of strong functional alignment, including developing expertise, sharing lessons across the department, and ensuring efficient use of resources. In support, the Panel recommends the following:

- **Dedicated Core Resources:** The COO has full authority over priorities, staffing, budgeting, and performance management for these areas and is fully accountable for outcomes, including service delivery and risk management. These teams operate entirely within the Water Utility and are not subject to oversight from city-wide functional groups.
- **Embedded Resources & Service Agreement:** The COO manages day-to-day priorities, workload, and performance expectations in alignment with utility needs, while the respective city functional groups retain final authority over hiring, budgeting, business processes, talent management and professional standards. This arrangement allows the Water Utility to tailor priorities to operational requirements while maintaining consistency with city-wide governance, fiscal policies, and corporate methodologies.

As shown on Exhibit 11, all core Water Utility functions maintain a hardline reporting relationship to the COO of Water. These core functions – Operations & Maintenance, Technical Services, Quality Assurance, Planning & Regulatory, Risk and Health, Safety & Environment – provide clear executive oversight and support timely, risk-informed decision-making across all areas of critical operation. They have been designated as core because they represent the essential capabilities required to manage critical infrastructure that must deliver safe, reliable service with low tolerance for failure.

Proposed Structure for Calgary's Water Utility Department

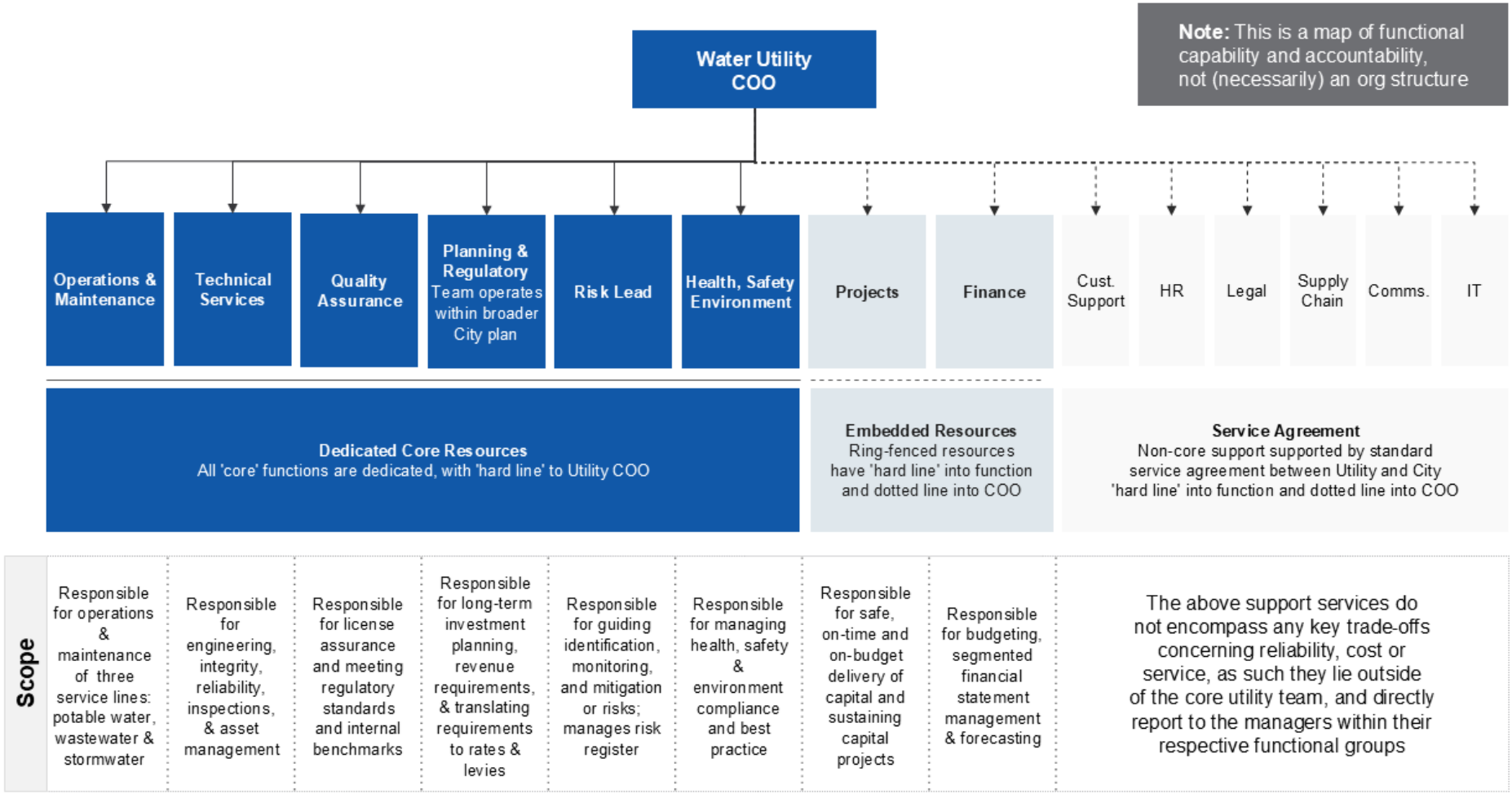


Exhibit 11: *Proposed Utility Structure*

While sometimes treated as a ‘support functions’, the Panel strongly believes that Technical Services, Planning & Regulatory and HSE warrants direct oversight within the Water Utility.

- **Technical Services**: The direct oversight of Technical Services reflects the unique complexity and technical demands of the City’s water system. The City’s infrastructure includes advanced treatment processes, high-pressure transmission mains, and real-time process control systems that differ substantially from other City operations. As a result, the Panel strongly believes that Technical Services should have a direct line to the COO to ensure that standards, methods, and design decisions affecting system reliability are owned and governed by those with the deepest technical expertise. The AMPs are a core deliverable of the Technical Services leader.
- **Planning & Regulatory:** The Planning & Regulatory function warrants direct oversight from the COO of Water because it encompasses several responsibilities unique to a regulated utility. Beyond traditional long-term and capital planning, it must manage the Water Utility’s economic regulation activities. This includes developing rate cases, conducting cost-of-service studies, establishing rate designs, and ensuring regulatory compliance, all in collaboration with the Water Finance group. The function also maintains the Integrated Resource Plan (IRP) as a living document that aligns operational needs, asset management plans, and capital sequencing with customer demand and city-wide growth. Direct reporting to the COO ensures these interconnected planning, regulatory, and financial activities remain coordinated with day-to-day operations, supporting transparent, cost-based decision-making and the reliable delivery of essential public services.
- **HSE:** The Panel believes HSE requires a direct line to the COO because water and wastewater operations carry distinct, high-consequence risks, and because the culture and management system needs to be developed. A single incident – such as a major main break or treatment failure – can threaten public safety and disrupt service. Direct oversight ensures that process safety, environmental compliance, and incident response receive executive attention equal to that given to system reliability. Having a peer relationship with the Operations and Technical leaders ensures that the HSE leader can serve as an independent conscience to protect people, environment, and assets, recognizing the unique complexity of managing long-lived assets within a large, self-funded Water Utility. With infrastructure lifespans exceeding 50 years and multi-year project lead times, the function must remain closely integrated with the Water Utility to align investment priorities and ensure system reliability.

The Panel recommends an ‘embedded resources’ model wherein ring-fenced Projects & Finance teams are embedded in the Utility and report (via a dotted line) to the COO.

- **Projects:** The scale of the Water Utility’s capital program at approximately $1 billion annually necessitates close executive oversight led by a dedicated Projects leader from the City Infrastructure Services organization.
- **Finance:** The Water Utility’s segmented financial statements and defined obligations related to rate-setting create unique regulatory and accountability requirements. To support these obligations, the Panel recommends that a dedicated financial controller own the segmented Water Utility financial statements. Developing those statements will require two to three dedicated Water Utility financial analysts, along with support from the City’s Corporate Finance Department to configure financial systems and define cost allocation methods.

Additional support services such as Customer Support, HR, Legal, Supply Chain, Communications, and IT are not unique to Utility operations. To reduce organizational churn and preserve efficiency without duplication the Panel recommends these services are provided in a manner that is consistent with today from existing teams.

While the new structure may look materially different from the current state, most front-line employees will not see their day-to-day work change. For senior leaders, the shift will be more visible and will require focused effort during transition, but it should simplify coordination, speed decisions, and make responsibilities easier to own.

As discussed, managing critical water infrastructure requires specialized technical, operational, and leadership capabilities that are distinct within the City of Calgary. Accordingly, the Water Utility Department will need to be deliberate in how it attracts, develops, and retains these capabilities. This begins with rigorous hiring processes for key leadership roles. The Panel has developed detailed role descriptions for the Chair of the WUOB, the COO of the Department, and the Risk Lead. Beyond recruitment, the Panel recommends that a formal capability development process be established, facilitated by HR but jointly owned by the Water Utility's leadership team. Within this, the COO and their direct reports would meet twice annually to assess current capabilities, identify gaps, and develop targeted plans to address them. This process should also include proactive succession planning for critical positions to ensure continuity of leadership and mitigate the risks associated with loss of institutional knowledge or key expertise.

See Appendix G for details on dedicated department implementation, including illustrative COO and risk lead job descriptions, a sample KPI dashboard and change management timeline.

Recommendation 3: Establish an Independent Expert Water Utility Oversight Board (WUOB)

The Panel recommends the City establish a WUOB to provide independent, expert oversight and advice to City Council and Administration.

WUOB is a dedicated body to evaluate critical infrastructure decisions with rigorous expert challenge. This will escalate cost, service, and reliability tradeoffs to Council, filling historical gaps where major Water Utility decisions were made with limited expert review. Positioning WUOB as an external and independent expert body that is not unduly influenced by operational pressures and short-term positions will provide long-term guidance and consistent focus across leadership cycles.

The Panel recommends that the WUOB function as a 'Committee of Council'. While final decision rights remain under the authority of the Council, WUOB's mandate would be to provide recommendations to Council. Administration would continue to manage day-to-day operations and implement Council's decisions, informed by WUOB's advice. To that end, the Panel recommends that WUOB be established with the following principles.

1. **Expert:** Members should have deep expertise in water infrastructure, large scale asset operations, finance, governance, and risk management. This expertise will supplement and extend Council's knowledge.

   Implications: WUOB must collectively have a defined and full set of relevant experience and expertise. To reflect this requirement, WUOB should provide members with compensation comparable to other independent boards.

2. **Independent:** WUOB must be independent from Council, the administration and the public, so that it can objectively and judiciously assess cost, reliability & service tradeoffs.

   Implications: WUOB must be independent from both administration and Council. Its selection process must be rigorous and panel members serve fixed terms and cannot be removed without cause.

3. **Authority:** WUOB must be able to drive action from Water Utility leadership, without usurping Council's legal responsibilities.

   Implications: While the WUOB will not approve decisions, it must have the ability to evaluate work, provide input on Water Utility leadership, request relevant information or analysis from the Water Utility management and provide advice on decisions Council makes. This encompasses having the ability, where necessary, to escalate disagreements with Water Utility leadership to Council. To reinforce this authority, WUOB should also have the budget to commission independent studies or audits to validate findings and address areas of concern.

4. **Accountability**: WUOB is accountable to deliver and support best practices in critical infrastructure management.

   Implications: WOUB's findings and recommendations must be disclosed publicly as a standard requirement, enabling the public to understand its output and role. WUOB should also prepare quarterly reports and presentations to Council and provide ad hoc briefings to the Mayor or CAO when required to maintain visibility of emerging risks and Water Utility performance.

Once the Water Utility transitions to an MCC model, the corporate Board of Directors will assume governance over management, making the WUOB's management-oversight role redundant. However, the Panel believes there should be a continuing role for Council to receive independent expert advice on matters such as shareholder directions, service and reliability standards, rate and transparency frameworks, and other public-interest considerations.

See Appendix H for details on WUOB implementation, including an illustrative job description for the WUOB Chair, an WUOB process flow, WUOB terms of reference and WUOB governance framework.

Culture Shift in Parallel

The recommendations presented throughout this report are interdependent, and their success depends on a deliberate and sustained shift in organizational culture. The City's Water Utility must evolve toward a long-term, risk-based critical-infrastructure mindset – one that reflects the scale, complexity, and public importance of the system it manages. Collectively, the recommendations will change the organization culture in the following way:

1. **Consensus to Consultative:** The Panel heard from numerous interviewees at all levels that a deeply embedded culture of consensus has impeded effective decision-making. The recommendations transition decision-making culture from consensus to a consultative model. Under a consultative model, input is actively sought from relevant stakeholders and technical experts to ensure decisions are well-informed, but final accountability rests with a clearly designated decision-maker – typically the COO of Water, CAO, or City Council. This approach values technical input through structured review mechanisms such as the WUOB while maintaining clarity of decision rights to ensure timely closure. Importantly, this shift also brings greater definition and transparency to where decisions are made and how they are made. Clearly articulated risk thresholds empower staff to act decisively on decisions within their mandate while ensuring higher-risk matters are promptly escalated. In practice, this model enables timely, risk-based decisions based on the best available information rather than waiting for full alignment across teams which may have misaligned priorities.

2. **Process Flexibility to Disciplined Rigor:** The recommendations support a shift from a culture of operational flexibility, where teams adapt to immediate issues and rely on discretionary judgment, to one of disciplined adherence to rigorous risk-informed processes. Rigorous processes are essential for critical infrastructure utilities to ensure that risk and asset integrity processes are applied efficiently and at scale for timely risk identification, monitoring, and mitigation. By codifying expectations and processes, the organization moves from relying on individual knowledge and relationships to institutional systems that can scale with complexity and support sustained performance.

3. **Short-Term Responsiveness to Long-Term Integrated Planning:** Short-term responsive planning can accelerate day-to-day delivery. This approach, however, limits the organization's ability to anticipate system-wide needs or balance competing objectives like growth, affordability, and reliability. Given the scale and complexity of critical infrastructure, a longer-term planning model is required to integrate functional priorities, timelines, and risk profiles. Tools such as the IRP and refreshed AMP processes provide the structure to align long-term service outcomes with capital investments, surface risks early for executive review, and track progress to long-term strategic goals.

