MEMO

To:	Cam Elsby, P.Eng. (City of Ottawa)	From:	GEI Consultants Canada Ltd.
GEI Project:	2501074 – City of Ottawa Urban Expansion Area Hydraulic Assessments	Date:	August 6, 2025

Leitrim Urban Expansion Area Assessment

1 Introduction

The City of Ottawa (the "City") has recently completed the new Official Plan (OP) and Infrastructure Master Plan (IMP). GEI Consultants Canada Limited (GEI, formerly GM BluePlan Engineering Limited) was previously retained to complete the Wastewater Master Plan (WWMP) as part of the IMP.

The Ministry of Municipal Affairs and Housing (MMAH) provided a set of urban expansion lands that were reviewed as part of the IMP. The IMP recommended system-level water and wastewater infrastructure to support these lands and to be ultimately incorporated into the urban boundary as part of the Province's final approval of the City's Official Plan. However, these expansion areas were subsequently removed from the Official Plan (and therefore from the IMP), with individual developers now eligible to apply to expand the urban area on an ad-hoc basis. This new process is the result of the Province of Ontario issuing a Provincial Planning Statement (PPS) in October 2024, which enables private landowners to request an expansion of the urban boundary at any time, outside of a comprehensive review or OP update. If a proponent wishes to include land within the urban boundary, they may make an application for an Urban and Village Boundary Expansion Official Plan Amendment (OPA). This process is generally site-specific and consist of the following five (5) steps:

Step 1: Assess existing servicing capacity
Step 2: Identify new servicing capacity
Step 3: Assess land need
Step 4: Settlement area parcel analysis
Step 5: Council decision

The City has retained GEI to complete Steps 1 and 2 as part of the "Sanitary Infrastructure Needs Assessment for Boundary Area Expansion Applications". Step 1 and Step 2 are further detailed below:

Step 1 aims to establish the baseline capacity of the system as well as identify deficiencies in supporting the planned growth outlined in the boundary area expansion applications. The key output of Step 1 is a hydraulic model capacity assessment of existing infrastructure.

Step 2 will assess how to address potential capacity constraints in the study area through identifying servicing solutions and developing subsequent conceptual designs to determine feasibility and Class D cost estimates. The key outputs of Step 2 are the development of conceptual design information to inform the feasibility, and Class D cost estimates for required infrastructure.

2 Background

2.1 Study Area

The City has identified there will likely be impacts to the existing Leitrim area through expansion of the City's urban boundary (this expansion area is referred to in this document as the "Leitrim lands"). This will require a review of the extent and timing projects needs identified in the recent Wastewater Master Plan. The affected infrastructure downstream of the Leitrim lands proposed in the OPA boundary expansion area may require a conceptual design and Class D cost estimate for the required infrastructure improvements if Step 1 deems the existing off-site infrastructure unable to support the growth.

As part of the assessment, the area review consisted of the following:

Capacity Review

- Assess the capacity of the Conroy Road Trunk Collector and the Green Creek Trunk Collector up to the Walkley Chamber to accommodate the flows from the Leitrim lands.
- A previous version of the IMP which included additional lands added by the Province of Ontario (MMAH) confirmed sufficient trunk capacity in the Conroy Road Trunk Collector; however, it was noted that the current population estimates for the Leitrim lands are greater than the previous population estimates in the MMAH lands.
- A new on-site pumping station is anticipated to service the new Leitrim expansion lands.

Servicing Solutions

- Conroy Road Trunk Collector Upgrade: Expedite the planned upgrades to the off-site trunk collector sewer to support new growth from the Leitrim lands.

Table 1, summarizes the population estimates and development area information for the Leitrim expansion lands.

Figure 1 highlights the development plans for the Leitrim lands and Figure 2 provides an overview of both the study area's population and its subsequent wastewater flow generated.

Table 1: Summary of proposed development in study area

Future Development	Population	Area (ha)
Residential		
Singles	8,010	79.74
Town	1,272	12.66
Back-to-Back Towns	2,544	25.33
Stacked Towns	1,696	16.88
Residential Total	13,522	134.61
Employment		
School (Institutional)[1]	-	36.29
Total:	**13,522**	**170.91**

[1] No population estimate for schools as wastewater flow is estimated using an area-based criteria.

