WITNESS STATEMENT OF MARK BISSETT, P.ENG.

Prepared June 12, 2024

PROCEEDING COMMENCED UNDER subsection 22(7) of the *Planning Act*, R.S.O. 1990, c. P. 13, as amended

Applicant/Appellant:	Caivan (Perth GC) Limited
Subject:	Request to amend the Official Plan – Failure to adopt the requested amendment
Property Address:	141 Peter Street
Municipality:	Town of Perth / County of Lanark
OLT Case No.:	OLT-23-000939
OLT Lead Case No.:	OLT-23-000534

PROCEEDING COMMENCED UNDER subsection 34(11) of the *Planning Act*, R.S.O. 1990, c. P. 13, as amended

Applicant/Appellant:	Caivan (Perth GC) Limited
Subject:	Application to amend the Zoning By-law – Refusal or neglect to make a decision
Property Address:	141 Peter Street
Municipality:	Town of Perth / County of Lanark
OLT Case No.:	OLT-23-000940
OLT Lead Case No.:	OLT-23-000534

PROCEEDING COMMENCED UNDER subsection 51(34) of the *Planning Act*, R.S.O. 1990, c. P. 13, as amended

Applicant/Appellant:	Caivan (Perth GC) Limited
Subject:	Proposed Plan of Subdivision – Failure of Approval Authority to make a decision
Property Address:	141 Peter Street
Municipality:	Town of Perth / County of Lanark
OLT Case No.:	OLT-23-000534
OLT Lead Case No.:	OLT-23-000534
OLT Case Name:	Caivan (Perth GC) Limited v. Lanark County

Qualifications:

1. I am a Senior Project Manager with Novatech. I have 25 years of experience in the field of civil engineering specializing in land development and municipal infrastructure. I have worked on numerous public and private sector projects and have been employed with Novatech for 25 years.

2. I am licensed as a Professional Engineer in the Province of Ontario and I am a member of the Professional Engineers of Ontario Association. My resume and Acknowledgement of Expert's Duty is attached as **Appendix A**.

Retainer:

3. I was retained as a Civil Engineer by the Town of Perth to provide professional infrastructure review services. In my capacity as a Senior Project Manager with Novatech, I conducted an independent review of the applicant's servicing report and prepared a summary memo. The summary memo is attached as **Appendix B**.

4. The evidence I will give at the hearing emerges from my review of the applicant's servicing study. I continue to have confidence in my review.

Reports:

5. I reviewed the following documents:
   - Town of Perth Infrastructure Master Plan Western Annex by JP2G (November 2019)
   - Proposed Residential Subdivision Functional Servicing Report by DSEL (February 2023).
   - 141 Peter Street Geotechnical Investigation by Gemtech (February 2023)
   - Comment Response Summary received by the Town (March 6, 2023)
   - Comment Response Memo from RVCA (June 22, 2023)
   - Comment Response Memo from RVCA (June 27, 2023)

Evidence in Chief:

6. Reference materials are listed below and included in **Appendix C**.
   a. Ottawa Design Guidelines – Water Distribution (July 2010).
   b. Ottawa Technical Bulletin ISTB-2021-03
   c. Ontario Ministry of the Environment, Guidelines for the Design of Sewage Treatment Works (July 1984).
   d. NFPA 1140 Standard for Wildland Fire Protection (2022 Edition)
   e. Ottawa Sewer Design Guidelines (October 2012).
   f. Environmental Science & Engineering Magazine, February 2018.

Issues:

7. The procedural order has set out 17 issues. This witness statement will address issues 2, 5 and 10.

8. Issue 2 c) asks if it is appropriate to introduce the proposed number of residential units without conducting a comprehensive review to assess the demands on infrastructure and public service facilities that the development will create.

   Water Tower

   The Infrastructure Master Plan (IMP) concluded the existing water tower and reservoir can support up to 7,230 people. Statistic Canada census for 2021 reported a Perth population of 6,469. The IMP recommended additional analysis to confirm the timing and location of specific water system upgrades.

   The Functional Servicing Report (FSR) projected growth of 34 dwelling per year from 2022 to 2025, increasing to 65 dwellings per year afterwards. The FSR estimates a population of 7,191 people by 2028 and concludes further investigation is required to identify the trigger water system upgrades.

   The FSR did not use design guideline population values for growth areas. We believe their approach is inappropriate and potentially underestimates both the future population and timeline for critical water system upgrades. We concur with the IMP approach that used City of Ottawa population values. Replicating the FSR calculations, we conclude the water tower may be at capacity by 2026 based on the approved service population.

   We believe a conservative analysis using design standards is appropriate for critical infrastructure such as the water distribution system. Sufficient time needs to be allocated for environmental assessment, design, construction and commissioning. A phased approach to development may be required to allow time for analysis and upgrades.

   Wastewater Lagoon

   The wastewater lagoon has a rated capacity of 7,718 m3/day (MECP permit). OPA 16 identifies the facility can accommodate 8,100 people with a potential upgrade to 10,500 people by adding a fourth treatment cell.

   The FSR completed a capacity analysis and concluded the lagoon would operate at 82% capacity in 2044 if all existing serviced industrial land and the Caivan development was built-out.

   In our opinion, the FSR used several incorrect values in the analysis. The lagoon capacity is incorrectly shown at 7,781 m3/day. The unit occupancy is below the IMP value for all growth areas. The infiltration allowance of 0.033 L/s/ha is below the minimum value recommended by the Ministry of the Environment. The stated growth assumption appears to reduce other building permits from 34 per year to 15 per year.

   Collectively these changes will advance the timeline when a lagoon upgrade is required. We recommend a conservative analysis of critical wastewater infrastructure.

9. Issue 5 asks if the Application conforms to the policies, purpose, and intent of the Town of Perth Official Plan (the “Official Plan”). Issue 5 a) says that the conformity test will consider, but not be limited to, several policies of the Town of Perth Official Plan including 5.2 Sewage and Water and 5.3 Storm Water Management and Drainage.

Official Plan Policy 5.2 Sewage and Water

Policy 5.2 F) states Council may consider development in the New Residential Area designation (Sect. 8.1.4) prior to the development of existing residential areas of the Town when the proponent submits a comprehensive plan and supporting studies that address specific land use matters including:

1) The availability of sufficient residual treatment capacity for municipal water and sanitary sewage services required to meet the projected requirements of the proposed development, in addition to any preceding servicing allocation and in compliance with Section 8.1.4.

Refer to discussion on Water Tower and Wastewater Lagoon outlined above in Issue 2.

2) The design of an infrastructure plan that will provide for the cost-effective and efficient integration/extension of roads, municipal water and sewage services and utilities to exiting infrastructure services.

Water Distribution

The Functional Servicing Report (FSR) recommends a connection to the existing water distribution system at both North Street and Rogers Road. The design does not conform to the IMP preferred solution that recommends connections at both North Street and Inverness Avenue.

In our opinion, the design does not provide the necessary redundancy and presents a cascade failure risk for the distribution system. An event that leads to the failure of one pipe segment is more likely to affect adjacent infrastructure. The water connection points should be separated to improve system reliability and hydraulics, while removing duplicate infrastructure from the municipal right-of-way.

The hazard presented by the possible loss of all water to the development area is deemed unacceptable with fire protection compromised until repairs are complete. The City of Ottawa stipulates a maximum of 50 dwellings can be serviced from a single watermain. The National Fire Protection Association Table 11.1.4.1(a) suggests 100 dwellings as the limit for reasons of access. With no clear provincial policy, the matter becomes one of engineering judgement. A reasonable Phase 1 limit from a single-feed water supply perspective is about 100 units.