4. **Outputs to Outcomes:** The recommendations also encourage a shift from an output-focused culture – where performance is measured by adherence to process, completion of reports, and avoidance of errors – to an outcome and learning-focused culture that emphasizes results, continuous improvement, and accountability. As noted in the 2025 MNP assessment, a lack of integration between teams and overlapping reporting requirements has driven managers and employees to define their roles by the plans they produce or the templates they manage rather than by their contributions to service outcomes.[82] This has reinforced a focus on activity and procedural compliance rather than the effectiveness or impact of services delivered. The Panel's recommendations seek to reverse this tendency by simplifying reporting structures, strengthening accountability for outcomes, and promoting transparency around both successes and challenges. In an outcome-oriented culture, incidents, near misses, and performance shortfalls are treated as opportunities to strengthen processes, share insights, and prevent recurrence, rather than as reputational risks to be contained. This requires cultivating an environment where employees can feel empowered in their contributions and can raise concerns without fear of reprisal.

These cultural shifts are not optional, they are essential. The Water Utility manages critical infrastructure that directly affects public health, safety, and economic stability. In such an environment, a culture of consensus without clear accountability and risk tolerance cannot persist. It must be replaced by a proactive risk culture that supports the long-term management of critical infrastructure.

[82] 2025 MNP CAO Organization Assessment Report

Roadmap, Path Forward & Panel Handover

The Panel has provided a comprehensive set of recommendations to strengthen the Water Utility. The Panel's urgent recommendations - those addressing immediate risks to the BPSFM and system reliability – should proceed as quickly as possible. As a result, they have been left outside this roadmap. This section focuses on the near-term recommendation and the path for implementing them. The water system is in a vulnerable condition and urgent, proactive action is needed. That starts with a commitment by City leadership to advance the Panel's comprehensive recommendations and put Calgary's water infrastructure in a position to deliver reliable, sustainable and affordable service as the city grows.

Roadmap

Going forward, the Panel recommends a one-year timeline to largely implement the near-term recommendations laid out in this report. This timeline starts when Council accepts the Panel's report and is consistent with the urgency required to address the root causes behind the BPSFM failure and better address ongoing residual systemic risk exposure. In support, the Panel has developed a high-level timeline with key deliverables. While administration and Water Utility leadership should be responsible for these changes, the Panel recommends that the city audit committee play a role on assurance through regular reporting.

The Panel would like to emphasize that the priority is to stabilize the Water Utility through a standalone Water department under a single accountable leader to establish rigorous financial, risk and asset management and in parallel, establish the WUOB as an independent oversight body.

The next step, transition to a MCC type model, requires extensive due diligence and study before Council decides on the best governance model. Once decided, legal, fiscal, regulatory, systems and people transition planning will need to be done before implementation of changes at this scale.

Within 3 months, the Panel would expect to see the initiation of structural change:

1. **Risk & Asset Integrity Processes:** A dedicated Risk Lead hired under direct oversight by the Water COO to lead updates to the risk management framework. Internal leads should be identified to update and enhance AMPs and initiate a new IRP.
2. **Dedicated Water Department:** The COO in role, with role descriptions for direct reports under development.
3. **Water Utility Oversight Board:** WUOB by-laws drafted and approved (based on terms of reference in Appendix H), and a recruitment firm engaged to identify WUOB Chair candidates for Council review.

Within 6 months, the Panel would expect to see the implementation of foundational processes:

1. **Risk & Asset Integrity Processes:** Updated risk and asset integrity processes operational on a trial basis, with feedback collected for refinement. Standardized templates developed for all AMPs, and the new IRP underway.
2. **Dedicated Water Department:** All direct reports for the COO hired and onboard, supported by a clear matrix of roles, accountabilities, and performance expectations across Water department.
3. **Water Utility Oversight Board:** WUOB Chair appointed with Council approval, with broader recruitment underway.

Within 12 months, the Panel would expect to see changes operationalized and institutionalized:

1. **Risk & Asset Integrity Processes:** Enhanced risk and asset integrity processes codified and implemented. All AMP updates and upgrades completed with the IRP development ongoing.
2. **Dedicated Water Department:** The organizational realignment completed, across the full organization; with segmented financial statements in place for year-end.
3. **Water Utility Oversight Board:** All members of WUOB selected and onboard, with regular meetings scheduled and ongoing processes underway.

Within 36 months, the Panel recommends completion of the transition to the intended end-state MCC model, a City-owned distinct Water Utility corporation.

The Panel recognizes that a 12-month timeline to strengthen risk and asset integrity processes, establish a dedicated utility department and an independent WUOB represents a rapid pace of change but believes it is both necessary and achievable. Urgent action is warranted to address systemic issues, and sustained progress is essential to restore resilience and public confidence in the City's water system. This level of ambition is also supported by the momentum already demonstrated through the Water Utility's implementation of the HPAR recommendations. The Panel is confident that this transformation can be delivered without significant disruption to day-to-day operations.

Path Forward

The Panel recognizes that many of these recommendations are consistent with the direction already being advanced by the Water Accountability Committee, which has been leading important work to strengthen governance, risk management, and performance culture within the Water Utility. The Panel commends this group for its leadership and believes it could serve as a valuable vehicle to help drive the transformation forward. The process, management and governance recommendations in this report will complement and accelerate many of the initiatives underway.

That said, the scale and pace of transformation envisioned is a substantial undertaking that will require focused capacity and visible leadership. To meet the Panel's recommended 12-month timeline and mitigate ongoing risk to the City's critical water infrastructure, the City should establish a dedicated implementation team of two to three full-time individuals with secure funding and clear authority. Without this focused capacity, the risk of failure is high – research shows that 70% of change programs fail largely because they lack consistent management support and dedicated resourcing.[83] Establishing a dedicated team will ensure that momentum is sustained throughout the transition, that implementation is not managed "off the side of the desk," and that staff are supported and guided through change. To be effective, it is important this team operates with strong management sponsorship from the CAO and the new COO of Water, signaling clear, top-down commitment and accountability.

One area that will require considerable investment is articulating and activating a meaningful culture change to one that is more consistent with critical infrastructure management. In support, the Panel recommends that the Water Utility's change management strategy emphasize cultural shifts and follow best practice.

- Leaders – particularly the COO and direct reports – should act as visible change ambassadors, cascading consistent and transparent messaging across functional groups and consistently model desired behaviours.
- Communication should be frequent, open, and two-way, creating space for dialogue rather than one-way dissemination.

[83] Gensys and GovLoop Survey of Public Sector Employees, n=312, September 19, 2018

- Early engagement and empowerment with employees will be critical to explain why change is necessary, connect it to lessons from the BPSFM failure, and reinforce the future vision for the Water Utility.
- Employees should be supported through targeted training and engagement programs that clarify what is changing and how it will strengthen the organization. To protect safe operations, distraction to front line employees should be minimized.
- Implementation should follow a structured, visible timeline with clear ownership and defined risks, ensuring that changes are introduced at a pace that maximizes adoption.

Embedding these practices and resources into the City's transformation effort will be essential to sustaining reform, reinforcing accountability, and realizing the full value of the roadmap.

Panel Handover

The Panel is open to continuing its support for roadmap implementation in the manner City Council and Administration deem appropriate. This could include providing independent oversight or advisory input during the initial transition period under a revised terms of reference – particularly until the new COO of Water and Chair of the WUOB are in place. The Panel will defer to Council's direction on how its expertise can best contribute to advancing the recommendation laid out in this report.

Appendix

Appendix A: Glossary

ADD	Average Daily Demand, which is the total annual water demand divided by 365 days per year. Total water demand includes demands for residential irrigation and regional customers. Since 2021, ADD is the system design criterion.
AMP	Asset Management Plan
BP	Bearspaw
BPSFM	Bearspaw South Feedermain originates at the Bearspaw WTP and proceeds east to the Shaganappi Pump Station near the southern end of Shaganappi Trail NW and then continues eastward to the Memorial Drive pump station west of 14 Street SW. The portion between the Bearspaw WTP and the Shaganappi Pump station is 1950 mm in diameter and it is the subject of this report. The first 1.6 km of BPSFM leaving the BPWTP is steel, and it goes under the Bow River. The steel portion joins the PCCP portion just south of the Bow River, and it is the PCCP portion that suffered the break and was repaired in several locations.
BPWTP	Bearspaw Water Treatment Plant. One of Calgary's two primary water treatment facilities, located in northwest Calgary. The BPWTP draws water from the Bow River and supplies over half of the City's treated water. The plant includes two existing treatment trains (Stages 1 and 2) that share critical infrastructure and a future Stage 3 expansion planned for 2035 to improve redundancy and system resilience. Its present nameplate capacity is 550 MLD.
Best practice	Refers to an approach that has been proven effective through demonstrated results, makes effective use of time and resources, and is repeatable yet adaptable as conditions change.
CAO	Chief Administrative Officer of the City
CEMA	Calgary Emergency Management Agency
Potable Water	One of the Water Utility's three main service lines. Responsible for the collection, treatment, and distribution of drinking water.
DSM	Demand Side Management
COO	Chief Operating Officer (of Water Department)
GMWTP	Glenmore Water Treatment Plant. It draws water from the Glenmore reservoir on the Elbow River. Its present nameplate capacity is 400 MLD.
HSE	Health, Safety, and Environment
HPAR	High Priority Action Report. report prepared by the Independent Review Panel for the City's senior administration. It identifies urgent risks and immediate actions required to mitigate short-term vulnerabilities in the water system.
IRP	Integrated Resource Plan

KPI	Key Performance Indicator
LDCP	Litres per day per capita
MCC	Municipally Controlled Corporation
MDD	Maximum Day Demand. The highest single-day water consumption in a year.
MLD	Million litres per day or Mega litres per day
NCWS	North Calgary Water Servicing project
Offsite levies	Offsite levies are a financial tool used by The City to fund infrastructure needed for growth by paying for all or part of the capital cost of eligible infrastructure and facilities that support growth in new and established communities. Developers pay these levies to cover their share of the offsite infrastructure needed to provide City services to new and growing communities. These services include water treatment and distribution, storm drainage, wastewater collection and treatment, mobility options like roads and pathways, and other infrastructure
PCCP	Prestressed Concrete Cylinder Pipe. A type of large-diameter pipe used in water transmission mains.
RACI	Responsible, Accountable, Consulted, Informed model that clarifies who does the work, who owns the outcome, who provides input, and who must be kept informed at each step of a process.
SCWS	South Calgary Water Servicing project
Stormwater	One of the Water Utility's three main service lines. Responsible for managing rainfall and snowmelt runoff to prevent flooding, protect water quality, and minimize impacts to infrastructure and the environment.
TDD	Typical Day Demand. A planning benchmark representing normal daily water use, excluding seasonal irrigation or extreme weather-related peaks.
UAC	Utility Advisory Committee. An internal administrative committee that previously reviewed Water Utility matters but did not have binding authority.
Wastewater	One of the Water Utility's three main service lines. Responsible for collecting, conveying, and treating sewage and industrial wastewater to protect public health and meet environmental standards
WAC	Water Accountability Committee. Established following the former UAC to provide clearer oversight and accountability for The City's Water Utility. It leads ongoing work to strengthen governance, risk management, and performance culture within the Water Utility – aligning with many of the directions recommended by the Independent Panel.
Water Utility	Refers to the Business Unit that manages, operates, maintains and continues to the development of the potable water, stormwater and wastewater services
WUOB	Water Utility Oversight Board
WWTP	Wastewater Treatment Plant

Appendix B: Panel Mandate, Process & Composition

This appendix includes (B1) the Panel's mandate, (B2) composition, and (B3) process and summary of materials reviewed. It is intended to provide background on scope and approach taken in development of these materials.

B1: Mandate of the Review

The Panel was convened in early 2025 with a mandate to conduct an independent assessment of the BPSFM incident, identify the underlying technical, operational, managerial, and governance causes, and recommend actions to ensure Calgary's water system is resilient, well-governed, and effectively managed. The Panel has operated independently of City Council and Administration.

Specifically, the Panel was tasked to:

- Review and assess Calgary's potable water system, with consideration of wastewater and stormwater systems where relevant
- Evaluate the technical, management, and governance factors contributing to the BPSFM failure
- Provide near-term and long-term recommendations to strengthen reliability, accountability, and governance

The Panel's deliverables included:

1. A High Priority Action Report (HPAR), issued in September 2025, which identified immediate actions to reduce near-term risk;
2. An Interim Report, issued in November 2024, which provided preliminary observations on the causes of the failure and identified emerging themes for further examination; and;
3. This Final Report provides a full root-cause analysis and a comprehensive set of recommendations for governance, structural, and cultural reform.

The Panel primarily engaged in a management review. While technical aspects are addressed, the report is not intended to replace comprehensive engineering or technical assessments. This Report was prepared specifically for The City of Calgary and should not be relied on by any other party or any other purpose.

B2: Panel Composition

The Panel is comprised of six independent experts with diverse backgrounds in engineering, utilities, governance, finance, and risk management, collectively representing over 200 years of industry leadership experience. Members were selected by the Chair and Advisory Group for their deep expertise in critical infrastructure, organizational governance, and risk management.

Siegfried W. Kiefer, Chair

Expertise: Infrastructure Governance and Public Utilities Leadership

Siegfried Kiefer is the past Honorary Director, Office of the Chair, ATCO Ltd., and former President & CEO of Canadian Utilities Limited. Over his 38-year career with the ATCO Group, he led several transformative initiatives, including the Alberta PowerLine project – Canada's longest 500 kV transmission line – and major corporate divestitures. Mr. Kiefer brings deep expertise in infrastructure strategy, corporate governance, and regulated utility operations.

Michael J. Crothers

Expertise: Energy and Risk Governance, Operational Leadership

Michael Crothers has more than 37 years of Canadian and international energy experience, including five years as President and Country Chair of Shell Canada Limited. He has led complex plant operations and large-scale infrastructure projects, including Shell's Oil Sands and LNG Canada investments. Mr. Crothers has extensive experience in corporate governance, safety, and risk management, and serves on several boards, including Cenovus Energy, Keyera Corp and the United Way of Calgary.

Gordon M. Engbloom

Expertise: Utility Economics, Regulation, and Policy

Gordon Engbloom has over 45 years of experience in energy and utility economics, the last 43 years as a sole consultant with Confer Consulting Ltd. He has advised governments, regulatory agencies, and major utilities on pricing, regulation, and market design. He has served as an expert witness before regulatory boards and gas price arbitration panels. Mr. Engbloom holds a B.Sc. in Chemical Engineering from the University of Alberta and an M.A. in Economics from Queen's University.