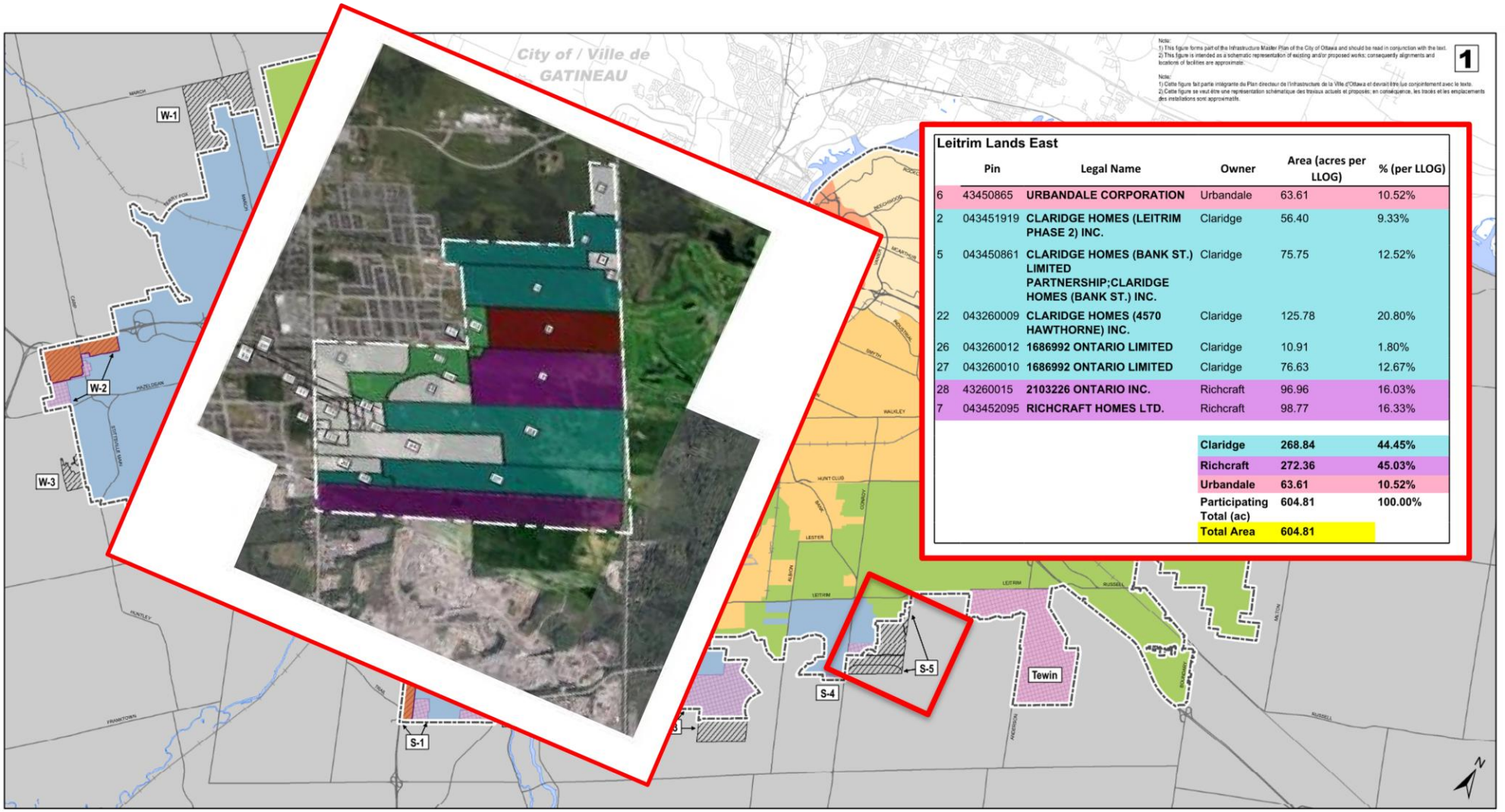

Figure 1: Leitrim Lands East Figure

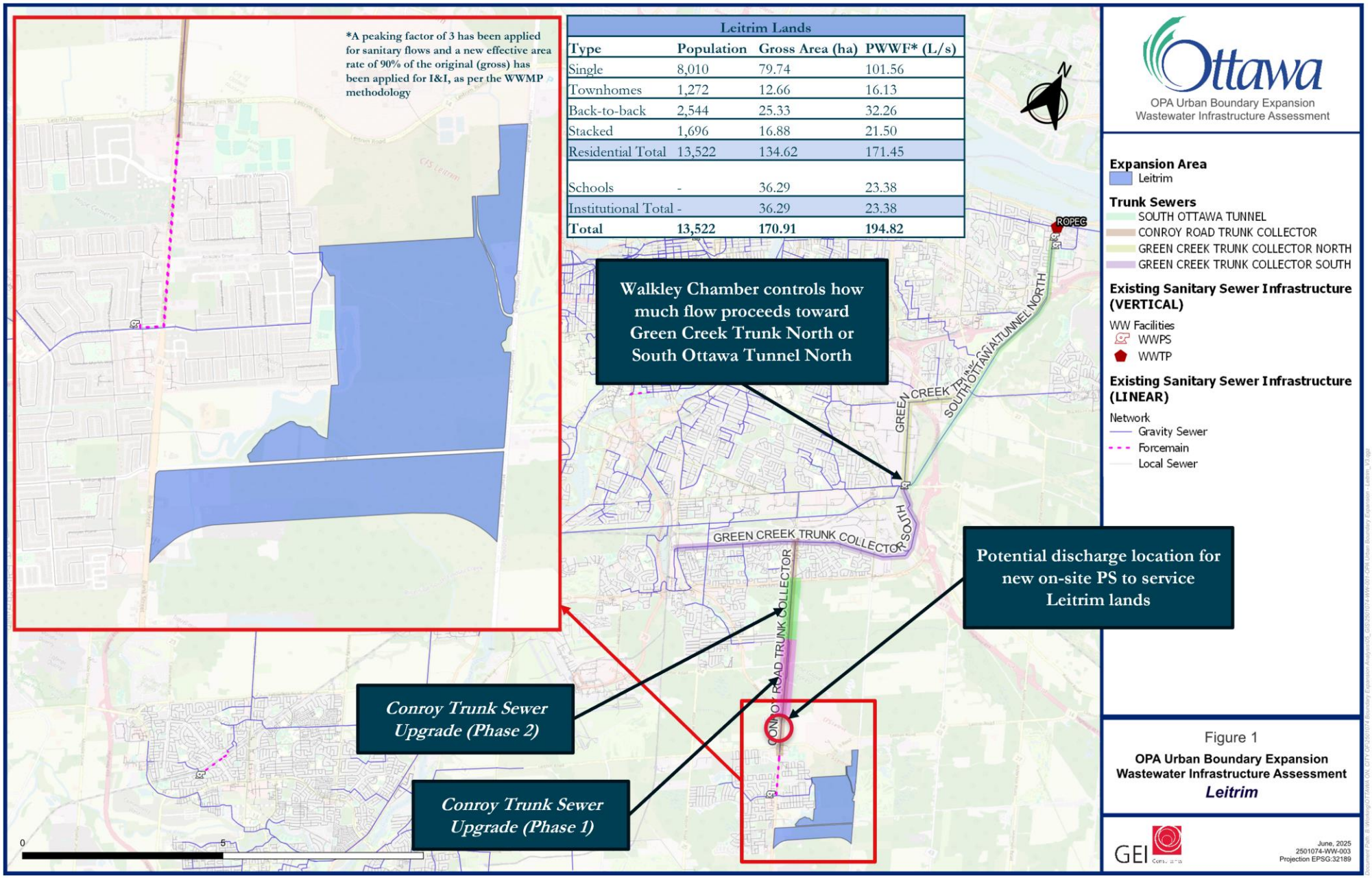

Figure 2: Study Area and System Overview

2.2 Background Information

To better understand the constraints of the study area, previous studies were reviewed. This includes the following studies:

- Leitrim Development Area Serviceability Report (2016)
- City of Ottawa 2024 Infrastructure Master Plan (2024)

Leitrim Development Area Serviceability Report

After the amalgamation of twelve local municipalities, the City of Ottawa further studied these communities, which include the Leitrim Development Area (LDA). The study area is bounded by Albion Road to the west, Leitrim Road to the north, and Ottawa's existing urban boundary to the east. The purpose of the study was to provide recommendations on the overall system of the LDA, including upgrades required to meet the City of Ottawa' level of service (LOS) requirements for build-out.

The LDA was expected to be serviced by the Leitrim Sanitary Pumping Station (Leitrim PS), which was commissioned by the City of Ottawa in 2002. The station operates under Environmental Compliance Approval (ECA) and has an ultimate firm pumping capacity of 361 L/s. All wastewater from the LDA is conveyed to Leitrim PS through a network of trunk and sub-trunk sanitary sewers.

The LDA sewer network consists of a 600 mm trunk sewer along Findlay Creek Drive (Park Trunk Sewer), supported by 375 mm sub-trunks on Kelly Farm Drive South, Kelly Farm Drive North, and Bank Street East. These sewers flow directly from specific zones to Leitrim PS, ensuring efficient conveyance.

It was noted that the ultimate capacity of 361 L/s at Leitrim PS was sufficient to support wastewater flow generated from the LDA; however, the Conroy Road Collector Sewer downstream would pose a bottleneck, as one segment is limited to 248 L/s. To address this, the City recommended the Conroy Road Collection Twinning project to increase downstream capacity. This project has since been modified in the 2024 IMP to a linear upsizing project which will be completed in two phases.

By the end of 2013, 164.4 hectares of the LDA had been developed, supporting 2,195 residential units and a population of 6,356. The developed area consisted of 119.5 hectares of occupied residential land, 24.4 hectares of unoccupied residential land, 10.8 hectares of parks, and 7.8 hectares of commercial land. The population and housing unit growth reflected broader city trends, with average occupancy rates of 3.05 persons per unit for single and semi-detached homes, 2.72 for townhouses, and 1.71 for apartments.

Flow monitoring conducted between 2011 and 2014 recorded an average dry weather flow of 38.31 L/s and groundwater infiltration of 20.74 L/s. The maximum daily dry weather flow was 52.71 L/s, with a peak total flow of 65.58 L/s and a calculated peak factor of 1.91. The Stevens-

Schutzbach method validated infiltration rates, with accuracy within ±1.6 L/s. Infiltration rates were consistent with expectations for newer infrastructure, ranging from 0.05 to 0.08 L/s/ha, while total inflow and infiltration ranged from 29.91 to 39.32 L/s.

Initial design criteria followed MOECC standards, assuming residential flows of 350 L/capita/day, employment/institutional flows of 50,000 L/ha/day, and infiltration of 0.28 L/s/ha. Residential peaking factors followed the Harmon formula, ranging from 2.0 to 4.0. However, monitored data showed actual flows were lower: residential flows averaged 300 L/capita/day, employment flows 10,000 L/ha/day, and institutional flows 17,000 L/ha/day, with dry weather infiltration between 0.14 and 0.19 L/s/ha. These adjusted values were adopted to improve cost efficiency and avoid unnecessary oversizing.

At full build-out, the LDA is projected to support a population of 20,177 over 559.1 hectares. Using monitored data, peak flows are expected to be approximately 307 L/s, within the capacity of the pumping station. In contrast, applying MOECC design criteria would result in peak flows of 436 L/s, exceeding the station's capacity by 21%. Based on these projections, the use of monitored data is recommended, along with continued flow monitoring and contingency planning for upgrades as needed.