Crossing the Tay River for the second watermain connection potentially affects the draft plan and may require land acquisition. These matters should be resolved before an application is submitted.

Wastewater Collection

The FSR recommends a forcemain direct wastewater to existing sewers near Roger Road and Jessie Drive.

The proponent should include dual forcemains between the new pump station and outlet to improve operating conditions, system reliability, and future repairs.

Official Plan Policy 5.3 Storm Water Management and Drainage

Policy 5.3 C) outlines the principles which Council intends to utilize in its approach to stormwater management with Subsection 3 stating that proposed development will not result in increased downstream flooding or erosion or cause adverse effects on receiving waters by appropriate management of stormwater volumes and contaminant loading.

Policy 5.3 D) states it is the intent of Council to incorporate stormwater management controls into the development review and approval process. Proponents of development will be required to plan for and undertake stormwater management which complies with the above principles as well as any master drainage plan. This may require a sub-watershed management plan for large tracts of land or a stormwater management plan. Proponents may utilize best management practices where they are consistent with and will achieve the Town's water quality and quantity targets.

The developer has proposed installation of Oil-Grit Separator (OGS) units in two drainage areas to provide quality control of stormwater runoff. This approach is contrary to the Infrastructure Master Plan (IMP) that stipulates Enhanced Treatment of stormwater drainage. Enhanced Treatment of residential stormwater effluent is typically achieved via removal of at least 80% Total Suspended Solids (TSS).

A properly designed wet pond, as recommended in the IMP, is a proven technology that will achieve the Enhanced Treatment objective for stormwater. By contrast, OGS units are an emerging technology subject to increased scrutiny. The TSS removal rates claimed by OGS manufacturers are being called into question by some authorities. The Canadian Environmental Technology Verification (ETV) protocol entitled "*Procedure for Laboratory Testing of Oil-Grit Separators*" attempts to more accurately simulate particulate size and floatable hydrocarbons in the effluent stream. Environmental Science & Engineering Magazine published that "an examination of the sediment capture results for the range of devices tested demonstrates that OGS devices are suitable for pretreatment applications and can be reasonably sized to capture 60% of the ETV particle size distribution on an annual basis".

The OGS unit is typically installed where capture of oil or fuel is important with the unit commonly installed at gas stations, fast food restaurants, and industrial zones. We do not support the applicant's proposal to provide stormwater quality control primarily via OGS treatment units. The design does not comply with the IMP and may not achieve the OP objective.

10. Issue 10 asks if the proposed development can be accommodated with appropriately sized and located stormwater infrastructure that avoids potential impacts on the Tay River and Grant's Creek floodplains.

    The Infrastructure Master Plan (IMP) outlines stormwater targets including:

    a) ensure post-development flow does not exceed pre-development flow rates
    b) confirm the change in flow does not increase the risk of flooding; and
    c) provide *Enhanced* total suspended solids removal per MECP criteria.

The Functional Servicing Report identifies three wet ponds and two Oil-Grit Separators to achieve the stormwater objectives. Several Low Impact Development (LID) measures are proposed to help achieve the quality treatment target including roof leader discharge to grassed areas, dry swales, rain barrel education program, perforated pipes, and catch basin shields.

Wet ponds are deemed an appropriate technique to achieve the IMP stormwater targets of flow control, flood risk, and quality treatment. The stormwater facility (SWMF), as a constructed and managed feature, is typically located outside the floodplain and away from environmentally significant areas. The proponent has suggested a change to the floodplain boundary that remains unresolved with the regulatory agency (RVCA). Until the new floodplain has been established, it is premature to locate the pond block on a draft plan. The proponent should use the existing regulatory floodplain boundary or complete the process to establish new floodplain limits before submitting their application.

The OGS treatment units are deemed inappropriate for the reasons outlined above in Official Plan Policy Section 5.3 Storm Water Management and Drainage.

11. Conclusion

The applicant should provide a second watermain connection in general conformance with the IMP for reasons of public safety (fire protection). The proposed design does not provide appropriate system redundancy and presents an unacceptable risk.

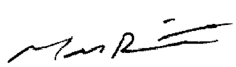
The applicant should provide two wastewater forcemains from the proposed pump station to the discharge outlet near Roger Road and Jessie Drive to improve operating conditions, system reliability, and future repairs.

The applicant should update their analysis of water tower infrastructure using design parameters from the IMP for growth. The purpose is to identify when the upgrades are required and establish a Phase 1 development limit until the environmental assessment, design and construction work is complete.

The applicant should update their analysis of the wastewater lagoon using design parameters from the IMP. The purpose is to identify when the facility upgrades are required and if the Caivan development will trigger this work.

Until these outstanding items are completed and incorporated into the design, the applications are premature and should not be approved.

Prepared by:



Mark Bissett, P.Eng.
Senior Project Manager, Land Development

APPENDIX A

Resume

Mark A. Bissett, P. Eng.

NOVATECH
Engineers, Planners & Landscape Architects

Position:

Senior Project Manager Land Development & Public Sector Engineering
1998 - Present

Education:

B.A.Sc., University of Ottawa
1994

Affiliations:

P.E.O.

Expertise:

Land/Site Development

Municipal Infrastructure

Mr. Bissett is a Senior Project Manager with 25 years of progressive experience in a wide range of civil projects. His current responsibilities focus on the design and construction management of municipal and land development projects. His expertise includes design of subdivisions and site plans, contract administration, cost sharing, and construction management.

Land Development

Fernbank, Pond 1 ***(2022 – 2023).*** Design of a stormwater management facility to service a new 74ha community in West Ottawa. Establish fish habitat outlet channel and obtain agency approvals (DFO, MECP, Conservation Authority, City of Ottawa). Storm sewer hydraulic modelling and flow routing from upstream drainage area. Analysis of downstream Carp River capacity. Cost estimate and tender preparation. Construction pending.

Fernbank Crossing Subdivision, Phases 1-5 ***(2012 – 2023).*** Detailed design of a 700-unit residential subdivision including grading, water and sewer, road works, utilities, and external agency coordination (City of Ottawa, conservation authority, school boards, adjacent landowners, utility companies, home builders, etc.). The water distribution and sewer systems were hydraulically modelled. Roadway noise was analyzed, and mitigation measures designed. Local and collector road network design for the subdivision. Post-design services include cost estimates, tender documents, contract administration, and construction management.

Klondike Ridge Subdivision ***(2021 – 2023).*** Direct the detail design of a 58-unit residential subdivision and apartment block including grading, water and sewer, road, and utility infrastructure. Reconstruction of Klondike Road with a service crossing of Shirley's Brook. Coordinate subconsultant teams (geotechnical, environmental, planning, and architectural). Work with approval agencies (City Departments, Conservation Authority). Construction budget and tender preparation.

Barrhaven Conservancy Lands ***(2020).*** Civil design peer review of an 89ha draft plan of subdivision completed for the City of Ottawa.

Fernbank, Pond 2 ***(2020).*** Design and approval of a stormwater management facility servicing a 29ha development parcel. Coordination with subdivision design team, approval agencies (City, CA, MOE), subconsultants (survey, geotechnical), landowners, and general contractor. Facility is now operational.