Nancy F. Foster

Expertise: Organizational Governance, Safety, and Risk Management

Nancy Foster brings 38 years of leadership experience in the oil and gas sector, including executive roles with Husky Energy and Nexen. She has led large teams across human resources, health, safety, environment, and corporate governance, and developed crisis and emergency management programs for international operations. Ms. Foster is recognized for her leadership in strategic planning, culture change, and risk governance.

Bob B. Kerr

Expertise: Asset Integrity and Incident Investigation

Bob Kerr retired from ExxonMobil Canada after a 33-year career with significant focus on asset and operations integrity management systems. He has implemented and audited asset and operations integrity management programs across ExxonMobil's global operations, including offshore facilities, LNG terminals, and oil sands projects. Mr. Kerr has extensive experience leading root-cause investigations into industrial accidents, providing him with deep insight into the technical and human factors that underpin infrastructure risk.

Stephen Stanley

Expertise: Municipal Water Utility Management

Stephen Stanley is a retired executive from EPCOR Utilities Inc., where he spent 25 years in senior leadership roles including Senior Vice President, Water Services. He has overseen water treatment, distribution, and drainage systems for major municipalities, managing large operations teams and multi-million-dollar infrastructure budgets, giving him a valuable technical and operational perspective.

B3: Panel Process and Documents Reviewed

Panel Process

Since being fully constituted in April 2025, the Panel has undertaken a structured, evidence-based review process designed to ensure independence, rigor, and balance. The review process included:

1. **Document Review:** The Panel examined more than 250 documents and historical records.

2. **Interviews and Workshops:** The Panel conducted more than 50 interviews and 10 workshops with over 90 City staff, external consultants, and subject-matter experts. The panel also visited the Calgary Water Centre, Emergency Operations Centre, BPWTP, GWTP, Shaganappi pump station, and Bonnybrook WWTP.

3. **Comparative Analysis:** The Panel conducted a comparative assessment of risk, management, and governance practices across Canadian municipalities and international peers.

4. **Validation and Deliberation:** The Panel confirmed findings through consistent validation and deliberation to ensure they reflect the most current comprehensive understanding of Calgary's Water Utility performance, operations, and governance.

Throughout its review, the Panel focused on identifying systemic causes rather than assigning individual fault, and on developing credible, actionable recommendations that will improve transparency, accountability, and long-term system resilience.

Non-Exhaustive Summary of Key Documents Reviewed

Document Reference	Date of Issue	Description
Feedermain Condition Assessment	2007	Technical inspection and condition assessment of major feedermains including BPSFM; early identification of PCCP risk factors.
Utilities Financial Plan and Indicative Rates	2011	Provided a plan to address excess debt in the Water Utility
Water Long Range Plans (WLRP)	2011 and 2021	City's long-term infrastructure planning document addressing redundancy, growth, and risk management across treatment and distribution systems. Includes 2011 plan and 2021 Volume 1 &2 updates.
Vulnerability Technical Memos	2011, 2018	Technical evaluations of asset condition, system redundancy, and key infrastructure risks.
Cost of Service Studies	2014, 2018, and 2022	Successive rate-setting and cost allocation studies used to determine utility rates.
Raftelis Financial Consultants Report (Draft)	2015	Independent financial and governance review of Calgary's Water Utility.
Business Plans & Budgets	2015-2026	Annual City of Calgary business plans and budgets.

Document Reference	Date of Issue	Description
Water Efficiency Report	2016	Internal City report summarizing water efficiency measures, per capita use trends, and impacts on system demand.
TAMP 2017 (Water Tactical Asset Management Plan)	2017	City-prepared tactical asset management plan outlining asset conditions, criticality, and renewal priorities for water infrastructure.
2019-2022 Water and Wastewater Financial Plan	2018	Multi-year capital and operating plan.
2019-2022 Stormwater Financial Plan	2018	Multi-year capital and operating plan.
SCWS Scope and Proposed Schedule	2018	Foundational project charter outlining scope, objectives, and governance for the South Calgary Water Servicing program. Defines project milestones, delivery approach, and alignment with long-term system redundancy and capacity goals.
Principal Risk Register Reports	2019-2024	Annual corporate risk reports summarizing City-wide and service-level risks, including infrastructure and utility service risks.
Water Security Report	2020	Assessment of Calgary's long-term water supply security and sustainability.
City of Calgary Drought Resilience Plan	2020	Framework for managing drought-related risks to water supply and operations under climate variability.
Offsite Levy Annual Reports	2020-2024	Annual reporting on the collection, allocation, and use of offsite levies.
Integrated Risk Management Administrative Guideline	2021	Summary of how an organization identifies, assesses, manages, and monitors risks across all operations to support informed decision-making.
UAC Terms of Reference	2022	Foundational governance document establishing the Utility Accountability Committee's purpose, membership, and decision-making structure.
Water Risk Report for WAC	2022	Comprehensive utility-wide risk assessment developed by Water Services for the WAC. Provides detailed analysis of key risks across all water service lines with defined owners, current status, risk trends, and mitigation measures
Fall & Spring 2022 Corporate Risk Reviews Bottom Up Analysis	2022	City-wide risk assessments summarizing departmental risk, includes analysis of infrastructure and operational risk exposure.

Document Reference	Date of Issue	Description
North Options Handover for Prelim Design V2	2022	Summary of design options for North Calgary Water Servicing Strategy
UAC Meeting Agendas	2022-2024	Meeting agendas for the Utility Accountability Committee.
Cochrane Sewer Line Strike Incident Debrief	2023	Post-incident analysis reviewing causes, response effectiveness, and learnings from the October 2023 Cochrane sewer line strike.
APEGA Practice Review – City of Calgary Water	2024	APEGA-conducted review following the BPSFM rupture, assessing engineering practice, design governance, and code compliance.
Associated Engineering, Forensic Investigation into the Bearspaw South Feedermain Rupture	2024	Provided a forensic analysis of the BPSFM break.
After Action Reviews	2024	Compiled internal summaries of operational responses to major infrastructure incidents.
2024 Maintenance Plan Report	2024	Operational plan detailing scheduled maintenance, inspection programs, and asset renewal activities for critical water infrastructure.
2024 Waterworks Annual Report	2024	Summary of Calgary Water Services' annual performance, including capital delivery, service levels, and reliability metrics.
NCWS Project Charter & Plan	2024	Foundational project charter outlining scope, objectives, and governance for the North Calgary Water Servicing program. Defines project milestones, delivery approach, and alignment with long-term system redundancy and capacity goals.
City Auditor's Office 4th Quarter 2024 & 1st Quarter 2025 Report	2024-2025	Quarterly report from the City Auditor's Office summarizing audit findings,
EY City of Calgary Infrastructure Review	2025	Third-party assessment of City infrastructure management and risk practices commissioned post-BPSFM rupture. Focused on asset management, capital planning, and governance maturity.
Offsite Levy Background Report	2024	Overview of Calgary's offsite levy policy history.
MNP CAO Assessment	2025	Third-party organizational review of the Chief Administrative Officer's office by MNP. Evaluates

Document Reference	Date of Issue	Description
		the City's corporate structure, decision-making model, and strategy execution processes, with recommendations to clarify accountability, streamline reporting, and strengthen enterprise risk and performance management.
Purple Pipe Third Party Review	2025	Independent assessment of the Shepard Energy Centre reclaimed effluent "Purple Pipe" system. Reviews risk management, maintenance practices, contractual obligations with ENMAX, and long-term redundancy options to ensure service continuity.
BPSFM Incident Review	2025	City-prepared technical report summarizing the June 2024 BPSFM rupture, immediate response, and recommendations for inspection, risk mitigation, and redundancy improvements.
AECOM Water Use and Water Loss Third Party Review	2025	Third-party assessment prepared by AECOM evaluating Calgary's water use and water loss. The review benchmarks the City against peer municipalities across North America, assessing data accuracy, infrastructure age, leak detection programs, and corrosion protection measures.
City of Calgary Organizational Chart	2025	Official depiction of the City's corporate structure as of October 2025, showing reporting lines between Council, CAO, and key departments.
WAC Q3 2025 Update	2025	Quarterly governance summary prepared by the WAC. Highlights progress on three strategic focus areas: utility governance, OneWater strategy development, and financial planning. Includes financial performance updates, water efficiency planning milestones, and a high-level risk overview.
Stormwater Level of Service Current State Report	Not Dated	Assessment of Stormwater system performance and service levels.
Wastewater Levels of Service Current State Report	Not Dated	Assessment of Wastewater system performance and service levels.
Potable Water Levels of Service Current State Report	Not Dated	Assessment of Potable water system performance and service levels.
WaterSmart South Saskatchewan River Basin Outlook	Not Dated	Summary of the current state and the supply and demand outlook of the South Saskatchewan River Basin.

Appendix C: Watershed Outlook

This appendix provides background on Calgary's long-term water supply outlook within the South Saskatchewan River Basin (SSRB), covering (C1) basin context and projected demand and (C2) opportunities to reduce demand and other potential paths forward.

C1: Basin Context & Projected Demand

The City's drinking water is supplied through three fixed water licenses – two on the Bow River and one on the Elbow River – with a combined diversion limit of approximately 963 MLD.[84] The SSRB is closed to new water allocations, meaning no new licenses can be issued. Calgary's growth must therefore be accommodated within its existing allocation. This planning must also recognize that even within existing license limits, Calgary's withdrawals occur within a system serving downstream irrigation districts and industrial users, creating potential future trade-offs between urban growth and agricultural production. While Calgary is fortunate to be positioned at the headwaters of the SSRB, it has an obligation to downstream users including a requirement to return 80% of its water intake back to the SSRB.

At current per capita consumption levels of roughly 350 L/Cd , the City's water license capacity can sustain a population of about 2.8 million people. Extrapolating the last 10 years of population growth, the city is expected to reach this threshold within the next 15 to 20 years. As a result, the Panel believes that opportunities to improve efficiency and extend supply will be increasingly important over the coming decades and need to be included in long-term water strategies.[85] An approach that combines large scale capital investment in storage infrastructure with water re-use and conservation is needed.

C2: Opportunities & Path Forward

The City has made major strides in conservation, reducing per capita water use by about 33% between 2003 and 2015, largely through metering, public education, household incentives, and efficiency improvements. Since 2015, however, usage improvements have plateaued, underscoring the need for renewed attention and innovation. Several initiatives are underway or planned to strengthen long-term water security, including:

- **Water Efficiency Plan Update** – Setting new reduction targets and conservation tools for residential, commercial, and industrial users. This may include changes to landscaping standards in new neighbourhoods and incentives for xeriscaping in established areas. Summer peak demand is 20% higher than annual average. As a result, summer demand exceeds Calgary's water allocation approximately 20 years before winter demand. Reducing peak summer demand allows current water licenses to support more growth.[86]
- **Water Loss Strategy** – Addressing current system losses of approximately 22%, compared with a median of 12% for peer utilities; achieving this benchmark could free up supply equivalent to serving hundreds of thousands of additional residents. This includes district metering, residential smart meters, and improved inspection and repair. A sustained multi-year program will be needed with adequate funding to stabilize and improve the leak rate.
- **Water Reuse and Stormwater Programs** – Advancing localized reuse and capture projects to offset potable demand where feasible, within the constraints of existing license return-flow requirements. This is particularly important for industrial customers. Specific projects for large industrial water users should

[84] Alberta Water Smart SSRB report, since the WaterSmart Report was issued, the Panel understands the City has increased its diversion limit to 1010 MLD.
[85] City of Calgary Regional Economic Outlook, Spring 2025
[86] Alberta Water Smart SSRB report

be prioritized in the City's Water Long Range Plan. For a comprehensive overview, see the Adaptation Roadmap for the SSRB (March 2024) by WaterSMART Solutions Ltd.

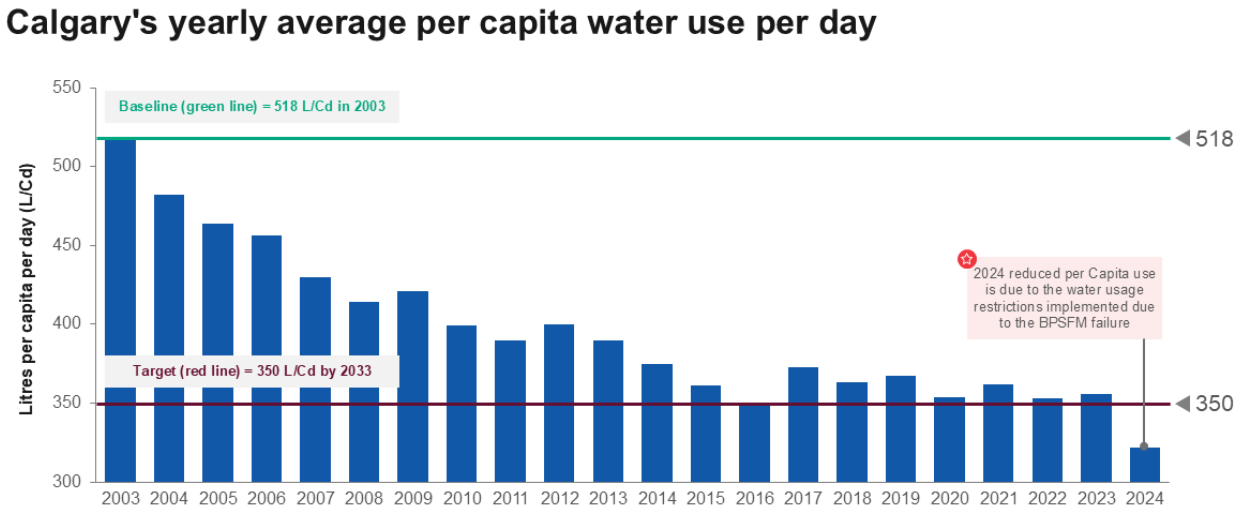


Exhibit 11: *Water Consumption per Capita*

Looking ahead, the City's long-term water security depends on managing demand, reducing system losses, and pursuing targeted supply-side measures to stretch existing licenses. Strengthened conservation programs, optimized storage infrastructure, and coordinated planning with provincial partners and other water license holders will be essential to sustaining growth and maintaining resilience across the South Saskatchewan River Basin.