The preferred servicing strategy relies on the City's existing municipal infrastructure, avoiding the need for a separate collection and treatment system. The recommended upgrades include replacing two pumps at Leitrim PS with 160 HP motors to increase capacity to 440 L/s and coordinating these improvements with the Conroy Road Sewer Twinning project. The existing sub-trunk network can generally accommodate flows, though Bank Street East is approaching capacity and will require monitoring and potential intervention.

City of Ottawa 2024 Infrastructure Master Plan (IMP)

As part of the WWMP assessment, 2046 population growth projections were used to develop a future hydraulic model scenario, with the aim of assessing future collection system performance and identifying necessary infrastructure improvements to accommodate increased demands from population growth.

The 1-in-25-year and 1-in-100-year June 2014 events were the primary triggers to identify a future system capacity constraint. The hydraulic model results were reviewed to identify sewers within the same general location which showed capacity issues and served as the basis for comparison between existing system capacity issues and system capacity issues caused because of future growth.

Six geographical areas were identified for the WWMP, where Leitrim was assessed as part of the South East geographical area. The South East area also consists of the Findley Creek, the Ottawa Airport Authority, and parts of Gloucester that drain to the South Ottawa Collector and Greens Creek trunk sewers. Major trunk sewer infrastructure downstream of the Leitrim lands (expansion area) include the Conroy Road Trunk Collector, Green Creek Collector North, Green Creek Collector

South, South Ottawa Tunnel, South Ottawa Collector, and Walkley Flow Diversion Chamber, terminating at the City's wastewater treatment plant (ROPEC)

Under existing conditions, the South Ottawa Collector trunk sewer (which runs west to east along the southern boundary of the greenbelt) shows substantial residual capacity overall. However, three main clusters of hydraulic capacity constraints were identified, with surcharged sewer pipes and maintenance holes where the hydraulic grade line (HGL) depth was less than 2.4 m from the ground.

Specific constraints that may impact the Leitrim lands include the Walkley Flow Diversion Chamber, located at Walkley Road and Sheffield Road, where flows exceeding 1,800 L/s in the Green Creek Collector North are conveyed to the South Ottawa Tunnel.

Additionally, under future conditions:

- The Conroy Road Trunk Sewer is surcharging near ground level due to growth within the Leitrim Development Area and the expansion area designated in the 2021 Official Plan.
- The Leitrim Pumping Station shows a future (2046) modelled peak flow of 350 L/s incoming to the station, nearing its ultimate rated capacity of 361 L/s.

The Conroy Road Trunk Sewer Upgrade is a key capital project identified in the 2024 Wastewater Master Plan to address hydraulic capacity constraints and support future growth in the South East geographical area and specifically the 2046 growth slated for the existing Leitrim area. The IMP identified the project as two phases: with Phase 1 starting from where the Leitrim PS forcemain discharges from Leitrim Road to Queensdale Avenue for 2.6 km and Phase 2 continuing from Queensdale Avenue to Lorry Greenberg Drive, for approximately 2.0 km.

Initially, design and construction phasing was identified in the 2024 IMP; however, through the 2026 Capital Budget process, the design of both phases was advanced to 2026, construction starting in 2028 and the trunk sewer anticipated to be fully in service by 2030. Both phases were costed using Class D estimates and followed a strategic oversizing approach, where the sewer was sized with additional post-period capacity to accommodate development beyond 2046.

2.3 Discussions with Stakeholders

To keep stakeholders informed of the recommendations being made for the area, the Technical Advisory Committee (TAC) was consulted in a meeting.

Discussions with the project team at the City as well as the TAC included a summary of the current study area conditions, current plans of additional growth added to the area, and potential concerns with maintaining level of service while enabling development in the Leitrim lands area to proceed. At the TAC, concerns about the modelling assumptions used and the I&I considerations were noted.

As part of stakeholder discussions, the hydraulic assessment and proposed servicing strategy for the Leitrim lands were presented, and key feedback was received. The Conroy Road Trunk Sewer from Leitrim to Hunt Club was reviewed and confirmed to align with documented sizing and future upgrades, with Phase 1 and Phase 2 now transitioning to preliminary and detailed design. Stakeholders discussed the potential need to advance these upgrades due to added flows from Leitrim.

Feedback from the committee members included commentary regarding:

- **Model Assumptions**
    - Modelled operational limitations at the Walkley Chamber were discussed, including potential backwater effects, gate maintenance, and odour control infrastructure, with a recommendation to verify model assumptions with City operations staff.
    - It was also noted that real rainfall data from recent years should be used to complement the 1-in-25-year design storm approach, given the increasing frequency of extreme weather events and wet weather flow responses.
- **Inflow and Infiltration (I&I) Considerations**
    - Long-term inflow and infiltration (I&I) growth, particularly due to high groundwater conditions in Leitrim, prompting a recommendation to incorporate I&I strategies and consider updated design standards.

2.3.1 Model Assumptions

The existing conditions hydraulic model used for this assessment was developed in-house by the City of Ottawa and provided to GEI during preparation of the 2024 Infrastructure Master Plan. GEI used the City's future population projections to develop the future conditions (2046) hydraulic model. The existing conditions model represents the operation of key municipal wastewater infrastructure in a simplified form, based on information known at the time of model development (and in coordination with City operations staff). These key wastewater facilities include the Walkley Chamber, several major sewage pump stations, and the inlet headworks at ROPEC.

The existing conditions hydraulic model is loaded based on water billing data and calibrated using available SCADA data at downstream sewage pump stations. The SCADA data were used by the City to calibrate the suburban areas of the wastewater collection system under both dry and wet weather flow conditions. The City of Ottawa does not currently have a system-wide flow monitoring program; the development of a full-coverage flow monitoring program was a recommendation in the recent Wastewater Master Plan. If implemented, the data from the flow monitoring program could be used to fully calibrate the entire wastewater model.

2.3.2 I&I Considerations

Based on discussions with City of Ottawa, it is understood that the Leitrim Pumping Station sewershed produces significant rates of inflow and infiltration (I&I), which are anticipated to increase over time as the condition of upstream infrastructure continues to deteriorate.

The City's Trunk System Planning unit monitors flows from the major pumping stations annually, including at Leitrim PS. The I&I rates at the station have been approaching the design threshold of 0.33 L/s/ha during significantly wet weather events. The City has also observed sudden spikes and drops in flow which are not correlated to wet weather events; these sudden fluctuations are suspected to be illegal discharges within the sewershed.

While the hydraulic model cannot effectively capture these illegal discharges to the sanitary network, routine updates to the model calibration based on newly collected flow monitoring data will be highly valuable to ensure that changing wet weather flows within this catchment are accurately reflected in planning-level assessments.

2.4 Level of Service and Design Criteria

As part of the hydraulic analysis, level of service (LOS) was assessed based on a set of design criteria. For the purposes of this assessment, level of service is defined as the expected hydraulic performance that serviced residents and business owners should expect to receive from the City's wastewater infrastructure. Methods to maintain the target level of service can include infrastructure upgrades to resolve existing issues and support additional growth, basement and surface flooding prevention measures, inflow and infiltration reduction, etc. The criteria used in this assessment originated from the WWMP to ensure consistency when reviewing and comparing results.

Three main hydraulic models were reviewed as part of this assessment:

- Existing Conditions
- Future Conditions All-Projects (without the addition of Leitrim)
- Future Conditions All-Projects (with the addition of Leitrim)

The hydraulic models were simulated under various design storms to compare hydraulic performance. As part of the LOS Review, the following storms will be used:

- 1-in-5-year June 2014 rainfall event (free flow)
- 1-in-25-year June 2014 rainfall event (projects flagged if 2.1 m HGL is triggered)
- 1-in-100-year June 2014 rainfall event (climate scenario for assessing resiliency)

It should be noted that the discussion of results is specific to the 1-in-25-year June 2014 event. Results for the 1-in-5-year and 1-in-100-year Event can be found in Appendix A.