200 Baribeau ***(2022).*** Direct the detail design of a 91-unit residential development in Vanier within the historic floodplain. Agency permits (City, RVCA, MECP) are issued; construction start pending.

Provence, Block 126 ***(2020 – 2023).*** Direct the design and approval of a 40-unit residential development in Orleans. Work includes tender preparation, cost estimate, and construction management.

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Municipal Infrastructure

Abbott Street Extension *(2018).* Design and construct a 500m road extension, including sewer, water, roadway grading and drainage, and streetlighting. Geotechnical coordination and permit acquisition (Ministry of Environment, Rideau Valley, City of Ottawa, Hydro One). Prepare cost estimates and landowner cost sharing agreement.

2740 Cedarview *(2018 – 2023).* Direct the design of a 194-unit residential development. Civil work includes survey, detail servicing and grading design, stormwater management, noise impact, and utility. Coordinate subconsultant team including traffic, environmental, archeology, and geotechnical. Stakeholder consultations with school board, and community church. Contract administration and construction management is ongoing.

Kizell Draft Plan *(2018).* Concept plan development with stakeholders (developer, adjacent landowners, school board, parks, City, Hydro One). Preliminary servicing and stormwater facility design, grading and earthworks analysis, arterial road corridor development, and coordination of trunk sewer alignment and profile. Subconsultant coordination (Geotechnical, Environmental, Archeological, and Transportation disciplines). Cost estimate preparation and development of landowner cost sharing agreement for the Fernbank North Community.

Terra Flats *(2017).* Direct the design and construction of a 96-unit residential development. Civil work includes servicing, grading and drainage, utility coordination, cost estimation, and tendering. Coordinate subconsultant disciplines (architectural, geotechnical, mechanical & electrical). Approvals and permits obtained, contract administration and construction inspection on behalf of owner.

Metro, Petawawa *(2014).* A 5.3 hectare commercial/retail development block with a Food Basics grocery store as the anchor facility. Site servicing, grading, and stormwater management designed were prepared to client specifications. Tasks included servicing design, grading and embankment design, coordination with adjacent land developments, municipal approvals, assistance with contract negotiations, and construction management.

Foxwood Collection in Fernbank *(2014).* Located in the Fernbank community, this parcel consists of 7 apartment buildings (84 units). Standard design elements include servicing, grading, and utility infrastructure. Client assistance with site plan and building layout, coordination with adjacent roadway design, tender preparation, permit acquisition, and construction management was provided.

Mattino Subdivision, Longfields *(2014).* A 200-unit residential subdivision whose work included the design and construction management for 500m of roadway and associated underground infrastructure. Engineering tasks included hydraulic analysis of watermain, sanitary and storm sewer design, and coordination of utility works. Construction services include tender specifications, contract administration, project management and supervision.

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Fernbank Trunk Sewer *(2013).* Design of the 750mm sanitary trunk sewer to service the Fernbank Community (674 ha, population ≈ 30,000). The project involves City of Ottawa consultation and assistance with the Hazeldean Pump Station upgrades, and ongoing coordination with the 11-member Fernbank Landowners Group for design requirements and cost sharing. The works are operational, with Mr. Bissett responsible for contract administration and project management.

Aveia Subdivision *(2012).* A 60-unit residential development in east Ottawa. Works include design, coordination, and approval of municipal infrastructure. Contract administration, construction management and field inspection services provided.

Brookside Subdivision, Ponds C & D *(2006).* Design and approval of stormwater management facilities to service development parcels of 26ha and 25ha respectively. Provision of water quality and quantity control prior to release into Shirley's Brook. The scope included approvals, contract administration, and construction management.

Master Planning Work

Master Servicing Study, Fernbank Community Design Plan *(2008).* This was a high-level, multi-disciplinary planning exercise that encompassed approximately 675ha of development land. The project followed the Municipal Class EA process and evaluated alternative development scenarios in participation with local government and public stakeholders. Mr. Bissett's role included the servicing design of the on-site development lands, analysis of external sanitary trunk infrastructure, and coordination of the engineering consultant teams.

Brookfield Tridel Lands, Official Plan Amendment Proposal *(2004).* Preliminary design and feasibility study for 233 hectares of development lands outside the urban boundary. Consultation was undertaken with City of Ottawa and Conservation Authority partners to address primary concerns associated with incorporation of development lands into the urban boundary. An analysis was conducted of the regional impact on existing city infrastructure and design solutions were proposed to reconcile localized capacity issues. Stormwater management initiatives required conformance with the Carp River Watershed Study for the Tridel lands, while the Brookfield lands incorporate the preliminary findings of the ongoing Jock River Reach 2 Subwatershed Study. Sanitary modelling of the Kanata South region has identified development constraints. Design solutions were prepared that included construction of a twinned trunk main in addition to retrofits to the Hazeldean Pump Station. Analysis of the 3W water distribution region was completed in participation with City of Ottawa forces. This modeling exercise forecast population and development growth within the Kanata region to 2021 in order to assess the timing and infrastructure requirements imposed by the development lands.

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Municipal Infrastructure

Municipal Infrastructure Projects

City of Ottawa, South Nepean Collector Phase II *(2015).* This project was the design and construction of 2400m of 900mm & 1050mm diameter trunk sanitary sewer. Depths ranged from 8 to 10m. Design considerations included selection of preferred pipe material, construction technique (open-cut vs trenchless for certain sections), maintenance hole and connection details, and alignment development. Approvals were required from the MOECC (ECA & PTTW), MNR, RVCA, MTCS (Stage I & II Archaeology), DFO, as well as various City Departments.

City of Ottawa, Watermain Reconstruction: Vancouver Avenue *(2014).* This project is located between Bank Street and Nottinghill Avenue and was initiated to replacing ageing watermain infrastructure, and to re-surface the roadway asphalt. Project elements include engineering design drawings, utility coordination, public consultation, tender preparation, construction inspection, and contract administration.

City of Ottawa Roadway Reconstruction: Dow's Lake Road *(2011).* This project is located in a residential neighborhood adjacent Commissioner's Park and Dow's Lake (NCC lands). Ageing pipeline and sewer infrastructure is to be replaced, and the road platform rebuilt to current standards. Successful project delivery includes consultation and coordination between City of Ottawa departments, the National Capital Commission, Ontario Ministry of Environment, utility companies, Dow's Lake Residents Association, and specialist consultants (geotechnical, landscape architecture, underground investigation). Design elements include protection of decorative NCC retaining walls, combined sewer abandonment, and storm water management. Construction management and contract administration services were provided.

City of Ottawa Roadway Reconstruction: Cambridge Street, Frederick Place and Jackson Ave *(2009).* This stimulus-funded municipal infrastructure project consists of rehabilitating several local roads in the Dow's Lake neighbourhood. The area is mostly residential, is bordered by a section of urban arterial main street, and suffers from cut-through traffic looking to avoid the busy Carling and Bronson intersection. Included in the assignment is the rehabilitation of the watermain, combined sewer, integration of city-designed street lighting, and storm water management. Active public consultation and construction management lead to successful project delivery.

Ontario
Ontario Land Tribunal

ACKNOWLEDGMENT OF EXPERT'S DUTY

Case Number	Municipality
OLT-23-000534	Town of Perth

1. My name is Mark Bissett. I live at 4A Oakley Avenue, Nepean
   in the Province of Ontario.

2. I have been engaged by or on behalf of the Town of Perth to provide evidence in relation to the above-noted OLT proceeding.