Appendix D: Wastewater & Stormwater Overview

This appendix provides a detailed summary of the Panel's findings related to the (E1) wastewater and (E2) stormwater service lines. While the Panel's primary focus has been on the potable water system, given its direct connection to the BPSFM failure, this appendix offers additional context on the Water Utility's other core services. It illustrates that the Panel's findings and recommendations are broadly applicable across the entire water system, reflecting common themes in risk and asset integrity, management, and governance.

D1: Wastewater

The Panel's review found that Calgary's wastewater system faces the same systemic gaps as the potable water system, marked by aging infrastructure, underinvestment, and limited long-term planning. The service line includes three treatment plants – Fish Creek, Pine Creek, and Bonnybrook – and an extensive collection network of 19 critical siphons and multiple large trunk lines. Although the wastewater network is unpressurized and allows greater operational flexibility for bypasses and repair, it is increasingly constrained by underinvestment and inadequate long-term planning.

Higher system flows due to population growth limit the ability to shut down infrastructure for maintenance, and reduced redundancy causes greater operational and environmental impact during outages. There is a significant risk of license non-compliance with untreated sewage leaks. Management of the system is becoming increasingly reactive instead of proactive.

The wastewater system is aging and operating with limited redundancy, and forecasts suggest that system capacity will lag projected demand growth until around 2035.[87] Growth and densification have outpaced infrastructure expansion, reflecting limited adaptability to changing population and land-use patterns. As a result, treatment and conveyance assets are under sustained strain, increasing operational risk as system demand continues to rise. Upgrading the system is also becoming more difficult, as aging trunk lines and siphons require greater investment to maintain service levels, yet many assets – particularly the critical siphons crossing the Bow River – are challenging to inspect or rehabilitate due to access and environmental constraints.[88] Although the City is piloting new pigging technologies to improve condition assessment, the expected service life of major siphons has already been revised downward from roughly 70–80 years to 50–60 years.[89] Additionally, approximately 30 major trunk assets across wastewater and stormwater cannot manage a one-in-fifty-year event,[90] underscoring the need for targeted renewal and long-range capacity planning.

The Panel found that direct causes of the wastewater system's current strain include chronic underinvestment in capital renewal and immature asset management systems. This has forced the Water Utility to rely increasingly on higher operating expenditures and reactive management rather than proactive renewal. The wastewater service now maintains a dedicated emergency response unit of ten staff, which handled three major incidents in the past year – nearly matching the total from the previous five years combined.[91] A clear example of these interdependent challenges is the Purple Pipe incident at the Bonnybrook Wastewater Treatment Plant in July 2024. The dedicated effluent line supplying reclaimed water to the ENMAX Shepard Energy Centre developed a leak – an asset that had already been identified

[87] Interviews with Water Utility Staff
[88] Interviews with Water Utility Staff
[89] Interviews with Water Utility Staff
[90] Interviews with Water Utility Staff
[91] Interviews with Water Utility Staff

as a single point of failure two years earlier.[92] While contingency measures prevented service disruption, the incident highlighted the system's dependence on reactive emergency response and the vulnerability of critical, aging assets operating without redundancy.

D2: Stormwater

The Panel found that the stormwater system faces challenges similar to those identified in the potable water and wastewater systems, driven by aging infrastructure, process inefficiencies, and growing environmental pressures. However, the stormwater network is comparatively more robust, having benefited from proactive planning and significant investment – particularly following the major 2013 flood. That event, much like the BPSFM failure today, marked a major turning point in how the City manages flood and drainage risk. It prompted a major shift in investment and planning, expanding the Community Drainage Improvement Program (CDIP) initiated in 2010. Since 2013, approximately $1 billion in flood mitigation funding has been invested through partnerships between the City, Province, and Federal Government.[93]

The stormwater system has significant complexity including pipelines, storm ponds, dams, separators and natural filtration zones. These are often accessible to the public and can pose major community safety risks. The stormwater system incorporates many of the same principles recommended in this report, leading to a more robust current state.

- The acceleration of major flood-mitigation projects has significantly strengthened system resilience, with river flooding no longer ranking among the City's top infrastructure risks.
- Maintenance and inspection programs have been strengthened, with increased inspections of large storm trunks, particularly near major intersections and lift stations that rely on sub-surface drainage.[94]
- Long-term, risk-informed planning has been embedded with a new Stormwater AMP expected in early 2026[95] and ongoing CDIP investments. However, these recommendations must be funded and acted upon, unlike those in previous AMPs.
- To reinforce accountability and promote integration, the stormwater function has established several cross-functional subcommittees focused on Established Areas, Asset Management and Operations, Green Infrastructure, and Performance Targets.

Despite these improvements, Calgary's stormwater system faces continued strain from the combined effects of climate change and rapid urban growth. Higher spring flows and more frequent, intense rainfall events are placing additional pressure on existing infrastructure, much of which was constructed prior to 1988 to design standards that became outdated, which has resulted in the infrastructure being unable to manage current or projected runoff volumes.[96] These areas remain at higher risk of localized flooding. At the same time, ongoing densification and land-use change have increased impervious surfaces across the city, reducing permeability and accelerating runoff into the system.[97] Continued investment in stormwater upgrades is critical to sustaining performance, yet project execution remains slow due to persistent process and management challenges. There are currently 30 Stormwater capital improvement projects underway, many of which are critical, but will take years to complete.[98]

[92] Independent Review Panel Report on Water Services at the Shepard Energy Center, August 1, 2025
[93] Interviews with Water Utility Staff
[94] Interviews with Water Utility Staff
[95] Interviews with Water Utility Staff
[96] Interviews with Water Utility Staff
[97] Interviews with Water Utility Staff
[98] Interviews with Water Utility Staff

Appendix E: Utility 101

This appendix summarizes the core features of a regulated utility and their relevance to Calgary's Water Utility – including (D1) why regulated utilities exist, (D2) how they are economically regulated and (D3) their obligation to serve. In aggregate, this exhibit helps explain unique characteristics of Utility operation and decision making.

E1: Why Regulated Utilities

In most parts of the economy, resources are allocated and prices are set through competitive markets. Buyers and sellers enter and exit, prices adjust based on supply and demand, and over time goods and services are provided efficiently at cost, including a fair return on investment.

However, some industries – such as water, electricity, and natural gas – are natural monopolies. In these sectors, it is more efficient for a single provider to serve all customers, rather than build and maintain multiple overlapping networks. Duplicating infrastructure like treatment plants, transmission lines, or pipelines would be costly and wasteful.

Because competition cannot operate in these conditions, regulation substitutes for the market. Economic regulation ensures that monopoly utilities provide reliable service at fair, cost-based prices and make efficient use of society's resources. Calgary's Water Utility is a monopoly in economic terms, it is accordingly subject to regulation in the sense that it has rates that are cost-based and approved by Council, and it is subject to the terms of Calgary's water bylaws.

E2: Economic Regulation

The basic elements of the economic regulation of an infrastructure utility include:

- Annual revenue requirement, which is the aggregation of costs, including costs for operations, maintenance, depreciation, taxes (if applicable), and return on rate base. A utility's rate base is primarily its undepreciated capital in the form of equipment and facilities that are used and useful in the provision of service. Rate base is financed through a mix of debt and equity. As noted in the text of this report, there is a cash approach or utility approach to accounting for utility revenue requirements, and, while the City presently uses the cash approach for in-City rates, the Panel recommends that a utility approach be adopted.
- Cost of service (COS) allocation where the revenue requirement is allocated among customer classes through allocation variables that reflect how costs are caused in the utility. For example, because small-volume Water Utility customers use the large, high-volume feedermains and smaller, lower-volume distribution networks on the system they also cause those costs and are allocated a share of those networks' costs, but large-volume users only use the feedermain network and do not cause and are not allocated distribution costs. The result of a COS study is that each customer class is allocated its share of the total revenue requirement.
- The costs allocated to each customer class are recovered by applying rate design principles to establish cost-based just and reasonable rates for each customer class, which is the same result one would expect in the long-term if a competitive market existed.

There are several attributes associated with economic regulation of utilities. Among those, setting and achieving the utility's revenue requirement has the highest priority because without sufficient revenue a utility cannot provide safe and reliable service. In other words, a utility supplying an essential service cannot perform the critical and necessary tasks without sufficient revenue that includes a return of and on capital that enables the attraction of new capital. Other important attributes are just and reasonable rates that not

only provide the utility with a reasonable opportunity to recover its revenue requirement but also provide price signals that promote efficiency and fairness and prevent wasteful use of the utility service.[99] Observing these priority attributes does not mean other attributes, such as rate stability and predictability cannot be pursued, but such pursuit should not be at the expense of the priority attributes.

In the case of Calgary's Water Utility, most of its revenue comes from rates charged to customers, and the remainder comes from offsite levies. Together, the revenue from rates and from offsite levies should equal the revenue requirement. The volatility of offsite levies has been a key factor in the financial underperformance of the Utility since 2000.

D3: Obligation to Serve

A utility serving the public has an obligation to provide service in its area where a customer meets the requirements in a utility's tariff, which is approved by its regulator, or, in the case of the Calgary Water Utility, water bylaws approved by Council. This is consistent with the utility having a dominant monopoly-like position that it must not use to unduly discriminate about who gets service. It also means that a utility must plan and construct facilities in a timely, cost-effective manner as demand for its services is forecast to exceed the present capacity to supply customers.

[99] Principles of Public Utility Rates, Public Utilities Reports Inc, AWWA, Manual of Water Supply Practices – M1, 7th Edition; Principles of Water Rates, Fees and Charges; 2017

Appendix F: Risk & Asset Integrity Illustrative Tools

This appendix includes a series of illustrative tools, including a (F1) common risk management pitfalls and how to address them, (F2) key components of a proactive risk culture, (F3) target RACI map for risk management, and best-practice guidance on (F4) AMPs and (F5) IRPs. These materials are intended to help the City translate the Panel's strategic recommendations into practical actions by providing reference frameworks, role descriptions, and process models drawn from leading Water Utility practices.

F1: Common Risk Pitfalls & Applicable Safeguards

The table below summarizes how the Panel's recommendations directly address common pitfalls observed in public and private risk management systems.

Risk Management Pitfall	How to Address
Risk topics are not clearly articulated or appropriately addressed in senior management discussions.	Hiring a **dedicated risk expert** reporting directly to the COO to own risk register management and leadership-level risk awareness, supported by **quarterly reviews by the WUOB and annual reviews by CAO and Council** of higher-risk items.
The "culture" dimension of changing organizational risk tolerance is underestimated.	The recommendations collectively steward a **clearly defined end-state culture** that promotes proactive risk management, supported by dedicated change-management resources and executive sponsorship to ensure this culture is achieved and sustained. See Appendix E2 for further examples of how culture can be embedded.
Risk reporting is reduced to an administrative exercise and fails to drive action	Leadership focus and action is maintained by **limiting formal reviews to approximately 10–15 higher-consequence risks.**
Projects are assessed on a stand-alone basis, not incorporating portfolio view and strategic stress tests	Consolidating the Water Utility under a **single department** enables integrated decision-making, while **the WUOB provides independent expert challenge** to pressure-test critical decisions against system-wide considerations. Additionally, the **IRP** ensures long-term interdependencies and cumulative risks are considered. These attributes would continue when the department transitions to the MCC.
Effort is put on "known" risks – no attention to high-consequence, but low-likelihood events	The enhanced **risk framework with education rebalances addresses likelihood bias and residual risk,** , ensuring that **escalation triggers** are in place to ensure all higher-risk items are reviewed by the GM, WUOB, CAO, and Council as appropriate
Different types of risk indicators and metrics hinders comparability	Consolidating the Water Utility under a **single department** promotes coordination and synchronization across all water functions. **Standardized scoring and inspection frameworks** applied utility-wide ensure consistent, comparable metrics within one **centralized risk register and a GM-overseen KPI dashboard.**

F2: How to Establish a Proactive Risk Culture

To assist in embedding cultural change alongside process reform, the Panel has provided a sample framework illustrating the key components of managing the transition to a proactive risk culture. This cultural shift is essential to ensure that staff at all levels are engaged with new processes and do not resist change due to common barriers such as competing priorities, limited communication, or insufficient leadership commitment. The framework provides practical, day-to-day examples of how leaders and staff can support the development of new risk management norms.

Key Components of a Balanced Risk Culture

	Tone from the Top	Accountability & Reinforcement	Communication & Challenge	Incentive Structure	Resources, Tools & Enablers
	For example: • Risk Appetite Framework • Code of Conduct • Leaders model risk curiosity	**For example:** • Roles & Consequence Mgmt. • Risk Monitoring • Escalation Mechanisms	**For example:** • Control Functions Stature • Comms Formats • Committee Interactions	**For example:** • Performance Metrics • Incentive Programs • Succession Planning	**For example:** • Resources & Competencies • IT Infrastructure • Organizational Setup
	Illustrative Examples | Non-Exhaustive				
Near Term	**Start with Risk:** COO of Water with support of the Risk Lead starts all executive meetings with a recap of the utility's risk principles, looks for weak signals and emerging trends	**Practice Scenarios:** Develop short tabletop training sessions that walk staff through understanding likelihood bias & residual risk and escalation framework using real examples	**Risk Office Hours:** Schedule regular "risk office hours" hosted by the risk lead, where team members can drop in to raise emerging issues or seek guidance on new processes and escalation paths	**Recognition:** Introduce recognition for early identification of risks and proactive mitigation actions (e.g., leaders avoid blame and respond to risk raises constructively)	**Risk Practice Repository:** Stand up a shared internal repository (SharePoint or Teams) for risk procedures, lessons learned, and playbooks
Long Term	**Lessons Learned:** A senior leader hosts quarterly sessions highlighting a recent incident or near miss, focusing on what was learned and how similar risks will be managed going forward	**KPIs:** - Timeliness of risk detection - Quality of risk assessments - Leading risk indicators - Recognizing early escalation - Embedding risk expectations in job description	**Education:** - Standardize guidance on likelihood and consequence at risk appetite & tolerance - Train all on risk escalation processes & triggers	**Performance Alignment:** Embed closure of risk mitigation actions and participation in risk reviews into annual performance objectives for managers and project leads	**Utility-Wide Dashboard:** Develop and maintain a comprehensive dashboard that consolidates top risks, mitigation progress, and escalation trends across water, wastewater, and stormwater services

F3: Illustrative RACI Framework for Risk Escalation and Closure

The framework below provides an illustrative example of how responsibilities for risk identification, monitoring, and mitigation can be mapped across the organization using a RACI (Responsible, Accountable, Consulted, Informed) model. A RACI chart clarifies who does the work, who owns the outcome, who provides input, and who must be kept informed at each step of a process.