When reviewing the results, the flow conditions for sewers will be assessed as follows:

- A sewer is considered free flowing when depth to diameter ratio (d/D) is less than 0.8 and the peak flow to theoretical pipe capacity ratio (q/Q) is less than 1
- A sewer is considered to be approaching surcharging by depth when the depth to diameter ratio (d/D) is between 0.8 and 1, but the theoretical pipe capacity is not exceeded ($q/Q < 1$)
- A sewer is considered surcharged by depth when the depth to diameter ratio is greater than or equal to 1 ($d/D \geq 1$), but the theoretical pipe capacity is not exceeded ($q/Q < 1$)
- A sewer is considered surcharged by flow when the depth to diameter ratio is greater than or equal to 1 ($d/D \geq 1$), and the theoretical pipe capacity is also exceeded ($q/Q \geq 1$)

In addition to sewer conditions, maintenance holes are also reviewed to identify areas of basement flooding risk.

- When HGL > 1.8m below ground level, the maintenance hole does not indicate basement flooding risk
- When HGL ≤ 1.8m below ground level, the maintenance hole is flagged as at potential risk for basement flooding
    - Clusters of nodes where HGL ≤ 2.4m below ground level were also flagged to identify an area of potential concern
- When HGL is above ground level, the maintenance hole indicates surface breakout (flooding)

2.5 Wastewater Flow Generation

The Leitrim boundary expansion area would add over 13,000 additional people to be serviced by the City's sanitary system as well as an additional 23~ L/s of institutional flow from schools. An estimate of the future peak wet weather flow (PWWF) has been added to Table 2.

Table 2: Summary of proposed development, with PWWF estimate

Development	Population	Gross Area (ha)	PWWF[1] (L/s)
Residential			
Singles	8,010	79.74	101.56
Town	1,272	12.66	16.13
Back-to-Back Towns	2,544	25.33	32.26
Stacked Towns	1,696	16.88	21.50
Residential Total	13,522	134.61	171.45
Employment			
School (Institutional)	-	36.29	23.38
Total:	13,522	170.9	194.83

[1] A new effective area rate of 90% of the original has been applied for I&I, as per the WWMP methodology

It is estimated that approximately 195 L/s will be generated from the new development within Leitrim, which is in addition to the 2046 projected population as represented in the IMP. The 2046 growth identified 12,048 future residents and 1,538 future employees upstream of Leitrim PS in the IMP.

3 OPA Step 1 – Assessment of Existing and Planned Infrastructure Capacity

Three scenarios were reviewed as part of the Step 1 and Step 2 process of the OPA:

1. **Existing Conditions:** The system under operating conditions based on the 2019 model calibration
2. **WWMP Future Conditions:** The system under projected future conditions to the 2046 growth horizon, which includes infrastructure upgrades and growth projected for 2046. This scenario was used in the recently-completed 2024 WWMP. This does not include the Leitrim expansion lands.
3. **OPA Future Conditions (with and without servicing solutions):** The system under anticipated future conditions for the 2046 growth horizon, which includes infrastructure upgrades, growth projected for 2046, and the Leitrim expansion lands.

3.1 Capacity Analysis

Capacity at Leitrim PS was reviewed in several model scenarios. Table 3 summarizes the inflow to the pumping stations as well as remaining capacity for existing and future conditions.

Table 3: Summary of Leitrim PS Capacity

Model Scenario		1-in-5-year		1-in-25-year		1-in-100-year	
Condition	Rated Capacity	Peak Flow	Remaining Capacity	Peak Flow	Remaining Capacity	Peak Flow	Remaining Capacity
Existing Conditions	**133**	112	21	131	2	149	(16)
WWMP Future Conditions	**361**	317	44	336	25	352	9
OPA Future Conditions	**361**	512	(151)	531	(170)	547	(186)

Capacity at Leitrim PS was assessed using the hydraulic model for existing conditions and WWMP future conditions. As per WWMP recommendations, the station's firm capacity is to be upgraded from 133 L/s to 361 L/s to address 2046 growth demands. Under existing conditions, the station has very limited capacity during higher return period events, with only 2 L/s remaining during the 1-in-25-year storm. The upgrade provides adequate capacity in the WWMP future conditions scenario. It should be noted that the capacity at Leitrim PS was assessed at a high level for the OPA future conditions scenario. This is because it is already known that the capacity at Leitrim PS would not be sufficient to service the new Leitrim expansion lands. For Leitrim PS to accommodate the almost 200 L/s growth flows from the Leitrim lands, the capacity at the station would need to increase by an additional 50% beyond the 2046 IMP recommended upgrades.

In addition to the capacity at Leitrim PS, the residual capacity of trunks to which the future flows from the Leitrim lands would ultimately drain were reviewed. A qualitative table describing capacity can be seen in Table 4.

Table 4: Summary of Trunk Residual Capacity

	Residual Capacity Available (1-in-25-yr)		
Trunk Segment	**Existing**	**WWMP Future**	**OPA Future**
Conroy Trunk Collector	Yes	Yes	Yes
Green Creek Trunk to Hawthorne Rd.	Yes	Yes	No[1]
Hawthorne Rd. to Walkley Chamber	No[1]	No[1]	No[1]

[1] This trunk sewer is affected by a backwater effect from the Walkley Chamber downstream; if the Walkley Chamber was not creating this backwater effect, the trunk sewer would have available capacity.

The trunk sewers downstream of the Leitrim lands maintain some amount of residual capacity even with the addition of the Leitrim expansion lands; however, it should be noted that due to the modelled flow restriction at Walkley Chamber, the trunk sewers immediately upstream of the Walkley Chamber show surcharging by depth because of the downstream restriction. It is expected that the trunk sewers upstream of the Walkley Chamber would be free flowing if the restriction was not present. A summary of the minimum residual capacity in the backwater-impacted pipes can be seen in Table 5.

Table 5: Minimum Residual Capacity in Backwater-Impacted Pipes

Scenario	Minimum Residual Capacity (L/s)
Existing Conditions	834
WWMP Future Conditions	465
OPA Future Conditions	304

There is a single segment of sewer pipe upstream of the Walkley Chamber with a very minimal slope, which causes the model to show zero theoretical residual capacity (although this pipe is sized adequately to accommodate the incoming flows). To show a more realistic residual capacity estimate, this segment of sewer was omitted from the analysis.

The upgraded capacity is sufficient to handle the additional flow generated from the 2046 growth flows within the Leitrim area under the 1-in-25-year design storm, prior to the addition of the Leitrim lands expansion. Based on the planned future capacity of the Leitrim Pumping Station, the projected peak flows from the Leitrim development lands are anticipated to exceed the facility's capabilities. As such, the station is not expected to accommodate these flows, even with the upgrades identified in the Infrastructure Master Plan. This outcome reinforces the conclusion that routing additional flows to the existing Leitrim PS is not a viable servicing option.

3.2 Hydraulic Assessment

The following section discusses the hydraulic assessment completed for three scenarios:

1. Existing Conditions
2. WWMP Future Conditions
3. OPA Future Conditions

Capacity and performance at key infrastructure was reviewed, including the existing Leitrim PS, Conroy Road Trunk Collector, and the Green Creek Trunk Collector.

Under existing conditions, Leitrim PS has a rated capacity of 133 L/s. It performs adequately during the 1-in-25-year event, with marginal remaining capacity at a peak inflow rate of 131 L/s. The trunk infrastructure (Conroy Road Trunk and Green Creek Trunk) up until Walkley Chamber operates as a free-flowing system, with Hydraulic Grade Line (HGL) levels remaining below the pipe obvert throughout the majority of the profile. While certain segments approach 80% full depth, these do not indicate hydraulic capacity restrictions. No sewer pipes exceeding their theoretical capacity ($q/Q > 1.0$) were observed in this scenario.