3. I acknowledge that it is my duty to provide evidence in relation to this proceeding as follows:

   a. to provide opinion evidence that is fair, objective and non-partisan;

   b. to provide opinion evidence that is related only to matters that are within my area of expertise; and

   c. to provide such additional assistance as the OLT may reasonably require, to determine a matter in issue.

   d. not to seek or receive assistance or communication, except technical support, while under cross examination, through any means including any electronic means, from any third party, including but not limited to legal counsel or client.

4. I acknowledge that the duty referred to above prevails over any obligation which I may owe to any party by whom or on whose behalf I am engaged.

Date...April 15, 2024............... ...Mark Bissett...
Signature

APPENDIX B

Functional Servicing Report Review Memo

NOVATECH
Engineers, Planners & Landscape Architects

M E M O R A N D U M

DATE: **JULY 25, 2023**

TO: **GRANT MACHAN, TOWN OF PERTH**

FROM: **MARK BISSETT**

RE: **WESTERN ANNEX LANDS – 141 PETER STREET**
FUNCTIONAL SERVICING REPORT REVIEW
123056

CC: **EDSON DONNELLY, STEVE PENTZ, JENNIFER LUONG**

Novatech was retained to provide assistance with planning, engineering, and transportation matters related to Draft Plan, Official Plan Amendment, and Zoning Amendment applications for the above development. The development consists of 640 single family homes and 299 townhouse dwellings.

We have reviewed the following civil engineering related documents:

- Functional Servicing Report for Caivan (Perth GC) Limited Proposed Residential Subdivision, by DSEL (February 2023)
- Infrastructure Master Plan, Western Annex in the Town of Perth, by JP2G (November 2019)

This memo provides a summary of our review and recommendations.

Water Supply

The water distribution system needs to reliably convey adequate supply for domestic consumption and fire protection to the new community. This is achieved by maintaining system pressures during a wide range of operating conditions. Typically, a water distribution model is prepared to analyze the design based on pipe layout (size, length, material), demand and background pressure to ensure compliance with regulations. Reliability is a key objective commonly assessed via break-analysis whereby the designer reviews how the distribution system would perform during a failure scenario. These are infrequent events of short duration (i.e., frozen pipe repair) that potentially affect many dwellings creating both public nuisance while supply is unavailable and hazard while hydrants are non-functional. Connection redundancy to the supply network often permits the distribution system to continue operating during a failure scenario with reduced pressure.

Caivan has proposed a dual watermain crossing at the Peter Street Bridge with connections in the vicinity of North Street and Lustre Lane to service the new subdivision. They used a hydraulic model Stantec prepared in 2016 for the Town of Perth to establish background conditions, then added the subdivision pipe network and demands to analyze system pressures. The proposed water distribution design is a viable solution that complies with regulatory criteria and provides two connections to the existing network, but it may be vulnerable to cascade failure.

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We are concerned the twin bridge crossing and proximity of connection to the existing network reduces reliability for the development. An event that leads to failure of one pipe segment is more likely to affect adjacent infrastructure. The proposed design deviates from the Infrastructure Master Plan (IMP) that identifies a crossing of the Tay River with a connection near Inverness and North Street.

In sum, the dual water connection proposed by Caivan is technically viable but is more vulnerable to failure. Separating the water connection points will improve both system redundancy and hydraulics, while removing duplicate infrastructure from a planned roadway. We recommend the developer provide two spatially separated water connections as outlined in the IMP.

Both the Functional Servicing Report and IMP identify a future need for additional reservoir and/or elevated storage (water tower). The timing, scope, and obligation for the expansion works should be analyzed as part of detailed design; current information suggests these capital works are not urgent.

Wastewater Collection

A municipal wastewater system is generally comprised of gravity sewers, local pump stations, discharge (forcemain) lines, and a treatment facility. Peak flow is calculated using criteria provided by the province with the engineer responsible to design a conveyance system with appropriate freeboard to basements. Typically, sewers should not exceed their free-flow conveyance capacity and pump stations should have an emergency overflow in the event of extreme weather.

Caivan has proposed a network of gravity sewers draining to a single pump station to service the development lands. The local pump station has an emergency overflow into an adjacent storm pond in the event of catastrophic failure. A forcemain is routed through the subdivision, across the Peter Street Bridge, and extends southeast along Roger Road discharging into the 750mm trunk sewer near Jessie Drive. Wastewater would flow by gravity to the sewage lagoon at Wildlife Road for treatment before discharge into the Tay River. Research suggests the lagoon has adequate capacity to service the development lands.

The wastewater design deviates from the IMP that recommends two local pump stations for the development with discharge to gravity sewers in addition to upgrades at the Cockburn PS. On this matter, Novatech supports the proponent recommendation to construct a single local pump station for reasons of efficiency, cost, and maintenance. We believe a single local pump station is mutually beneficial for both the developer and town.

The proposed wastewater design presents a viable solution that will by-pass the Cockburn PS which is near capacity and avoids gravity sewers approaching their free-flow limit. The preceding benefits are contrasted by significant public disruption to Roger Road during the forcemain construction.

The town might benefit from a hybrid approach whereby a single local pump station discharges to gravity sewers across the Peter Street Bridge. This would require additional analysis of the sewer system to ensure adequate freeboard to basements along the discharge line. The Cockburn PS would require upgrades as outlined in the IMP, but this appears viable and would significantly increase the firm capacity of the station offering increased public protection and growth opportunities for the town. We recommend the proponent explore this hybrid option.

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Stormwater Management

Stormwater design is regulated by the Ministry of Environment, Conservation and Parks and the Rideau Valley Conservation Authority (RVCA) with the objective to provide both quantity and quality control of runoff from new developments. Quantity control is achieved by restricting outflow to pre-development discharge rates for a variety of design storms. Quality control is typically achieved by removing Total Suspended Solids (TSS) prior to release into the environment. Low Impact Development (LID) measures can assist with both quality and quantity control.

Gravity sewers typically convey stormwater to designated treatment facilities such as wet ponds. The designer must calculate the hydraulic grade line to ensure adequate clearance to the underside of footing elevation as protection against basement flooding. Stormwater ponds are commonly located in naturally low-lying areas adjacent to a receiving watercourse. The pond location needs to consider the flood elevation under a variety of return periods and any natural environment features such as Provincially Significant Wetlands.

Caivan has proposed three stormwater management facilities (SWMF) around the development with a normal water level at the modelled 2-year elevation of the receiving watercourse (either the Tay River or Grant's Creek). This deviates from the IMP that recommends the pond water level is set at the 100-year elevation. Novatech supports setting the normal water level in the ponds based on the 2-year elevation. This conforms to standard design practice, keeps the earthwork operation within reasonable limits, and appropriately protects the public.

The proponent recommends the installation of oil and grit (OGS) separators in two locations that cannot easily drain to a pond. These units provide some treatment function but are not as effective as a wet pond; further the OGS units require ongoing maintenance. We recommend the town challenge the developer to route these areas to a SWMF.

Stormwater ponds are subject to regulatory floodplain and development restrictions; facilities are typically located outside the 30m setback from wetlands and other sensitive areas. Confirming the 100-year floodplain location is deemed critical to advancing the application as this establishes the development boundary and dwelling setbacks. The IMP indicates that any SWMF located within the floodplain would need approval through a satisfactory Environmental Assessment process that demonstrates there is no viable alternative. The floodplain boundary is regulated by RVCA, and confirmation of the line requires their approval.