- **Responsible** individuals complete the work and coordinate with other stakeholders; their performance should be reflected in their KPIs.
- **Accountable** individuals own the results and approve outcomes in case of escalation, typically at the executive or managerial level.
- **Consulted** individuals provide essential subject-matter input but do not have final decision rights.
- **Informed** individuals are kept aware of progress and may offer feedback.

		Engaged only on high or extensive-risk items			Risk Lead	Operations, Technical mgmt. & Maintenance	Cust./Bus. Support, Assurance, HSE, and Projects	Capital Planning & Finance
		City Admin	WUOB	Water COO				
	Phase 1: Risk Identification & Assessment							
1	Detect potential risk				I	A R	Note: only one "A" per process step	
2	Assess risk in standardized format				A	R		
3	Record risk in centralized risk register				A R	I		
	Phase 2: Escalation & Governance Review							
1	Classify risk level, and escalate accordingly				A R			
2	For high or extensive-risk items, conduct structured exec review			R	A			
	Phase 3: Mitigation Planning & Execution							
1	Develop mitigation plan and cost estimate		C	C	C	A R	R	R
2	For high or extensive-risk items, receive exec approval on plan	C	C	A R	C	I		
3	Integrate approved mitigations into maintenance plan, OPEX budgets, and capital plan		C	A		R	I	R
4	Execute mitigation plan		C	A		R		
5	Update register with mitigation progress & outcomes			A	R			I
	Phase 4: Verification & Closure							
1	Verify effectiveness through inspection and audit		C	A	R	R	I	I
2	Identify and log any residual risk considerations		C	A	R	C	C	C
3	Close risk in register when desired outcomes achieved		I	C	A R			
	Phase 5: Continuous Monitoring & Learning							
1	Periodic review of the register to confirm risk assessment and progress on mitigation timeliness	I	C	A	R			
2	Capture lessons learned for leadership team			A	R			

Legend: R Responsible A Accountable C Consulted I Informed

F4: Asset Management Plan Best Practices[100]

An AMP provides a structured approach for managing a Water Utility's physical assets (i.e., pipes, pumps, and treatment facilities) so they continue to deliver reliable service at the lowest overall cost. It links day-to-day maintenance activities with investment planning by identifying what assets the Water Utility owns, their condition and performance, and when they require renewal or replacement. A sound AMP is based on a predictive model for failures which is continuously improved.

Cadence of Refresh

AMPs should be reviewed and revised on an ongoing basis to ensure their accuracy and relevance as asset conditions, performance data, and service priorities evolve. This includes validating asset conditions, updating maintenance and renewal programs, reviewing risk scores, and adjusting budget requirements. Comprehensive AMP updates occur on three- to five-year cycles, and involve full condition re-assessments, lifecycle model recalibration, and re-forecasting long-term capital and financial plans – effectively rebuilding the AMP to capture systemic shifts in infrastructure, demand, or policy. KPIs and service level reporting are refreshed on an ongoing basis through integrated monitoring systems (e.g.,

[100] Panel expertise

CMMS, GIS, or SCADA), allowing utilities to continuously update operational data and use it to inform near-term decisions between formal plan reviews.

Core Inputs

According to AWWA and ISO-55000, comprehensive AMPs include:

Component	Purpose	Key Data Inputs
Asset Inventory	Provide a complete picture of all the assets the Water Utility owns and manages	• Asset name, ID, type, location, and function • Installation year, material, dimensions, manufacturer
Performance Targets	Define the standard of service the Water Utility commits to provide and how success will be measured	• Service level targets (i.e., maximum duration of service outages, target break frequency, or acceptable water pressure range)
Condition Assessments	Evaluate how assets are performing and identify deterioration trends to inform maintenance and renewal priorities.	• Results from inspections, testing, and monitoring • Failure history and downtime records • Maintenance cost and frequency data • Condition rating and remaining useful life
Risk Analysis	Identify the criticality of each asset.	• Likelihood-of-failure scores (based on age, condition, operating stress) • Consequence-of-failure factors (safety, service disruption, environmental harm) • Redundancy and resilience data
Lifecycle Management Strategies	Outline how each assetwill be maintained, renewed, or replaced to achieve required service levels at minimum cost.	• Preventive/predictive maintenance schedules • Rehabilitation and replacement programs • Lifecycle cost models and renewal curves • Resource requirements (staffing, equipment, materials)
Financial Forecasting	Integrate technical plans with financial planning to ensure long-term funding adequacy and affordability.	• Capex and Opex forecasts • Rate studies and funding sources • Asset replacement or renewal value • Financial performance indicators

Integration into Decision Making

In best practice utilities, AMPs directly inform IRPs, allowing projects to be prioritized based on quantified risk reduction and service improvement per dollar invested. AMP findings flow into annual budgets and Council approvals, providing transparent justification for funding allocations and ensuring that investment decisions are grounded in lifecycle data and risk analysis.

F5: Integrated Resource Plan Best Practices

An IRP provides a unified framework for balancing water supply, demand, cost, risk, and sustainability over the long-term, typically 20 to 30 years. It integrates engineering, financial, environmental, and social considerations into a single, data-driven process that guides major Water Utility decisions. A best-practice IRP evaluates both supply-side and demand-side options together to identify the least-cost, most reliable strategy for meeting future needs. It also links together all service lines – water, wastewater, stormwater, and reclaim – to ensure coordinated investments and synchronized decisions across the entire system.

Cadence of Refresh

IRPs are typically updated on a five-year cycle, reflecting their role as long-range planning documents. These updates capture shifts in demand forecasts, supply conditions, or regulatory requirements, while interim reviews are used to track progress against key assumptions.

Core Inputs

An effective IRP draws on multiple inputs to provide a comprehensive view of long-term needs:

Component	Purpose
Asset Management Plans	Provide data on the condition, capacity, and cost of existing infrastructure, establishing the baseline for current system performance and future investment needs.
Municipal Development Plans	Ensure that future water infrastructure aligns with planned urban growth, identifying where new service areas, redevelopment districts, and density increases will occur – and how that growth will shape water demand.
Supply & Conservation Forecasts	Combine analysis of conservation trends, water use efficiency, and supply reliability to project future balance between available resources and demand.
Financial & Rate Modelling	Evaluate long-term affordability, funding options, and rate stability to ensure that investment pathways remain fiscally sustainable and aligned with goals to support access for all user segments.
Long-term Risk Assessment	Incorporate analysis of natural hazards (e.g., earthquakes, floods, extreme heat), environmental risks (e.g., drought, water quality degradation), and strategic risks (e.g., regulatory changes or funding shortfalls) that could disrupt service delivery.

Integration into Decision-Making

The IRP serves as the bridge between long-term strategic planning and near-term operational and financial decisions. It informs capital planning by sequencing projects that deliver the greatest value for cost, reliability, and environmental benefit. IRP outcomes also directly guide rate and budget cycles, ensuring that decisions reflect long-term needs.

Appendix G: Dedicated Water Utility Department Illustrative Tools

This appendix includes a series of illustrative tools, including illustrative job descriptions for each the (G1) CCO of Water and (G2) Risk Lead, (G3) a KPI dashboard, and (G4) a sample change management timeline. These materials are intended to assist The City translate the Panel's strategic recommendations into practical actions by providing reference frameworks, role descriptions, and process models drawn from leading Water Utility practices.

G1: Illustrative COO of Water Job Description

Role Summary

The COO of Water serves as the executive lead and single point of accountability for the safe and reliable delivery of water services for the Calgary Metropolitan Area, including Aidrie and Chestermere. Reporting directly to the City's CAO and supported by oversight from the WUOB and Council, the COO is responsible for the overall performance, financial sustainability, and resilience of the Water Utility.

Responsibilities

- Lead the dedicated Water Utility Department, ensuring a high-performing organization focused on reliability, efficiency, and service excellence.
- Foster a positive work environment that attracts, retains, and motivates high-quality talent across all levels of the Water Utility.
- Uphold and promote the highest standards of ethics, corporate citizenship, and social responsibility in all Water Utility operations.
- Oversee day-to-day operations for all three service lines: Potable water, Wastewater, and Stormwater and deliver to the service level objectives of each.
- Ensure the water executive leadership team operates in an integrated and synchronized manner.
- Support the development and execution of the Water Utility's long-term strategy, with a foundation of the Asset Management Plan and Integrated Resource Plan,
- Oversee the development and delivery of the capital investment portfolio.
- Maintain a close working relationship with the CAO, providing regular briefings on key risks, operational performance, and emerging issues requiring administrative attention.
- Work closely with the Risk Lead to maintain a comprehensive, current understanding of the Water Utility's top risks and ensure timely implementation of mitigation strategies.
- Ensure management performance, strategy, and risk information are clearly presented to WUOB and that WUOB feedback is appropriately addressed.

Skills & Qualifications

- Minimum 15 years of progressive leadership experience in large utilities or complex infrastructure organizations, with at least 5 years of experience in an executive or senior leadership role.
- Proven ability to lead multi-disciplinary teams in a regulated or public-sector environment.
- Deep understanding of water infrastructure systems.
- Demonstrated ability to lead through change and foster organizational transformation.
- Exceptional communication and stakeholder engagement skills, with the ability to navigate political, regulatory, and community environments.
- Strong financial acumen with experience in rate setting, cost-of-service analysis, and long-term financial planning.

G2: Illustrative Risk Lead Job Description

Role Summary

The Risk and Asset Integrity Lead will serve as the Water Utility's senior risk lead, responsible for implementing a modern, best-practice approach to risk and asset integrity management. The role ensures that risks are consistently identified, evaluated, and mitigated across the organization, supporting transparency and accountability from the frontline to executive leadership and the Water Utility Oversight Board (WUOB).

Responsibilities

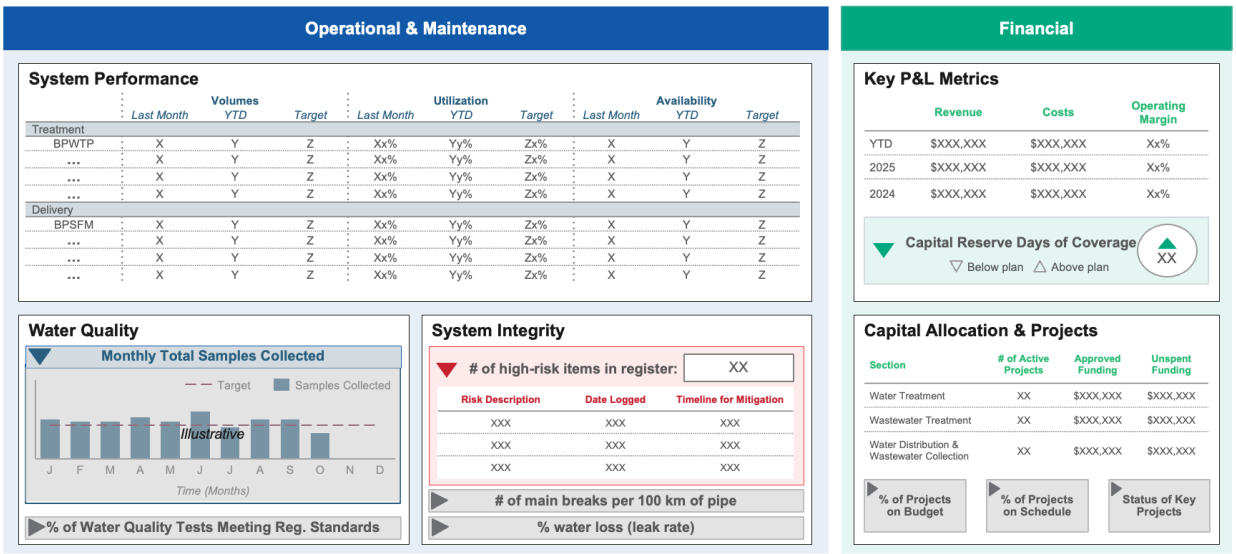
- Lead the refresh, enhancement and implementation of a new utility-wide risk assessment framework.
- Redesign risk escalation processes and triggers with defined and time-boxed escalation paths.
- Align all risk and inspection protocols with recognized standards (i.e., AWWA, ISO 55001)
- Maintain and continuously update the centralized risk register.
- Develop standardized reporting tools and dashboards providing real-time visibility to the COO.
- Assist with the integration of risk data into AMPs and the IRP
- Brief the COO and executive leadership on high-consequence risks and their mitigation progress.
- Liaise with WUOB to ensure comprehensive reporting on high-risk items and proposed mitigations.
- Promote disciplined adherence to the risk framework through coaching, documentation, and continuous improvement.
- Lead root-cause analyses on incidents or near misses, ensuring lessons learned are embedded in future practice.
- Oversee the execution and closure of all risk mitigation strategies.
- Establish and maintain clear KPIs to measure the effectiveness of risk controls and mitigation actions.
- Develop and deliver training programs to build organizational risk literacy.
- Collaborate with Engineering, Operations, and Finance teams to ensure risk considerations are embedded in planning and budgeting decisions.
- Represent the Water Utility in external regulatory reviews, audits, and inter-agency coordination on risk-related matters.

Skills & Qualifications

- Minimum 15 years of experience in critical infrastructure management, specifically in risk or asset integrity functions.
- Demonstrated ability to design and implement enterprise-level risk frameworks and registers.
- Strong understanding of asset management, engineering risk, and regulatory compliance within critical infrastructure or public-sector environments.
- Proven experience engaging with executive leadership, regulators, and oversight committees.
- Advanced knowledge of ISO 31000, ISO 55001, or equivalent risk and asset management standards.
- Exceptional communication and analytical skills; ability to synthesize complex data into actionable insights.
- Strong leadership presence with the ability to drive cultural change and influence at all organizational levels.