A common downstream constraint seen in all scenarios is surcharging upstream of the Walkley Chamber due to a backwater effect. This is attributed to the modelled flow control function of the

Walkley Chamber, which regulates discharge to the South Ottawa Tunnel downstream. This backwater effect is shown in Figure 3. It should be noted that the Walkley Chamber has been modelled using a simplified approach for master planning purposes; the exact operational control logic and chamber configuration is not represented in a fine level of detail in the hydraulic model. Figure 3 shows the profile view from Conroy Road Trunk until the Walkley Chamber and Figure 6 shows the map view.

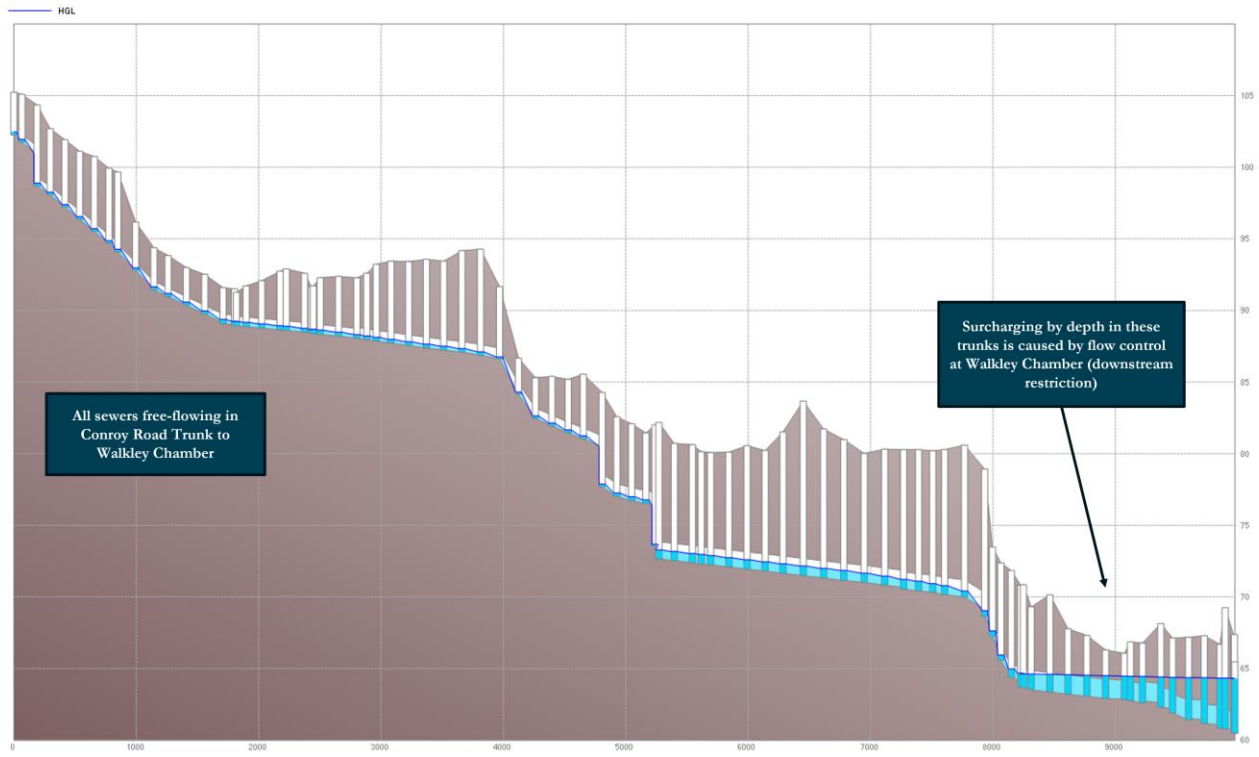

Figure 3: Profile view of Conroy Road Trunk to Walkley Chamber under existing conditions (1-in-25yr)

The WWMP future conditions scenario was evaluated using the updated hydraulic model, which incorporates projects identified in the City's Infrastructure Master Plan (IMP). Key projects to support the growth at Leitrim include an expansion of the Leitrim Pumping Station to a firm capacity of 361 L/s, as well as trunk sewer upsizing along the Conroy Road Trunk (Phase 1 and Phase 2).

Model results indicate that the upgraded pump station would perform adequately under the 1-in-25-yr storm, with a peak incoming flow of 336 L/s and a remaining capacity of 25 L/s under 2046 growth conditions.

In the downstream sewer network, the trunk sewers from the connection point in the Conroy Road Trunk Sewer all the way to the Walkley Chamber can convey the 2046 growth flows. The hydraulic profile shows that the trunk system handles base and design storm flows within acceptable operational thresholds. Similar to existing conditions, while some pipe segments are surcharging, this is a byproduct of the operation at the Walkley Chamber. These conditions are not indicative of

capacity issues but reflect modelled system behavior during high-flow events, where conveyance efficiency is reduced due to downstream flow restriction.

Figure 4 shows the profile view from Conroy Road Trunk until Walkley Chamber and Figure 7 shows the map view.

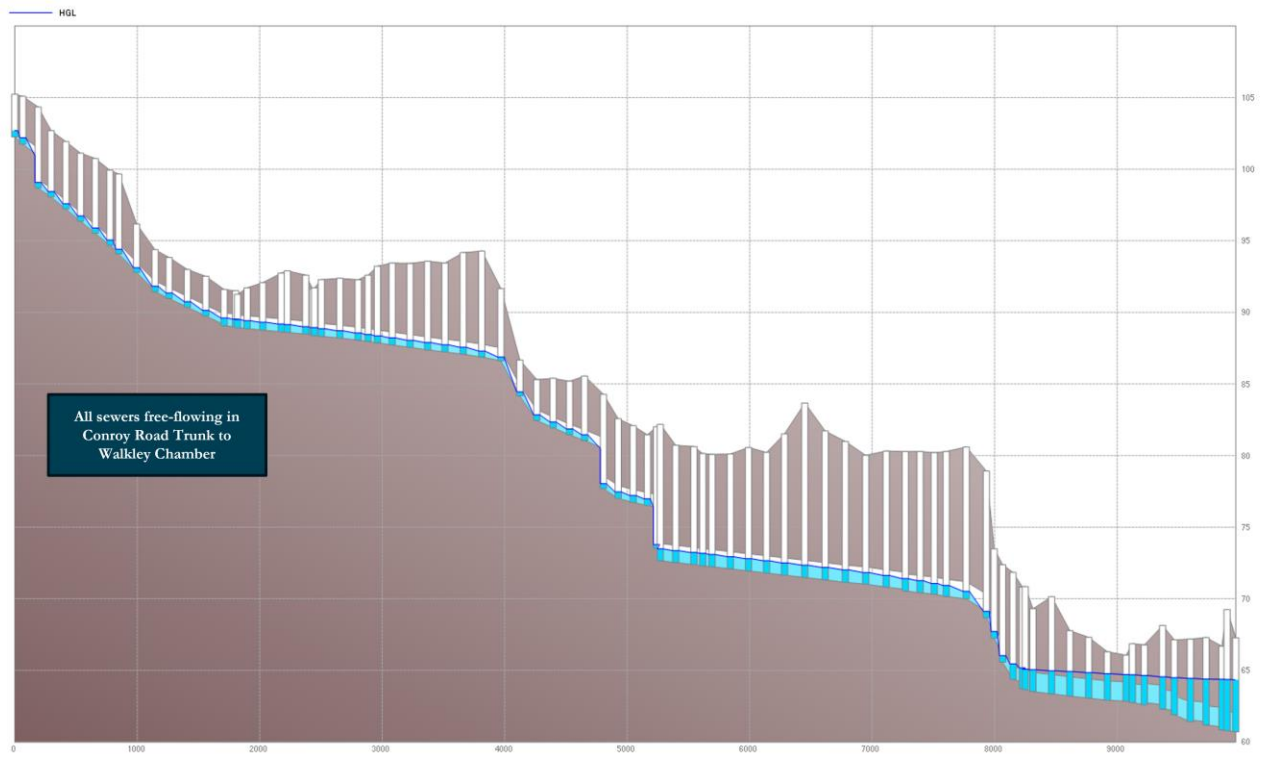

Figure 4: Profile view of Conroy Road Trunk to Walkley Chamber under WWMP future conditions (1-in-25yr)