In short, the Caivan stormwater design generally follows the regulatory intent, but we cannot meaningfully complete a review until the floodplain is established with consensus from the RVCA.

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APPENDIX C

Evidence in Chief

2. If the above is not possible then the next preferred measure is a pressure reducing valve, as a central unit, to be located in a chamber or facility.

3. As a last resort, pressure reducing valves to be installed immediately downstream of the isolation valve in the home/building, located downstream of the meter so it is owner maintained.

4.2.8 Population Density

Proposed Development Land – When the number and type of housing units within a proposed development are known, the calculation of population for the proposed development shall be based on the following:

Table 4.1 Per Unit Populations

Unit Type	Persons Per Unit
Single Family	3.4
Semi-detached	2.7
Duplex	2.3
Townhouse (row)	2.7
Apartments:	
Bachelor	1.4
1 Bedroom	1.4
2 Bedroom	2.1
3 Bedroom	3.1
Average Apt.	1.8

(Source: custom tabulation of 1996 Census data for units built in the previous five years)

In the absence of any specific information use 60 persons per gross hectare density to estimate average population for suburban type of residential development.

Pre-zoned Land - When lands are already zoned for a specific residential use and detailed information is not available calculate the persons per net hectare by dividing the above persons per unit by the units per net hectares allowed by the zoning designation. Persons per gross hectare are approximately 61% of the persons per net hectare. See City of Ottawa Zoning By-law 2008-250.

Table 4.2 Consumption Rates for Subdivisions of 501 to 3,000 Persons

Demand Type	Amount	Units
Average Day Demand		
Residential	350	L/c/d
Industrial - Light	35,000	L/gross ha/d
Industrial - Heavy	55,000	L/gross ha/d

August 18th 2021

TECHNICAL BULLETIN ISTB-2021-03

The document entitled *Ottawa Design Guidelines – Water Distribution,* First Edition, dated July 2010 and all subsequent Technical Bulletins, are amended by the following changes:

Summary of Changes

This bulletin revises the acceptable locations for water services, calculation methods for fire flows, average daily residential water usage, and servicing requirements for industrial, commercial, and institutional facilities.

Specific Changes

Based on the above overview, the specific change to the contents of the *Ottawa Design Guidelines – Water Distribution* are shown below.

Section	Section Title	Page	Revision
4.2.8	Population Density	48	In Table 4.2 Consumption Rates for Subdivisions of 501 to 3,000 Persons, the residential average day demand amount of 350 L/c/d shall be replaced with 280 L/c/d.
4.2.11	Fire Demand Calculation Method	50	Replace section 4.2.11 in its entirety with the following: When calculating the fire flow requirements and affected pipe sizing, designers shall use the method developed by the Fire Underwriters Survey, and follow the protocol for application of the method as provided in Appendix H: Protocol to Clarify the Application of the Fire Flow calculation method Published by Fire Underwriters Survey (FUS). The requirements for levels of fire protection on private property in urban areas are covered in Section 7.2.11 of the Ontario Building code. If this approach yields a fire flow greater than 9,000 L/min then the Fire

			Underwriters Survey method shall be used to determine these requirements instead. The requirements for levels of fire protection on private property in rural areas are based on the FUS method in all cases.
4.3.1	Configuration	52	Replace the second paragraph in section 4.3.1 in its entirety with the following: Industrial, commercial, institutional service areas with a basic day demand greater than 50 m³/day and residential areas serving 50 or more dwellings shall be connected with a minimum of two watermains, separated by an isolation valve, to avoid the creation of a vulnerable service area. Individual residential facilities with a basic day demand greater than 50 m^3/day shall be connected with a minimum of two water services, separated by an isolation valve, to avoid the creation of a vulnerable service area.
4.6.4	Location	72	Replace the fourth paragraph in section 4.6.4, including the bullet point list, in its entirety with the following: All services 50 mm and smaller shall be located under landscaped areas, except where lots have no landscaped area, or where locating the service under the landscaped area would prevent the planting or retention of a tree. Where services are permitted to run underneath garages, they shall be sleeved with a 200 mm PVC pipe from the edge of the garage slab to the foundation wall.
Appendix A	Glossary of Terms	96/97	Replace entry titled Vulnerable Service Area in its entirety with the following: **Vulnerable service area:** An industrial, commercial or institutional area with a basic day demand greater than 50 m³/day, or a residential area serving 50 or more dwellings, where a single point of

			infrastructure failure would result in loss of or substandard service. Add entry after Transmission Main: **Tree**: As defined by City of Ottawa By-Law No. 2020-340, or as amended.

End of Technical Bulletin ISTB-2021-03

APPENDIX 'D'

EXTRANEOUS FLOW ALLOWANCES

In the design/assessment of any sanitary sewerage works facility there should be an allowance made for extraneous flows. (i.e., infiltration/inflow). The absolute value utilized in any specific system design/assessment will vary depending upon local conditions and/or the nature of the application of the infiltration allowance (i.e., sewer design; sewage pumping station design; sewage treatment plant design; existing sewerage works assessment and acceptance testing of new sewers).

In this Appendix the customary or design units are stated under each heading. Based on a typical plan of subdivision these customary units have been converted to "equivalents" for illustrative purposes only.

Acceptance Testing of New Sewers

Section MOE 02650, Clause 3.16 - Field Testing of the Ministry's Standard Specification for the Construction of Sewer and Watermains lists an allowable extraneous flow/leakage (infiltration/exfiltration) of 0.075 litres/millimetre diameter per 100 metres of sewer per hour.

This "customary" unit converts to the following based on the typical plan of subdivision.

a) 22 L/cap.d
b) 0.01 L/ha.s

Sewer Design

Typically, in the design of a sanitary collection sewer system a peak extraneous flow allowance of between 0.10 and 0.28 L/ha.s is made. These customary units, when applied to a typical plan of subdivision convert to the following values.

a) 0.72 to 2.03 L/mm Ø/100 m/h*
b) 212 to 593 L/cap. d

* total sewer system including main sewers, service connections and building sewers.

The above-noted design value is for new collector sewer systems and assumes;

a) Strict control by the municipality of building sewer connections (i.e., no roof drains or foundation drains connected directly or indirectly to the sanitary sewers).

b) Adequate design and inspection during the construction of the public sewers and the private connections.

c) A routine inspection and maintenance programme will be undertaken by the municipality/operating authority to ensure that a "tight" sewer system is maintained.

Sewage Pumping Stations and Sewage Treatment Works

As with the design of new sanitary collector sewers it is accepted practice to make an allowance for extraneous flows in the design of any sewage pumping station or sewage treatment facility. However, as the design period for pumping stations and treatment facilities is generally less than that of the sewers (i.e., 10-20 years vs 20-40 years) a lesser extraneous flow allowance should be used. Also, while the allowance is made in sewer design it is assumed that the actual volumes received will be substantially less because of the controls and inspections which are undertaken during and after construction.

Therefore, in the design of any new pumping station or treatment facilities complementary to a new collector sewer system an extraneous flow allowance of 90 L/cap. d (average) and 227 L/cap.d (peak) should be made.

This design value, when applied against the typical plan of subdivision, is approximately equivalent to;

a) 0.043 - 0.107 L/ha. s
b) 0.308 - 0.776 L/mmØ/100 m/h

Assessment of Existing Sewage Works

The capital and operating costs associated with new sewerage works facilities are increasing steadily. In addition, the Ministry's "Water Management - Goals Policies, Objectives and Implementation Procedures of the Ministry of the Environment" requires that all Certificates of Approval for new sewage treatment facilities contain the effluent requirements for the facility.