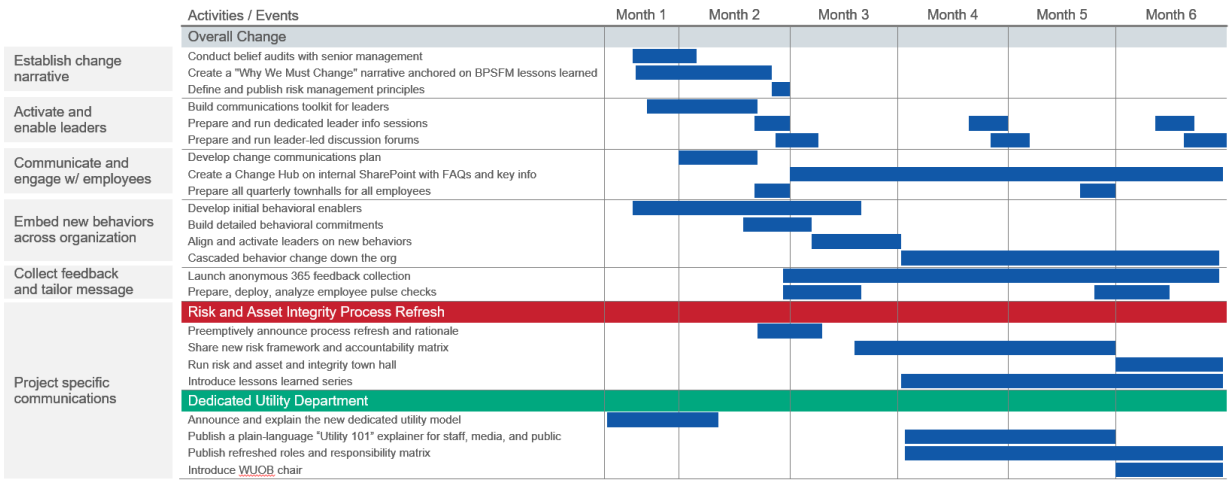
G3: Illustrative KPI Dashboard for COO of Water

To strengthen management visibility and accountability, the Panel has developed an illustrative KPI dashboard outlining a proposed structure for integrated system performance reporting. The tool is designed to give the COO of Water a monthly, end-to-end view of operational, financial, and integrity metrics across the water, wastewater, and stormwater networks.



G4: Illustrative Change Management Timeline

To assist in translating the Panel's recommendations into action, the timeline below provides an illustrative six-month change management plan outlining key activities and sequencing to support early implementation. The plan focuses on leadership alignment, employee engagement, and cultural reinforcement to ensure consistent adoption across the Water Utility. These actions are intended as a practical reference for establishing a transparent approach to implementation.



Appendix H: WUOB Illustrative Tools

This appendix includes a series of illustrative tools, including (H1) an illustrative job description for the WUOB Chair, (H2) an illustrative WUOB involvement process flow, (H3) a illustrative Terms of Reference for the WUOB, and (H4) a illustrative WUOB governance framework. These tools are meant to support the implementation of the Panel's recommendation to establish an expert independent oversight board. These materials are intended to assist The City translate the Panel's strategic recommendations into practical actions by providing reference frameworks, role descriptions, and process models drawn from leading utility practices.

H1: Illustrative WUOB Chair Job Description

Role Summary

The Chair serves as the principal steward of Calgary's independent water oversight mechanism, responsible for ensuring that the WUOB fulfills its mandate to provide trusted, expert oversight of the City's Water Utility. The Chair leads WUOB to ensure that all deliberations are disciplined, evidence-based, and result in clear, actionable guidance to Council and Water Utility leadership.

Responsibilities

- Recruit, orient, and mentor WUOB members, ensuring a balanced mix of expertise across infrastructure, finance, governance, and risk domains.
- Uphold the standards of conduct defined in WUOB's Terms of Reference.
- Provide input on Water Utility leadership selection and performance.
- Set clear WUOB meeting agendas to guide deliberation and drive actionable outcomes.
- Work with Water Utility management to ensure performance information is clearly presented to WUOB.
- Make final decisions on recommendations and what rework or response is required from the Water Utility.
- Ensure Water Utility management is aware of WUOB's concerns and recommendations, confirming that appropriate follow-up actions are completed.
- Maintain clear information flows with the Water Utility COO, Risk Lead, CAO, and Council.
- Oversee WUOB's quarterly reports to Council and public disclosure reports.

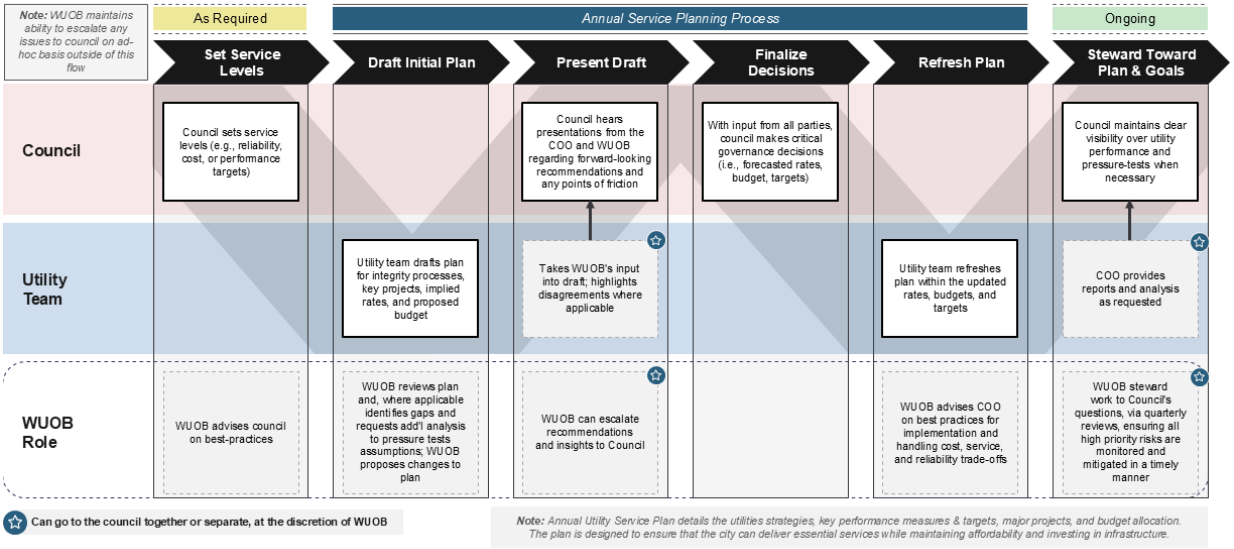
Skills & Qualifications

- Minimum 15 years of senior executive or board-level experience in critical infrastructure.
- Proven ability to lead expert advisory or governance bodies and to manage complex stakeholder relationships across political and administrative environments.
- Strong understanding of water infrastructure, finance, governance, and enterprise risk management.
- Exceptional communication and facilitation skills, capable of fostering trust and collaboration across diverse perspectives.
- Commitment to impartiality, integrity, and evidence-based decision-making.
- Professional designation or advanced degree in engineering, finance, law, or public administration preferred.
- Prior experience serving as a board chair, committee chair, or independent director considered an asset.

H2: Illustrative WUOB Involvement Process Flow

This appendix provides a sample process flow detailing how the WUOB could be engaged throughout the Water Utility's annual planning and decision-making cycle. For the WUOB to be effective, its role must be clearly integrated into existing governance processes, with defined responsibilities and points of interaction between Council and the Water Utility team.

Proposed end-to end process for WUOB involvement



H3: Draft Terms of Reference for WUOB

1. *Definitions*

1. In this Bylaw:
   a. "Administration" means the administration of The City of Calgary.
   b. "Chief Administrative Officer" means the individual appointed by Council as its Chief Administrative Officer pursuant to Bylaw 8M2001.
   c. "Council" means the municipal council of The City of Calgary.
   d. "The City" means the municipal corporation of The City of Calgary.
   e. "Utility" means The City's water, wastewater, and stormwater systems and associated infrastructure and services.
   f. "WUOB" means the Water Utility Oversight Board established under this Bylaw.
2. All schedules attached to this Bylaw form part of the Bylaw.

2. *Continuation of WUOB*

The WUOB will be established as a permanent committee of Council.

3. *Mandate*

1. The WUOB's mandate is to:
   a. assist Council in fulfilling its oversight and stewardship responsibilities by gaining and maintaining reasonable assurance in relation to:
      i. the integrity and sustainability of The City's utility systems and services;
      ii. effective governance, financial performance, and rate-setting practices;
      iii. the adequacy of infrastructure planning, asset management, and lifecycle funding;

iv. the identification, mitigation, and management of key utility risks; and
v. compliance with applicable standards and Council-approved policies.

b. support transparent, accountable, and evidence-based decision-making through independent review, advice, and reporting.

2. The WUOB's role is advisory in nature and does not extend to operational decision-making. The WUOB reports directly to Council.

4. *Authority*

1. The WUOB is authorized to:
   a. request reports from the Chief Administrative Officer and General Manager, Infrastructure Services, regarding financial, operational, and risk-related matters affecting the utilities;
   b. review long-range financial plans, asset management plans, and performance reports;
   c. commission special studies or technical reviews related to governance, cost, service, or risk management;
   d. invite presentations from Administration, regulators, or external experts;
   e. recommend to Council any action, policy change, or further review deemed appropriate;
   f. approve its annual work plan and forward to Council for information; and
   g. meet in closed session when required under the *Municipal Government Act* (Alberta).

5. *Composition*

1. The WUOB will consistent of five (5) public members.
2. Public members must collectively demonstrate expertise in one or more of the following areas:
   a. utility governance or regulation;
   b. finance or accounting;
   c. engineering or asset management;
   d. risk management;
   e. environmental science or sustainability;
   f. customer engagement or communications.

6. *Terms of Appointment*

1. Public members are appointed for three-year terms, expiring at the annual Organizational Meeting.
2. Public members may serve up to six consecutive years, unless extended by a two-thirds vote of Council.
3. Terms shall be staggered to ensure continuity.
4. Vacancies may be filled by Council for the balance of the unexpired term.

7. *Meetings and Attendance*

1. The WUOB shall meet not less than four (4) times per year.
2. Meetings are open to the public unless closed under the *Municipal Government Act* (Alberta).
3. Quorum is a majority of voting members.
4. Members may participate remotely and are deemed present for quorum.
5. Public submissions may be heard at the discretion of the Chair.

8. *Chair and Vice-Chair*

1. The Chair and Vice-Chair are appointed annually by Council.
2. The Chair presides over meetings and reports to Council.
3. In the Chair's absence, the Vice-Chair presides.

9. *Administrative Support*

1. The City Clerk's Office provides legislative and meeting support.
2. Technical and analytical support is provided by Administration.
3. The Chief Administrative Officer ensures timely access to required data and expertise.

10. *Annual Work Plan*

The WUOB develops and approves an Annual Work Plan outlining meeting dates, review priorities, and deliverables for the upcoming year, and forwards it to Council for information.

11. *Annual Reporting*

1. The WUOB submits an Annual Utility Oversight Report to Council summarizing key findings, recommendations, and emerging issues, including progress on previous recommendations.
2. The WUOB will coordinate with the Audit Committee and other relevant Council Committees to avoid duplication of oversight and ensure alignment.

12. *Governance And Conduct*

1. Members shall act with integrity, independence, and impartiality, and comply with the Code of Conduct for Boards, Commissions, and Committees.
2. Conflicts of interest must be declared and managed in accordance with City policy.
3. Decisions are made by majority vote.

13. *Review of Terms of Reference*

The WUOB must review these Terms of Reference at least once every four years and recommend updates to Council as required. This review will also confirm consistency with the Water Utility Governance Framework.

H4: Draft Governance Framework for WUOB (the Committee)

1.0 *Purpose and Scope*

1.1 Purpose: Defines how the Committee is to support Administration to deliver safe, reliable, and sustainable water, wastewater, and stormwater services to Calgary and the region. This Framework establishes a governance and management structure consistent with recognized industry standards, and stakeholder engagement considerations consistent with leading practices. It provides the foundation for transparent oversight, regulatory compliance, and continuous improvement consistent with leading municipal utilities across North America.

1.2 Scope: Applies to all aspects of utility governance including financial management, performance oversight, and risk management for water, wastewater, and stormwater operations.

2.0 *Governance Structure*

2.1 Council: Provides strategic direction, approves utility rates and budgets, and ensures alignment with community priorities.

2.2 The Committee Provides policy-level oversight of financial sustainability, service performance, regulatory compliance, and risk; serves as Council's independent oversight and advisory body for major utility decisions.

2.3 Administration: Administration will manage daily operations, customer service, asset management, compliance, and reporting required by this Framework.

2.4 Guiding Principles: The Committee will consider the following guiding principles in its work with the Utility: Service Reliability; Affordability and Value; Service–Cost–Risk Balance; Environmental Responsibility; Accountability and Transparency; Continuous Improvement.

3.0 *Strategic Direction*

3.1 Purpose: Provide strategic guidance to sustain resilience and financial sustainability aligned with Council's objectives.

3.2 Scope: Long-term vision; alignment with City priorities; policy integration; performance and benchmarking; strategic foresight; public confidence.

3.3 Expected Outcomes: Guide decisions that ensure current and future service reliability, sustainability, and critical infrastructure protection.

3.4 Review and Recommendation to Council: Review the Utility Strategic Plan and make recommendations to Council that align with City policy and resilience principles.

3.5 Long-Term Planning Oversight: The Committee will review the 10-year Utility Long Range Plan, including growth projections, infrastructure renewal schedules, and system capacity analyses. The review will consider:

- Alignment with Council-approved growth strategies and climate adaptation plans.
- Demand forecasting and supply reliability scenarios.
- Integration of financial, asset, and risk plans into a unified strategic outlook.
- Confirmation that long-term capital plans maintain intergenerational equity and resilience.

3.6 Integrated Service–Cost–Risk Framework: The Committee will ensure that Administration integrates the balance needed between service performance, cost efficiency, and risk tolerance. Each major decision request must document service impact, cost implications, and risk exposure. Risks including residual risks will be reviewed annually by the Water Utility Committee.

3.7 Integrated "One Water" Approach: The Committee will review Administration's One Water Plan and ensure it aligns with the City's long-term sustainability and resilience goals. This approach will promote holistic management of the urban water cycle – linking source protection, treatment, distribution, drainage, and reuse – and align with The City's growth, climate, and environmental strategies. The One Water Plan provides the overarching integration framework for all water, wastewater, and stormwater services, while the 10-Year Long-Range Plan operationalizes these principles through detailed capital, asset, and financial planning.