The OPA future conditions scenario was assessed to evaluate the system's ability to convey the increased peak wet weather flows associated with growth within the urban expansion area. As part of this assessment, approximately 200 L/s of additional peak flow from the Leitrim urban expansion area was applied to the model. Routing these flows to the existing Leitrim Pumping Station was determined to be infeasible, as the station would be significantly over capacity even with the capacity upgrades proposed in the IMP; this would result in upstream system surcharging and create risk of basement flooding in the upstream sewershed. The addition of future flows from the Leitrim urban expansion area did result in surcharging by depth in the upstream local sewers, as a result of backwater conditions from Leitrim PS.

Figure 5 shows the profile view from Conroy Road Trunk until Walkley Chamber and Figure 8 shows the map view.

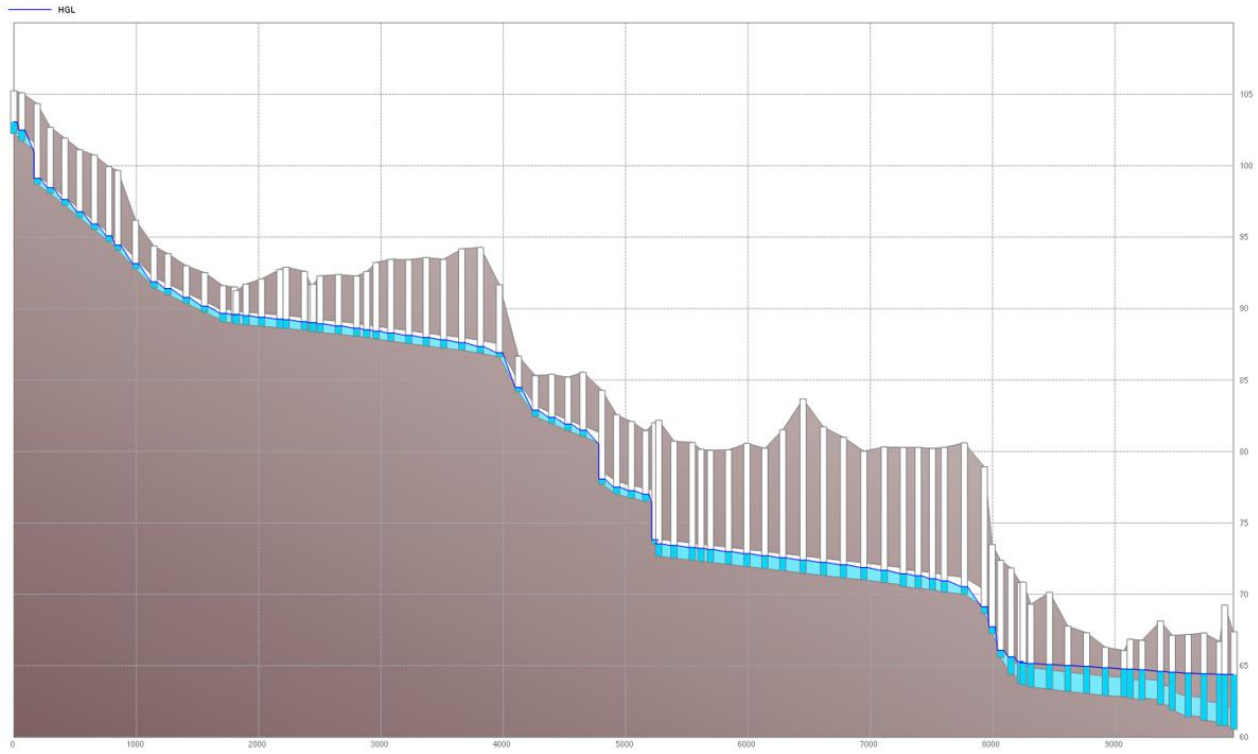

Figure 5: Profile view of Conroy Road Trunk to Walkley Chamber under OPA future conditions (1-in-25yr)

3.3 Step 1 Conclusions & Recommendations

Overall, the hydraulic assessment evaluated three servicing scenarios for the Leitrim catchment area: (1) existing conditions, (2) WWMP future conditions scenario, and (3) OPA future conditions scenario. These scenarios were assessed using hydraulic model outputs with a focus on identifying system constraints and verifying available capacity within the downstream trunk sewer system.

Under existing conditions, the Leitrim Pumping Station, with a rated firm capacity of 133 L/s, is generally able to accommodate peak flows under typical wet weather events. The downstream system, particularly the Conroy Road Trunk Sewer extending to the Walkley Chamber, remains largely free-flowing, though modelled results suggest a backwater effect near the chamber caused by discharge throttling. This is a modelled operational constraint, and it is expected that the trunk sewers would otherwise flow freely.

In the WWMP future conditions scenario, the upgraded Leitrim PS capacity of 361 L/s sufficiently accommodates the 2046 projected growth flows under the 1-in-25-yr storm event. However, the capacity assessment in Step 1 highlighted the inability of Leitrim PS to support an additional 200 L/s from the expansion area. This is shown in the OPA future conditions scenario, where hydraulic restrictions (surcharging and surface flooding) are seen upstream of Leitrim PS in Figure 8. This hydraulic restriction would be made significantly worse if the Leitrim expansion area growth flow was to be serviced by the existing pumping station; thus there is no existing or planned sanitary capacity available for this proposed expansion area.

As such, the assessment proceeds to Step 2 to review potential servicing solutions for the expansion area.