Accordingly, studies to ascertain the extent and source of extraneous flows are becoming more important.

Experience in the United States has indicated that if the extraneous flow, based upon the highest weekly average within a 12 month period, is less than 140 L/mm.km.d, rehabilitation of the sewer system will not be economical.

Based upon the preceding typical plan of subdivision this value of 140 L/mm.km.d is approximately equivalent to

a) 0.08 L/ha.s
b) 171 L/cap.d

NOTES:

1. The "typical" plan of subdivision has the following characteristics.

Overall Area -	23 ha
Total Lots/Units -	263
Typical Set Back -	7.6 m
Population Density -	3.0 persons/lot (unit)
Main Sewer length and size -	3072 m of NPS-8*
Sewer lateral length and size -	2645 m of NPS-5*
Building sewer length and size -	2004 m of NPS-4*

*Nominal pipe size is indicated with a NPS designator number.

2. Critical in reducing the volume and rate of flow to be handled by a foundation drainage system and hence, its ability to keep a basement dry is lot grading. Therefore, in all new development, every effort should be made to ensure that the lot is drained away from the foundation walls.

10.1.3.4.7* Prior to occupancy of any portion of the development, supporting infrastructure shall be installed, operational, and approved by the AHJ.

10.1.3.5 Public Notification.

10.1.3.5.1 The applicant for a land development or land use change shall provide written documentation and illustrative maps to the AHJ that specify areas that will be included in the proposed land development or land use change.

10.1.3.5.2 One or more published public announcements shall be made to publicize one or more public hearings at which the AHJ will present the proposed project, outline proposed methods to comply with Chapters 10 through 18 using best applicable data, and allow testimony by the public.

10.1.3.5.3 The applicant for a land use or land development change shall submit a written proposal to the AHJ regarding the level to which Chapters 10 through 18 shall be imposed, including justifications that demonstrate compliance, fire service impact, and responses to the public testimony.

10.1.3.5.4 The AHJ shall review the applicant's land use or land development change proposal and public testimony and render a written final determination if the proposed land use or land development change complies with Chapters 10 through 18.

10.1.3.6 Public Appeals Process. Any person shall be permitted to appeal a decision of the AHJ. A process for appeal shall be made available to the public by the appropriate administrative body of the local adopting authority.

10.1.3.6.1 Adoption Appeals.

10.1.3.6.1.1 Appeals shall be permitted, in part or whole, to the adoption of Chapters 10 through 18.

10.1.3.6.1.2 Upon appeal, the designated local government having authority shall affirm, modify, or disapprove in writing the determination of the AHJ in accordance with 10.1.3.5.3.

10.1.3.6.2 Other Appeals. Appeals of individual requirements shall be permitted when it is claimed that any one or more of the following conditions exist:

(1) The true intent of the requirements described in Chapters 10 through 18 has been incorrectly interpreted.
(2) The provisions of Chapters 10 through 18 do not fully apply.
(3) A decision is unreasonable or arbitrary as it applies to alternatives or new materials.

10.1.3.7 Impact Assessment. The AHJ shall conduct an impact assessment of the proposed land development or change in land use to determine the extent of impact on fire services currently available, as specified in Chapter 12 of this standard.

10.2 General. As a minimum, the AHJ shall require preliminary, working, and as-built plans to be submitted in a timely manner.

10.2.1 Plans shall demonstrate compliance with this standard.

10.2.1.1 The AHJ shall be permitted to require the review by an approved independent third party with expertise in the matter to be reviewed at the developer's expense.

10.2.1.2 The independent reviewer shall provide an evaluation and recommend necessary changes to the proposed plan development.

10.2.1.3 The AHJ shall be authorized to require design submittals to bear the stamp of a registered design professional.

10.2.1.4 Review and approval by the AHJ shall not relieve the applicant of the responsibility of compliance with this standard.

10.3 Noncombustible Material. See 25.2.1.

Chapter 11 Means of Access (NFPA 1141)

11.1 General.

11.1.1 This section shall apply to all means of access, publicly or privately owned, whether or not they are designated as public thoroughfares.

11.1.2 Means of access shall be provided to all buildings more than 400 ft^2 (37 m^2) in ground floor area and to public occupancies with structural components.

11.1.3 The AHJ shall have the authority to require a means of unlocking any security feature that is installed.

11.1.3.1 Any gates shall not be located closer than 30 ft (9.144 m) from an intersection and shall open in the direction of emergency vehicle travel unless other provisions are made for safe personnel operation.

11.1.3.2 The clear opening through gates shall have a usable width at least 2 ft (0.6 m) wider than the means of access it controls.

11.1.4 Number of Means of Access.

11.1.4.1* A land development shall have one or more means of access in accordance with Table 11.1.4.1(a), Table 11.1.4.1(b), or 11.1.4.2, whichever produces the greatest number.

11.1.4.2 Where residential areas are mixed with nonresidential areas, the minimum number of access routes shall be determined by calculating five parking spaces for each dwelling unit, adding that number to the parking spaces count for the nonresidential area, and using Table 11.1.4.1(b).

Table 11.1.4.1(a) Required Number of Access Routes for Residential Areas

Number of Households	Number of Access Routes
0–100	1
101–600	2
>600	3

Table 11.1.4.1(b) Required Number of Access Routes for Nonresidential Areas

Number of Parking Spaces	Number of Access Routes
0–1250	1
1251–3000	2
>3000	3

11.1.4.3 Where multiple means of access are required, one of the means of access shall be permitted to be restricted for emergency use only, when approved by the AHJ.

11.1.4.4 Where multiple means of access are required, they shall be located as remotely from each other as practical and acceptable to the AHJ.

11.2 Roadways. Roadways shall be constructed and maintained in accordance with this section.

11.2.1* The legal right-of-way for a roadway shall accommodate the width necessary for the construction, drainage, erosion control, and maintenance of the roadway, and provisions for utilities and sidewalks.

11.2.2 Roadways shall be constructed of a hard, all-weather surface designed to support all legal loads of the jurisdiction.

11.2.3 Roadways shall have a minimum clear width of 12 ft (3.7 m) for each lane of travel, excluding shoulders and parking.

11.2.3.1 Curves shall not reduce the width of the roadway.

11.2.3.2 Provisions shall be made for drainage, snowbanks, parking, utilities, and the like such that they do not impinge on the minimum clear width.

11.2.4 Where parking is permitted, such space shall be provided in accordance with Section 11.4.

11.2.5 Any roadway intersecting with another shall be sloped to prevent the accumulation of water and ice on either roadway.

11.2.6 At least 13 ft 6 in. (4.2 m) nominal vertical clearance shall be provided and maintained over the full width of the roadway.

11.2.7 Turns in roadways shall be constructed with a minimum radius of 60 ft (18.2 m) to the outside of the turn.

11.2.8 Median left-turn lanes and traffic signals shall be provided at intersections where necessary to prevent traffic from impeding fire department response time.

11.2.9 Where required by the AHJ, any traffic signal system shall have an automatic means for fire apparatus to control the signals to maintain an unimpeded right-of-way.

11.2.9.1 Sight distance shall be incorporated into the design of intersections.

11.2.10* Bridges and culverts shall be designed to accommodate a minimum of 100-year flood elevations and flows in accordance with accepted engineering practices.