3.8 Asset Management Oversight Role: The Committee will review annual asset condition and renewal performance metrics, including:

- Asset replacement value and reinvestment rate.
- Condition index trends for critical assets (feedermains, treatment plants, outfalls).
- Capital backlog and risk-weighted renewal prioritization.
- Lifecycle cost alignment with the 10-year capital plan.

Deferred or accelerated capital renewals will be documented that record project timing changes and their service, cost, and risk implications. All deferred renewals must identify rationale such as condition reassessment, permitting, demand change, or climatic factors, and the cumulative effect on risk and lifecycle cost will be disclosed in annual reporting.

The Committee will confirm renewal funding remains consistent with industry norms and that deferred renewals are transparently documented as accepted risks.

3.9 Risk Oversight and Challenge Function: The Committee will provide an independent viewpoint to management's risk assessments and mitigation priorities by:

- Reviewing the top 10 enterprise risks annually;
- Requiring management to present residual risk and deferral decisions;
- Documenting risk acceptances for Council acknowledgment (no data = high risk); and
- Confirming that the risk register aligns with The City's Enterprise Risk Policy and industry norms.

The Committee may request external peer or engineering reviews where uncertainty or consequence is extreme.

3.10 Climate Resilience Integration: The Committee will ensure that Administration integrates water security and adaptation measures into all asset, risk, and capital planning processes. Demand management and water conservation strategies will be considered integral to climate resilience and service sustainability.

4.0 *Service and Performance Standards*

4.1 Purpose: The Committee will review service performance to ensure safe, reliable, and sustainable operations consistent with approved service levels, and recognized industry standards.

4.2 Performance Framework: Performance standards define the expected service levels and quality outcomes that form the baseline for performance-based regulation and continuous-improvement review.

4.3 Core Service Objectives: Public Health and Safety; Reliability and Continuity; Customer Service; Environmental Stewardship; Asset Stewardship; Transparency and Accountability.

4.4 Committee Oversight Responsibilities: Review annual performance reports; monitor reliability targets; review compliance and risk mitigation progress; recommend service adjustments; promote benchmarking with leading North American utilities.

4.5 Performance Indicators: Service reliability (frequency/duration of interruptions); water quality compliance; infrastructure health (condition, renewal rate, probability of failure); emergency preparedness (time to restore); financial efficiency (cost per ML delivered); customer satisfaction; sustainability metrics (energy intensity, GHG, water loss).

4.6 Reporting and Benchmarking: Annual reporting with prior-year comparisons and peer benchmarking; independent studies or audits may be requested to validate outcomes.

4.7 Continuous Improvement: Promote a learning culture and risk transparency; integrate lessons from incidents, audits, and customer feedback into future planning. Results against these standards provide the reference for evaluating performance-based regulation outcomes.

4.8 Stakeholder and Customer Engagement: The Committee will review Customer and Stakeholder Engagement Plans to ensure transparent communication and informed participation in decision-making. The Plan will outline engagement objectives, methods, and reporting mechanisms to build public confidence, improve service awareness, and support effective policy dialogue on rates, service levels, and investments.

4.9 Emergency Preparedness: The Committee will review emergency preparedness, response, and recovery protocols that define responsibilities, contact protocols, mutual aid agreements, and annual review cycles. Readiness exercises and after-action reviews will be documented with root causes and integrated into the Utility's continuous improvement process.

5.0 *Rate-Setting and Financial Management*

5.1 Purpose: Ensure cost recovery and financial sustainability through fair and transparent rate design informed by service, risk, and regulatory requirements.

5.2 Rate-Setting Principles: Full cost recovery for operations, maintenance, depreciation, debt servicing, and reserves; rates reflect service levels, long-term capital plans, and prudent reserve funding; aligned with the *Municipal Government Act* (Alberta), The City's Fiscal Sustainability Framework, and recognized industry standards.

5.3 Business Case Requirements: All major capital or operational initiatives must include a structured business case demonstrating need, alternatives analysis, lifecycle cost, and benefit-to-risk evaluation; Committee review precedes Council approval.

5.4 Long-Term Financial Planning: Maintain a long-term financial plan aligning capital and operating expenditures with revenues and reserves to ensure intergenerational equity and rate stability. All adjustments will be documented and disclosed in the annual performance or financial report.

5.5 Four-Year Operating and Capital Budget Review: The Committee will review the four-year Utility Service Plan and Budget before submission to Council. The review will evaluate:

- Operating and capital alignment with strategic priorities.
- Funding adequacy for renewal, growth, and regulatory compliance.
- Consistency with financial targets (Section 10.2).
- Sensitivity analyses for inflation, energy, and debt assumptions.

Recommendations will be documented and provided to Council with the budget submission.

5.6 Rate-Setting Oversight and Cost of Service Review Cycle: The Committee will review draft Cost of Service and rate-setting reports in advance of any public consultation and Council decision. A Cost of Service Study will be undertaken at least once every four years; interim updates may be requested if significant changes in cost structure, service levels, or regulatory requirements occur. Reviews will ensure:

- Alignment with recognized industry standards and fairness among customer classes.
- Transparency in cost allocation between water, wastewater, and stormwater.
- Sensitivity to affordability and financial sustainability.
- Integration of performance and risk results into pricing decisions.

The Committee will recommend final rates to Council based on the cost-of-service findings.

A process will be maintained for extraordinary, unforeseen cost or capital pressures outside approved plans – including regulatory compliance, emergent infrastructure failures, or third-party relocations. All requests must include a justification, financial and risk impact assessment, and public disclosure of the resulting budgetary change.

6.0 *Performance-Based Regulation*

6.1 Performance- Based Regulation: The Committee will oversee Administration's application of performance-based regulation (PBR) principles that link operational and financial outcomes to service quality, efficiency, and risk management. Performance will be assessed through a defined set of indices each reviewed annually to evaluate outcomes/results including variances, corrective actions, and proposed adjustments to performance targets or incentives.

6.2 Reporting Schedule: Quarterly, annual, and biennial reports as previously defined for performance, risk, financials, and benchmarking.

6.3 Public Reporting: Performance indicators will track service reliability, financial health, asset condition, and risk trends. Annual reports will summarize outcomes and corrective actions, published for Council and the public.

6.4 Committee Interpretation of Results: The Committee will assess performance results to determine whether outcomes are improving, stable, or declining. Where indicators deviate from targets, the Committee will require management to:

- Explain root causes and corrective actions.
- Identify policy or resourcing constraints.
- Recommend adjustments to maintain service, cost, and risk balance.

Annual reports will include management responses and Committee commentary for Council transparency.

7.0 *Financial Policies and Performance Standards*

7.1 Purpose: The Committee will ensure the Utility maintains financial health consistent with Council policy, and recognized industry standards.

7.2 Financial Targets

Policy Area	Measure	Target / Standard
Self-Sustaining Utility	N/A	Operate without tax support
Debt Service Coverage	Ratio	Minimum 1.6x
Cash Financing Of Maintenance Capital	Percent	100%
Debt-To-Equity	Ratio	60/40
Debt Term	Years	Up to 25
Sustainment Reserve	Days	120 days of annual operating expenditures
Return On Equity	Percent	8.5% on 40% of net rate base

Depreciation	Compliance	Maintain rates aligned with GAAP/regulatory norms

Annual reporting will include forecast-to-actual variance analysis for key financial measures, including revenue, operating cost, and return on rate base or equity. Variances exceeding 5 percent from approved forecasts will be disclosed with explanation and corrective actions.

7.3 Committee Oversight: The Committee will review forecasts, assess compliance with financial targets, integrate asset and risk considerations into budgeting, recommend necessary adjustments to Council, and monitor alignment with recognized industry standards.

8.0 *Regulatory Oversight*

8.1 Purpose: Ensure compliance with applicable federal, provincial, and municipal legislation, approvals, and reporting obligations.

8.2 Federal Framework: Fisheries and Oceans Canada (Fisheries Act); Guidelines for Canadian Drinking Water Quality (Health Canada); Canadian Navigable Waters Act (Transport Canada); engagement/ consultation with Indigenous partners where applicable.

8.3 Provincial Framework (Alberta): Environmental Protection and Enhancement Act (facility approvals, reporting of releases); Water Act (licensing and diversion); Public Lands Act (use of beds and shores); Safety Codes/OHS where applicable.

8.4 Municipal Framework: The City's bylaws and policies governing water, wastewater, and stormwater services.

8.5 Committee Oversight: The Committee will review annual compliance reports and inspection findings; ensures timely disclosure of reportable events and corrective actions; promotes proactive regulator relationships.

9. *Committee Reporting Cadence*

9.1 Reporting: To ensure consistent oversight and transparency, the following minimum reporting cadence will apply:

Category	Report Frequency	Reviewed By	Notes
Enterprise Risk Register & Top 10 Risks	Quarterly	Utility Oversight Committee	Include residual risk trends, mitigation status, and new/emerging risks.
Financial Performance (Operating, Capital, Reserves)	Quarterly	Utility Oversight Committee	Include variance analysis and forecasts against budget and financial targets.
Benchmarking & Performance Indicators	Annually	Utility Oversight Committee and Council	Compare prior-year and peer utility results; include management responses.
Strategic Plan Progress Review	Biennially	Utility Oversight Committee	Assess long-range plan alignment with City strategic goals.

Category	Report Frequency	Reviewed By	Notes
Rate-Setting And Budget Submissions	Every Four Years	Utility Oversight Committee → Council	Coincides with the Utility Service Plan and Budget cycle.

The Committee may request interim updates where performance, financial, or risk deviations are material.

10.0 *Relationship to Council and Other Committees*

10.1 Reporting Relationship: The Committee is established by Council and reports directly to Council, providing advice and recommendations on strategic, financial, operational, and risk matters.

10.2 Coordination with Other Committees: The Committee will coordinate with Audit, Infrastructure and Planning, Community Development, and Intergovernmental Affairs Committees; joint briefings or coordinated reporting may be requested by the Chair to avoid overlap.

10.3 Recommendations to Council: Recommendations may include strategic plan approvals, financial policies, cost-of-service studies, KPIs and service standards, compliance updates, and direction for additional analysis.

10.4 Public Accountability and Transparency: The Committee will review financial, asset, and risk performance annually, ensuring compliance with City policies and recognized industry standards. Key results and policy compliance will be reported publicly in the Annual Performance Report.

11.0 *Administration and Support*

11.1 Administrative Support: City Clerk's Office provides support to the Committee; the General Manager, Water Utility Department (or designate), serves as administrative liaison and ensures timely reports and analyses.

11.2 Meetings: Quarterly minimum; additional meetings for urgent financial performance, regulatory compliance, or service continuity; public unless in closed session under the *Municipal Government Act* (Alberta) and *Access to Information* (Alberta).
11.3 Quorum and Decision-Making: A majority of appointed members constitutes quorum.

11.4 Records and Documentation: Agendas distributed in advance; minutes record all resolutions, recommendations to Council, and follow-up actions; records maintained as set out in The City's policies.

11.5 Annual Work Plan: Committee will set an Annual Work Plan covering key reports, studies, and education/engagement; submitted to Council for approval.

11.6 Member Education and Orientation: Members receive orientation on governance, financial policies, regulatory obligations, and risk management; ongoing education on industry standards and critical infrastructure resilience is encouraged.

11.7 Effective Date: Takes effect upon Council approval and remains in force until amended or rescinded.

11.8 Implementation and Review: The Framework will be reviewed at least every four years, or sooner following material policy, regulatory, or risk changes, to align with Council's term and the Water Utility Committee's Terms of Reference.

Appendix I: HPAR Report

This appendix contains the Panel's first mandated deliverable – the High Priority Action Report (HPAR). The HPAR identified the immediate actions required to mitigate near-term risks following the BPSFM failure, focusing on critical infrastructure reliability, redundancy, and emergency preparedness. The findings and actions outlined in the HPAR provided the foundation for the broader organizational, governance, and cultural reforms developed in this Final Report.

Please note, the HPAR document included as an appendix retains its original confidentiality header. This header has been preserved to maintain the integrity of the original document. The Panel confirms that, as part of the release of this final report and the full evaluation review, the HPAR is no longer confidential and may be read and relied upon in its entirety.

Bearspaw South Feeder Main Independent Review Panel

October 15, 2025

David Duckworth, P.Eng., MBA
Chief Administrative Officer
The City of Calgary
800 Macleod Trail SE
Calgary, T2G 5E6

Dear David,

On behalf of the Bearspaw South Feedermain Independent Review Panel ("Panel"), I am pleased to provide the High Priority Action Report ("HPAR") in accordance with the Panel's mandate to review the Bearspaw South Feedermain ("BPSFM") break that occurred in June 2024. The Panel's final report will be issued at the conclusion of its work in 2025.

HPAR is a confidential report to the City. It identifies critical risks to the water system. It enumerates current issues and immediate actions proposed by the City. Having regard for these risks, issues and actions, the Panel provides several recommendations that require immediate study and involve changes to the current project timelines and budgets, all of which should be available for consideration by the incoming Council.

Further, the Panel recommends that the new City Council receive a dedicated and detailed assessment of the water system. This presentation, which the Panel understands will occur after its final report is submitted, should focus on the key vulnerabilities, the actions underway, and the opportunities to further mitigate risk exposure. A dedicated session would ensure that the new Council has clear visibility into these issues and is in an informed position to provide the necessary direction and support for action plans.

With respect,

Siegfried Kiefer
Chair,
Bearspaw South Feedermain Independent Review Panel

Enclosure

cc: Stuart Dalgleish, Chief Operating Officer, The City of Calgary
Lori Kerr, Senior Corporate Liaison - Utility Review, The City of Calgary
Michael Crothers, Vice Chair, Bearspaw South Feedermain Independent Review Panel
Gord Engbloom, Member, Bearspaw South Feedermain Independent Review Panel
Nancy Foster, Member, Bearspaw South Feedermain Independent Review Panel
Bob Kerr, Member, Bearspaw South Feedermain Independent Review Panel
Stephen Stanley, Member, Bearspaw South Feedermain Independent Review Panel

This document presents draft analysis and recommendations of the Independent Review Panel DEVELOPED FOR THE CITY OF CALGARY. It is intended solely for the Panel AND THE CITY OF CALGARY and should not be shared further.