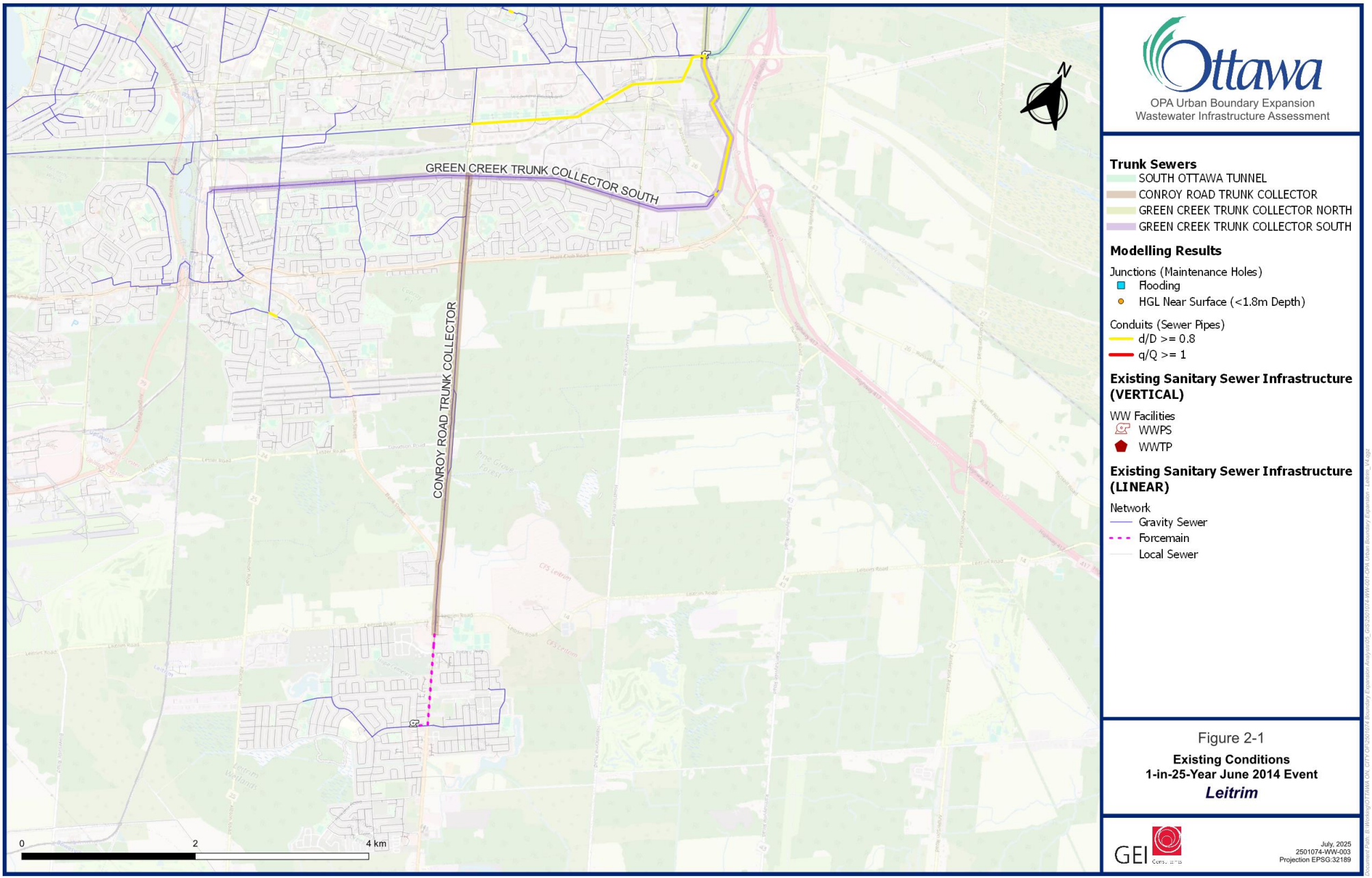

Figure 6: Map view of existing conditions

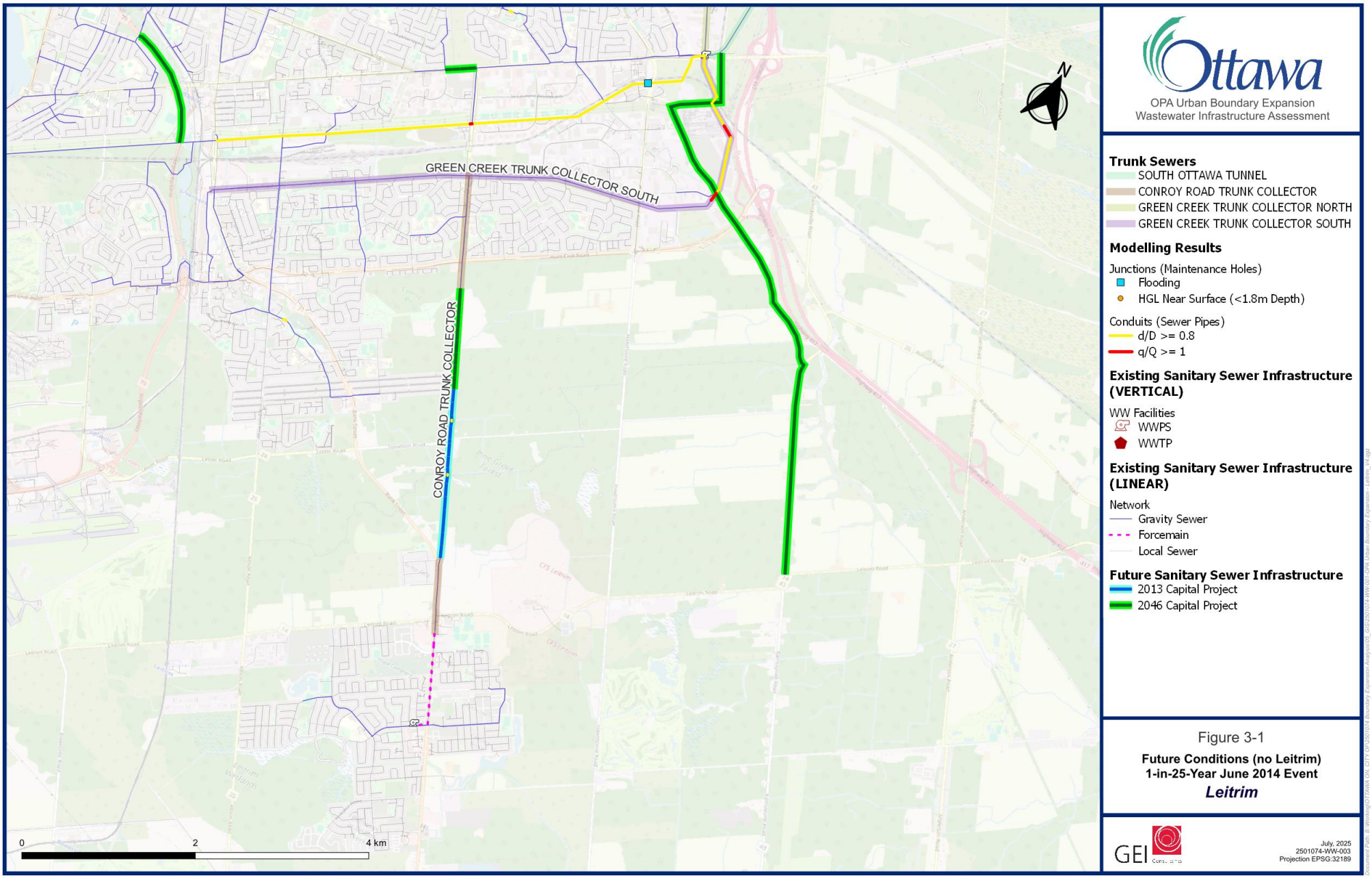

Figure 7: Map view of WWMP future conditions (no expansion area)