11.2.11 Vehicle load limits shall be posted at both entrances to bridges where required by the AHJ.

11.2.12 Easements shall be obtained to permit vegetation clearance alongside roads to minimize the likelihood of evacuation routes being blocked during wildfire or other natural disasters.

11.2.13* Roadways shall not be designed and constructed to include speed bumps or speed humps.

11.2.14 Alternative traffic calming devices such as chicanes and roundabouts shall be acceptable with approval by the AHJ.

11.2.15 Roadway design shall incorporate provisions for emergency pull-offs, spaced according to the AHJ.

11.2.16 Grades.

11.2.16.1 Grades shall not be more than 10 percent, except as permitted by this section.

11.2.16.2* Grades steeper than 10 percent shall be permitted by the AHJ where mitigation measures can be agreed upon by the fire department and the road engineering department, taking into consideration climate, traffic load, environmental conditions, the number of turns that would affect traffic flow, and the ability of fire apparatus to operate on steeper grades.

11.2.16.3 The angle of approach and the angle of departure shall not exceed 8 degrees at any point on the roadway or its intersection with another roadway or fire lane.

11.2.16.4 Where local conditions do not allow the maximum angles of approach and departure be limited to 8 degrees, the AHJ shall permit greater angles where local emergency apparatus can accommodate such angles.

11.2.16.5 Where grades are less than 0.5 percent, the road shall be crowned in the center to prevent pooling of water in a traveled way.

11.2.16.6 The design of grade crossings at railroad tracks shall be done by a professional engineer with expertise in railroad grade crossings.

11.2.17 Dead Ends.

11.2.17.1 Every dead-end roadway more than 300 ft (91 m) in length shall be provided at the closed end with a turnaround having no less than a 120 ft (36.6 m) outside diameter of the traveled way.

11.2.17.2* The length of any cul-de-sac shall not exceed the firefighting capability of the fire department.

11.2.17.3* A cul-de-sac exceeding 1200 ft (366 m) in length shall be provided with approved intermediate turnarounds at a maximum of 1200 ft (366 m) intervals.

11.2.18 Signage.

11.2.18.1 Addresses and Street Names.

11.2.18.1.1 Addresses shall be assigned in a logical, consistent manner based on the local addressing system.

11.2.18.1.2 Street names shall be phonetically unique.

11.2.18.2 Sign assemblies with the name of each road shall be constructed of noncombustible material and installed at each intersection.

11.2.18.3 These signs shall be installed a minimum of 7 ft (2.1 m) above the traveled way.

11.2.18.4 The letters on the signs shall be no less than 4 in. (100 mm) in height, with at least a 0.5 in. (12.7 mm) stroke, reflective and of a contrasting color to the background of the sign.

11.2.18.5 Where required by the AHJ, signs shall also include references to address numbers pertinent for that section of the road.

platform and grating level. Divided wet wells should be considered for all pumping stations with discharge capacities in excess of 100 L/s or where three or more pumps are provided. Provisions should be made to permit the pumping station to continue operating while one portion of the wet well is dewatered for maintenance or modification. Sluice gates shall be provided for isolation of the wet well compartments.

7.2.4.11 Dry Pit Sump Pump Discharge to the Wet Well

In wet well/dry well installations, the sump pump discharge should be raised above the high level elevation, in either the wet well or dry pit, and should cross between the wells below the frost line. See Section 7.2.2.5.2.

7.2.4.12 Pipe Connections to Wet Wells

If more than one sewer enters the site or is required to be connected to the pumping station, a junction maintenance hole is preferred so that only one inlet to the wet well will be required. Appropriate stubs are to be provided within the junction chamber for future connections.

7.2.4.12.1 Inlet Sewer Elevation

Excessive entrainment of air into the flow stream entering the wet well should be avoided to prevent entrained air from reducing pump performance or causing loss of prime. Provisions necessary to address this may include drop tubes inside wet wells of small facilities, grade adjustments, or a drop maintenance hole upstream from the pumping station to lower the elevation of the inlet to the station. However, inlet sewers shall not enter the wet well at an elevation lower than the design capacity flow rate’s normal high liquid level.

7.2.4.12.2 Inflow Shutoff Provisions

An inflow shutoff installation (e.g. gate valve) is to be provided on the inlet to the wet well so that inflow to the wet well can be interrupted. Shutoff devices should be installed in the first maintenance hole upstream from the pumping station. Installing shutoff devices within the wet well is not recommended unless there is no alternative. Under these circumstances, provisions must be made for operation of the shutoff installation without entry to the wet well.

7.2.4.12.3 Emergency Flood Relief Conduit Elevation

See Section 7.2.1.6.8.

7.2.5 Forcemain Design

7.2.5.1 Forcemain System and Size Considerations

For the purposes of these guidelines the forcemains will be collectively referred to as the **forcemain system**. The construction of dual mains is primarily for improved operating conditions but also offers the added benefit of improved system reliability.

Dual forcemains allow the provision for a forcemain of reduced diameter leading to improved operating conditions during the initial phases of development as well as for on-going operation during typical dry weather flow conditions. The design of a sewage forcemain system is to include a study of the comparative costs of construction and long-term operation for alternative sizes. This analysis shall be conducted at the pre-design stage in consultation with the City of Ottawa.

There are practical limitations to the size options that may be considered, as flow velocities are required to exceed certain minimum values to prevent slime growth within the forcemain and to ensure solids are not deposited within the forcemain. It is also necessary to minimize the residence time of sewage within pumping station wet wells and forcemains to avoid the production of odorous, hazardous, and corrosive gases such as hydrogen sulphide. Forcemains should be a minimum size of 100 mm except where grinder pumps are used.

7.2.5.2 Flow Velocities and Retention Time Limits

Design velocities for normal operation at the time of commissioning shall be in the range of 0.9 to 1.5 m/s, considering both operating costs and prevention of solids accumulation. A range of 0.8 to 2.5 m/s, however, is acceptable over the full operating range considering rare low and high flow conditions respectively.

When the forcemain grade profile includes steep slopes or vertical sections, the minimum design velocity should be increased by an order of 50%. Where design flow velocities in buried forcemains exceed 2.5 m/s, any special provisions required to ensure stability of the forcemain shall be identified and incorporated in the design. A maximum flow velocity of 2.5 m/s is recommended.

7.2.5.3 Design Pressure Ratings and Materials

The design for forcemains shall consider normal static and dynamic operating pressures, the potential conditions that may occur due to outlet surcharge or blockages, as well as transient pressure (water hammer) effects. A transient pressure analysis is required to determine whether protection is required and appropriate provisions are to be incorporated into the pumping system design.

The forcemain (and station piping) must be checked for its ability to withstand whatever water hammer pressures may be experienced. If necessary, measures such as combination air release/air vacuum relief valves at critical forcemain locations, surge relief valves on the discharge header, or other protective measures may be required to avoid dangerous water hammer conditions. See Section 7.2.5.5 for further guidance on valving requirements for forcemain systems.

CANADA'S ETV PROTOCOL SETS A HIGH BAR FOR EVALUATING OGS DEVICES

By **Joel Garbon**

Many professionals within the Canadian stormwater management community are familiar with the use of oil-grit separators (OGS) to remove pollutants. The very name of this class of treatment technology strongly suggests which pollutants are targeted for capture. Certainly, there are many products being marketed as being effective for separation of oil and sediment. However, a closer examination is required to determine if marketing claims really hold up.