Bearspaw South Feedermain Independent Review Panel

High Priorities Action Report

October 15, 2025

1. Introduction

The Panel was established in early 2025 following the rupture of the Bearspaw South Feedermain (BPSFM) that occurred in June 2024, and the subsequent water restrictions.[1] The Panel has three deliverables – a High Priority Action Report ("HPAR"), a draft interim recommendations report and a final report. This document is the HPAR. The final report will be delivered at the conclusion of the Panel's review in 2025.

The Panel's mandate states for the HPAR that the Panel is:

> "…to prepare and issue an expedited report on high priority action items related to system assurance, inspections, capital maintenance and operations (the "High Priority Action Report") so that The City may fund and action critical activity to mitigate near term risk. Phase 1 of the Review Panel's review should ensure the alignment of current issues and immediate action plans."

At this point, the Panel's primary assessment has focused on the potable water system, although the Panel has reviewed and continues to review the wastewater and stormwater systems. The Panel observes that risks for the waste and storm water systems have been identified and are being addressed by the City. At this time, the Panel considers that none of those risks should be included in the HPAR. As a result, the remainder of this document relates to the potable water line of service.

2. Work-to-date

Since being fully constituted in April 2025, the Panel has undertaken an extensive program of work to understand the state of Calgary's water utility. At the time of this report, the Panel's work included:

- More than 40 meetings with current and former staff from Water Services and other City departments, including multiple follow-up sessions to examine technical, financial, and governance issues in greater depth.
- More than 40 meetings and 4 workshops among Panel members to review and discuss the information gathered.
- More than fifty individual information requests submitted to the City, the majority of which have been answered, while others are still in progress.
- Historical documents prepared by the City and its consultants related to the planning, operation and strategy for the water system, including the Water Long Range Plans, Tactical Asset Management Plans, capital budgets and annual performance reports.
- Review of reports prepared after the BPSFM rupture including those prepared by Associated Engineering Alberta Ltd., APEGA, EY, Pure Technologies, and internal City documents.[2]

The Panel appreciates the diligence and cooperation of City staff, who have engaged openly and directly to support this process.

[1] BPSFM originates at the Bearspaw WTP and proceeds east to the Shaganappi Pump Station near the southern end of Shaganappi Trail NW and then continues eastward to the Memorial Drive pump station west of 14 Street SW. The portion between the Bearspaw WTP and the Shaganappi Pump station is 1950 mm in diameter, and it is the portion that suffered the break and was repaired in several locations. That portion is referred to in this HPAR as the BPSFM.
[2] A Glossary is provided at the end of this Report.

3. Risks

Through this work, the Panel has identified three near-term material risks that require urgent attention.

A. Bearspaw South Feedermain single-point-of-failure

The first risk is a single-point-of-failure on the BPSFM. Except for the portion immediately downstream of the Bearspaw WTP, this critical main was constructed with pre-stressed concrete pipe ("PCCP") technology in 1975 to the standards applicable at that time, but which have since been determined to be inadequate.[3] Various measures have been taken since the 2024 rupture to monitor the repaired main, including installation of a fibre optic acoustic monitoring system, a soil testing program, and management of the line pressure,[4] but none of these measures mitigate the single-point-of-failure risk to the water system.

There is evidence that PCCP pipelines in water service that wire breaks can occur rapidly, leading to unpredictable failures.[5] The City's strategy of external reinforcement to sections of BPSFM with increased frequency of wire breaks may not prevent rupture given the variability of pipe stress along the line and potential for rapid wire breaks.[6] Furthermore, PCCP line failures do occur for reasons other than wire breaks. As such, while acoustic monitoring for wire breaks is valuable, it leaves unmitigated residual risk. Other owners of PCCP mains, have augmented acoustic monitoring with increased inspection frequency, sounding and ultrasonic thickness testing, visual and robotic camera inspections, and periodic electromagnetic inspections.

The immediate action plan proposed by the City is to duplicate the PCCP portion of BPSFM with steel pipe. Upon completion, the duplication will allow water to move between the Bearspaw WTP and the Shaganappi pump station in all-steel pipe technology. On current schedules, the duplication will be fully operational in 2029. As a result, the City remains exposed for multiple years to the risk of another high-consequence failure of the existing BPSFM.

B. Inability to meet Average Daily Demand ("ADD)

The second risk is the water utility's weakness, under current plans, to sustain ADD at all times when the BPSFM is out of service. The City views ADD as the minimum level of water demand for the purposes of planning system redundancy.

The July 2024 BPSFM disruption was managed with outdoor water use restrictions, voluntary water conservation, high seasonal flows on the Elbow River, which enabled the Glenmore water treatment plant ("WTP") to operate at an average output of approximately 360 million litres per day ("MLD") when BPSFM was out of service, and additional supply from mains that originate at the Bearspaw WTP but do not use BPSFM.[7]

Looking forward, with growth in demand and BPSFM out of service, the system will be unable to meet ADD even at the higher summer flow rates on the Elbow River until 2028 after a Glenmore WTP upgrade is completed in 2027.[8] Starting in 2028, with BPSFM out of service the system is forecast to have a small or modest annual surplus of capacity in excess ADD varying from 3% to 12% through 2035.

[3] Associated Engineering Report, Forensic Investigation into the Bearspaw South Feedermain Rupture, November 2024, pdf page 60; APEGA, Report to the APEGA Practice Review Board, Practice Review of the City of Calgary (Permit #4428) Bearspaw South Feedermain Rupture, May 7, 2025, page 1
[4] Various sources in the water utility
[5] Trenchless Technology, "Large Diameter PCCP Water Main Failure", April 8, 2025
[6] ASCE Pipelines 2012, "Beyond the Wires, A Sustainable Approach to PCCP Pipe Management" by Faber, Coghill and Galleher
[7] Specifically, the BP North Feedermain and BP NW Feedermain
[8] Analysis provided by Water Utility (response to IR 3.7 "Response to 13").

However to generate those small levels of surplus capacity above ADD, the City will need to operate critical facilities at or near their nameplate capacity for sustained periods with vulnerability to reliability, complete the upgrade at the Glenmore WTP, complete the addition of the initial phase of the delayed North Calgary Water Servicing project ("NCWS") and complete the Mountain View Pump Station project.

Importantly, if a BPSFM failure occurs in the winter months when flows on the Elbow River are low, the output of the Glenmore WTP will be constrained. One estimate provided by the City indicates that 390 MLD would be available for 30 days compared to capacity at the Glenmore WTP of 380 to 400 MLD through 2027 and 450 MLD in 2028. In this case, total supply, including from the Glenmore WTP and from the output of the Bearspaw WTP that does not use BPSFM, is less than ADD until 2028 and then is a small margin of plus or minus 3% of ADD each year through 2035. The Panel has been advised by the City that low flows on the Elbow River may also occur during summer months when drought conditions prevail.

C. Bearspaw WTP Single-Point-of-Failure

The existing Bearspaw WTP consists of two trains which presently have a combined capacity of 550 MLD. After planned improvements, the plant will have a capacity of 650 MLD, with Stage 1 having a capacity of 250 MLD and Stage 2 having a capacity of 400 MLD. In 2020, the City initiated a project to improve isolation of the trains to reduce single points of failure such that an outage in one train would not result in a shutdown of the entire Bearspaw WTP. This project identified several existing single points of failure at the Bearspaw WTP, and the City has initiated a number of specific mitigation projects. However, these projects are at various stages with some started, a number yet to be in the design phase and one that cannot be completed until additional capacity is available through the Bearspaw WTP Stage 3 expansion, which is currently scheduled for 2035. Until all the single points of failure are addressed, there is a risk that failure of any one of these could result a shutdown of the entire Bearspaw WTP.

4. Panel Assessment

The Panel has serious concerns with the timelines of projects planned to address the three noted risks. Under the current plan, it will be 2029 before steel duplication of the PCCP portion of BPSFM is fully operational and lowers but does not eliminate the risk of a BPSFM failure or it being out of service due to planned or unplanned events. In 2026 and 2027, with BPSFM out of service, the remaining maximum system capacity cannot supply ADD. Starting in 2028 and with BPSFM out of service, other projects are planned to raise maximum system capacity to exceed ADD. However, under low seasonal flows on the Elbow River, the available system supply, even with the new projects on other parts of the system, would be more or less equal to ADD when BPSFM is out of service. Such small margins bring reliability issues into play, including near-perfect operation of critical supply facilities, which cannot be assured. Moreover, such small margins can be overwhelmed by demand growth that is higher than forecast due to higher population increases, resulting in ADD exceeding supply.

The Panel's concern with these results is heightened by insufficient analysis of residual risks to supply. These risks are indicative of worst-case events and require examination to provide for planned responses by the City. Examples of such risks include different estimates of low flows on the Elbow River, BPSFM line breaks when there are low volumes in the Glenmore reservoir throughout the winter season, multiple breaks or incidents on the BPSFM in one season, and extended repair periods at any of the complex repair locations such as two crossings of the Bow River, two crossings of the CPKC main rail line, and a major intersection. Obtaining more information on the impacts of these risks is needed for the Panel's final report, and the Panel will continue to work with the City to identify and assess these and other residual risks.

Further, Stages 1 and 2 at the Bearspaw WTP have shared common infrastructure that presents a single point of failure risk that will shut down the Bearspaw WTP if a shared common infrastructure fails. Such an event would mean that supply would only come from the Glenmore WTP and even if it operated at capacity, it would only supply about 65% of ADD, causing material shortfalls in water system supply more severe than occurred in 2024. Work to eliminate or otherwise mitigate these shared common infrastructure situations is required. In addition, the design basis for Plant 3 must require it to be fully independent of infrastructure common with Stages 1 or 2.

Finally, the Panel has observed during many interviews that there has been an over reliance on perceived likelihood of system failures, rather than proactive mitigation of the high consequences of failures in critical infrastructure. With the water system supply unable or barely able for the foreseeable future to meet ADD with a single major asset out of service, aggressive mitigation of high consequences must be the primary focus of the water utility.

5. Recommendations

The Panel recommends that the City maintain its current strategic direction while developing plans for immediate implementation to accelerate its pace of execution and supplement current projects with additional measures. The Panel is prepared to assist the City in assessing these opportunities in the context of ensuring they meet the goal of enhancing risk mitigation.

The following actions are recommended:

a) Accelerate the BPSFM Reliability Project.

- Undertake an acceleration plan that examines opportunities to advance timelines through measures such as concurrent permitting and construction, long-lead procurement, and increased resourcing.

b) Advance redundancy projects to support winter resilience.

- Undertake immediate risk assessments, including impacts of seasonal flows on the Elbow River, to address residual risks associated with water supply when BPSFM is out of service and available supply may or cannot meet ADD, including contingency planning for such events.
- Accelerate the schedule for NCWS and prioritize segments that deliver redundancy earliest.
- Expedite scoping and procurement for SCWS to enable partial service delivery before 2031, supported by newly installed crossties that can improve interim redundancy.

c) Advance work at Bearspaw Water Treatment Plant to improve redundancy

- Assess the risk of existing common shared infrastructure of Stages 1 and 2 that could result in the shutdown of the entire Bearspaw WTP.
- Design and implement separation of existing shared common critical infrastructure to make each Stage can operate independently and ensure no single points of failure could shut down the entire plant.
- Develop and test operational contingencies to ensure Bearspaw WTP operation for scenarios involving failure of shared facilities until projects to eliminate single points of failure are completed.
- Advance design work on Plant 3 and ensure it is fully independent of infrastructure common to Stages 1 or 2.

d) Expand the scope of monitoring and inspections for PCCP Mains

- Implement a representative sampling plan for soils along all installed PCCP mains, beyond the scope of 2025 sampling on Glenmore steel, Glenmore concrete and Top Hill. Once a baseline of soil conditions is established, the City can make better decisions on preventative maintenance, detailed inspection, and contingency plans to protect reliability.

- Consideration be given to including additional assurance measures for failures other than wire breaks on existing PCCP pipe in particular the BPSFM including some or all of the techniques currently used by other owners (see footnote 6).

e) Accelerate Demand-Side Management ('DSM') initiatives.

- Launch DSM initiatives in late 2025, rather than 2026, with a focus on winter-relevant demand reduction and leak abatement. The City's prior success with previous initiatives demonstrates that citizens and businesses respond constructively to incentives and education.
- Set near-term targets for measurable demand reduction; for example, 2–3% by winter 2026.

f) Strengthen emergency management capacity.

- Review the terms of reference and activation protocols of the Calgary Emergency Management Agency to support its effectiveness in coordinating city-wide emergency response. This would be consistent with a greater emphasis on response preparedness to high consequence incidents and acknowledgment of the frequency that the Emergency Operations Centre is being utilized.
- Conduct pre-winter outage exercises simulating BPSFM downtime under peak winter load to test readiness.
- Ensure that fibre-optic monitoring thresholds are clearly linked to pre-approved outage protocols and that decision-making authority for rapid response is clearly assigned.

g) Restore financial resilience.

- Rebuild the utility's sustainment reserve to 120 days by 2028 through staged contributions.

h) Support senior leaders in water utility workforce.

- Implement programs to support the wellbeing of senior utility staff, including measures to address workload stress and to backfill critical skills necessary for project delivery. Ensure that key people involved in the system recovery, project development, and ongoing improvement to business processes have had an opportunity to rest, which requires having experienced and capable backup.

Appendix A: Glossary

ADD	Average Daily Demand, which is the total annual water demand divided by 365 days per year. Total water demand includes demands for residential irrigation and regional customers.
APEGA	Association of Professional Engineers and Geoscientists of Alberta
BP	Bearspaw
BPSFM	Bearspaw South Feedermain originates at the Bearspaw WTP and proceeds east to the Shaganappi Pump Station near the southern end of Shaganappi Trail NW and then continues eastward to the Memorial Drive pump station west of 14 Street SW. The portion between the Bearspaw WTP and the Shaganappi Pump station is 1950 mm in diameter and is the portion that suffered the break and was repaired in several locations. That portion is referred to in this HPAR as the BPSFM.
DSM	Demand Side Management
EY	EY Canada
HPAR	High Priority Action Report. A confidential report prepared for City's senior administration
MLD	million litres per day or mega litres per day
NCWS	North Calgary Water Servicing project
SCWS	South Calgary Water Servicing project
WTP	Water Treatment Plant
Water System	The system of integrated facilities throughout the City that provide potable water supply
Water Utility	The institutional framework that manages, operates and maintains the water system