For instance, it is reasonable to assume that the terms "separation" and "capture" imply that separated/captured pollutant loads will accumulate within the device over time as more runoff volume is treated, and that these pollutants will be safely stored until cleanout. The expectation of the specifier, regulator and owner is that the captured sediment and oil will remain within the device, even during occasional high-intensity storm events that generate high influent flow rates.

In general, all OGS testing protocols allow the manufacturer to select any of their commercial model sizes as the test unit.

Retention of captured pollutants is a critical performance requirement. Simply capturing pollutants during relatively low-intensity storms, only to have them released during heavy downpours, is hardly effective treatment, and defeats the goal of protecting water resources. Therefore, it is appropriate that any testing programs designed to evaluate OGS performance characteristics include provisions to determine the propensity of a device to re-suspend/re-entrain and washout previously captured sediment and liquid hydrocarbons during high flow rate conditions.

The term "oil-grit separator" is used commonly in Canada, while the same technology is typically referred to as a "hydrodynamic separator" in the U.S. It is interesting to note that standardized laboratory testing protocols in the U.S. (such as the New Jersey Department of Environmental Protection protocol) focus exclusively on capture and retention of sediment, while the recently established Canadian Environmental Technology Verification (ETV) protocol, *"Procedure for Laboratory Testing of Oil-Grit Separators"* contains provisions for evaluating capture and retention of sediment, as well as retention of floatable hydrocarbons.

The advisory committee that developed the Canadian protocol included consultants, municipalities, conservation authorities, academics, and manufacturers. It recognized that testing of OGS devices needs to include provisions related to treatment of oil and fuel, which are pollutants of concern.

After examining the strengths and weaknesses of pre-existing testing protocols for OGS devices, the advisory committee established provisions in the Canadian ETV protocol that make it more rigorous. It also provides improved comparability of performance results for various OGS devices. A series of laboratory tests is designed to reasonably predict real-world performance, with provisions for evaluating sediment capture, resuspension and washout ("scour") of captured sediment and re-entrainment and washout of captured light liquids (oil and fuel).

Essential aspects of the comparability objective include specifications for the test sediment used in the capture and scour evaluations, specifications for the floatable plastic beads used as an oil/fuel surrogate in the light liquid re-entrainment evaluation, and provisions for various flow rates expressed as specified surface loading rates for each of the tests.

Additionally, the protocol specifies provisions to ensure that larger OGS sizes are suitably scaled relative to smaller tested devices. It also establishes the requirement for equivalence in treatment flow rate per unit of sedimentation surface area, as well as provisions for minimum depth of the device. These critical scaling requirements are intended to prevent the installation of poor-performing undersized devices that can result from the use of scientifically unproven scaling methods.

The Canadian ETV protocol specifies a test sediment with particle size distribution (PSD) ranging from 1 – 1000 microns. This is considered reasonably representative of the particle size fractions found in typical urban stormwater runoff, and is commonly known as the "ETV PSD". This specification is nearly identical to the specification for the test sediment used in the New Jersey lab protocol for the sediment capture test.

The Canadian protocol requires the ETV PSD to be added to the influent during the sediment capture test, and to be pre-loaded in the sump of the device prior to the sediment scour test. Unlike the New Jersey scour test provisions, which specify pre-loading the sump of the device with a coarser test sediment (no particles smaller than 50 microns), the use of the fines-containing ETV PSD and progressive effluent sampling methodology during scour testing is more rigorous and conservative. This is better representative of real-world conditions.

OGS devices primarily target sediment particles larger than 50 microns during inflow events of moderate and high intensity. However, significant capture of particles smaller than 50 microns occurs during the frequent low-intensity events that comprise a substantial portion of the annual runoff volume. It also occurs during the quiescent settling periods between storms.

Therefore, in the real world, a substantial amount of fines may be captured and present in the sump prior to a storm event of high intensity and high influent flow rates. The Canadian ETV scour test appropriately provides insight about fine sediment retention performance during such an event.

Low density polyethylene beads, with a size range of 3.5 – 4.5 mm and specific gravity 0.917, are a convenient surrogate for oil and fuel during the light liquid re-entrainment simulation test. Unlike hydrocarbon liquids that are messy and pose effluent disposal and system clean-up challenges, these are easy to handle, simple to recover from the OGS device and from the effluent during testing by using a net. Also, they are easily quantified by mass and volume.

A specified volume of beads is pre-loaded into the OGS device prior to testing. Beads washed out during testing are captured and quantified to determine how well the device performs in retaining them during flows that simulate a high-intensity storm event. This test sets the Canadian protocol apart from all other sediment-focused OGS test protocols by providing a simple, practical, and meaningful method for characterizing a very important aspect of OGS performance.

In general, all OGS testing protocols allow the manufacturer to select any of their commercial model sizes as the test unit. For reasons of cost and laboratory hydraulic capacity, smaller model sizes are most commonly tested. Earlier testing protocols allow each OGS manufacturer to establish the flow rates for testing of their device. Combined with the variability in the size of models tested, this makes it very difficult to establish "apples-to-apples" comparability of performance between various devices.

With comparability as a key objective of the Canadian ETV protocol, provisions were established that specify the influent surface loading rates that must be evaluated for each of the three performance tests.

"Surface loading rate" is defined as the influent flow rate divided by the sedimentation surface area of the device. This is typically the cross-sectional surface area of the treatment chamber and is expressed in metric units as L/min/m^2. Using a surface loading rate basis allows comparability between devices of various sizes. Seven different surface loading rates, ranging from 40

continued overleaf…

– 1400 L/min/m^2, are specified for the sediment capture test, representing a range of storm events from low intensity to high intensity.

Five different surface loading rates, ranging from 200 – 2600 L/min/m^2, are specified for the sediment scour test and the light liquid re-entrainment simulation test, representing a range of storm events.

Manufacturers who test their OGS device according to the Canadian ETV protocol must have testing independently performed by an accredited laboratory, and have the test results verified by an accredited third party. The resulting verification of performance claims is then posted on the Canadian ETV website.

Proper interpretation of OGS performance testing results is important to ensure that the selected device will function as intended. An examination of the sediment capture results for the range of devices tested demonstrates that OGS devices are suitable for pretreatment applications, and can be reasonably sized to capture 60% of the ETV PSD on an annual basis.

When installed upstream of ponds, detention facilities, bioretention, filters, and infiltration BMPs, OGS devices can remove a substantial portion of the sediment load from stormwater runoff. For sites where capture and retention of oil and fuel spills is important, such as fueling stations, convenience stores, fast food restaurants, accident-prone intersections, and other high traffic areas, it is important to select an OGS device that has demonstrated good performance during light liquid retention testing.

Civil engineers generally prefer to have the OGS device installed in-line with the storm sewer infrastructure. The expectation is that the device has an effective internal bypass to convey excessive flows, and that it will retain accumulated sediment even during very high intensity storm events.

Therefore, it is important that the performance testing demonstrates good results during scour testing. This is generally lower than 10 or 20 mg/L effluent sediment concentrations at the highest tested surface loading rates.

CONCLUSION

The Canadian ETV testing protocol has established a high bar for performance evaluation of OGS devices. It provides the opportunity to assess marketing claims in light of verified third-party test results. In the interest of upgrading environmental protection, provincial, regional, and municipal regulatory authorities are encouraged to use this information for their stormwater quality programs. ■

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