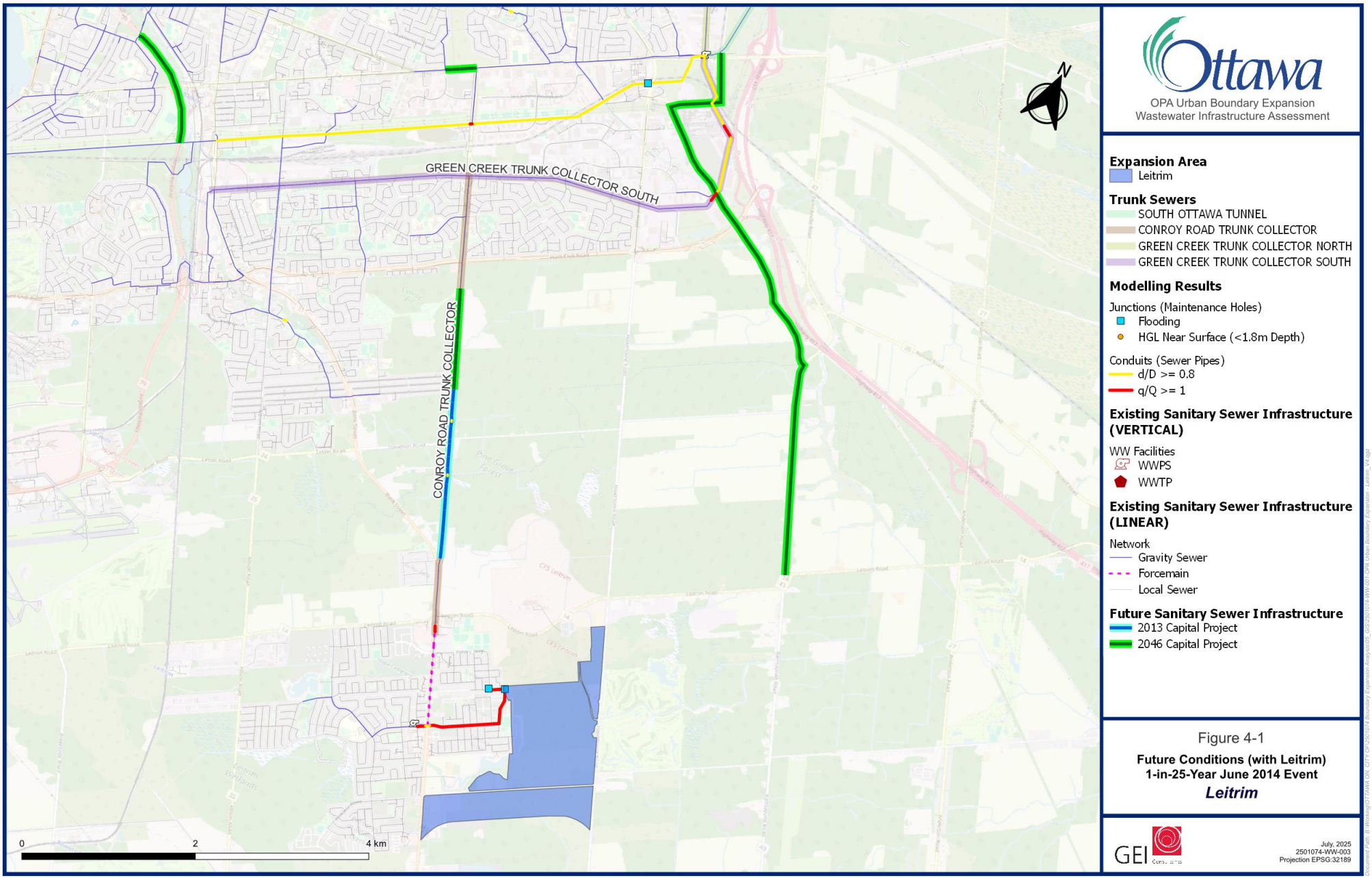

Figure 8: Map view of OPA future conditions (with expansion area)

4 Step 2 – Conceptual Design and Servicing Strategy

4.1 Servicing Alternatives

As the existing Leitrim PS does not have capacity to accommodate the projected flows from the Leitrim expansion lands without a significant capacity upgrade beyond what was recommended in the WWMP, a different off-site servicing solution is required.

Part of the servicing solution has been pre-established by the recent 2024 IMP, by utilizing the Conroy Road Trunk Sewer Phases 1 and 2. The project was strategically oversized in the IMP based on post-period capacity (PPC) necessary to accommodate population growth beyond the 2046 horizon (2101), with approximately an additional 200 L/s of capacity within the trunk. It should be noted that much of this projected post-period growth was previously added by MMAH (under the name S-5 East) and assessed through the IMP, before being ultimately removed from the Official Plan and now subsequently being re-reviewed through the OPA process.

When the Leitrim expansion lands were first reviewed through the draft 2023 IMP, the preferred servicing solution was to convey the Leitrim lands' growth flows to the Conroy Road Trunk sewer via a new on-site pump station. This was due to the insufficient capacity at the existing pumping station, even at its ultimate planned capacity of 361 L/s. It should be noted that on-site works are outside the scope of this OPA assessment. These components will be the responsibility of the landowners and their engineering consultants and are expected to be addressed as part of the Future Neighborhood process and detailed design submissions to the City.

4.2 Hydraulic Assessment

The required on-site sewage pump station was assumed in the model to discharge at the most upstream segment of the Conroy Road Trunk. This assumption represents a conservative worst-case scenario to evaluate downstream system performance. The actual discharge location may vary and will ultimately be determined through detailed design by the developer.

Assuming completion of the planned trunk upgrades identified in the Infrastructure Master Plan (IMP), the model demonstrates that the system could accommodate the additional flows from the Leitrim expansion lands without introducing new downstream constraints.

The addition of flows from the Leitrim expansion lands does result in slightly elevated HGLs in certain downstream trunk sewers; however, these increases in HGL do not trigger any new infrastructure upgrade requirements beyond those already identified in the existing or future growth scenarios.

Figure 9 shows the profile view from Conroy Road Trunk until Walkley Chamber and Figure 10 shows the map view.

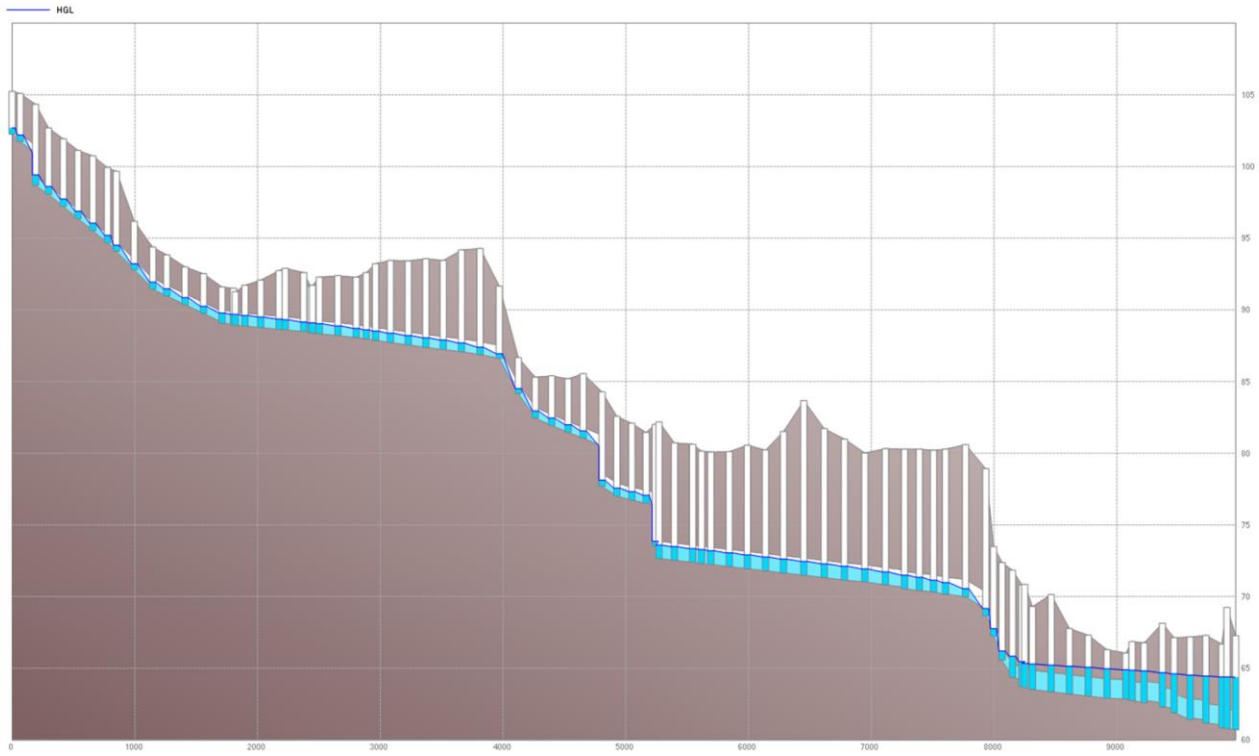

Figure 9: Profile view of Conroy Road Trunk to Walkley Chamber under future conditions, with Leitrim lands and servicing solutions (1-in-25yr)

4.3 Step 2 Conclusions & Recommendations

With the addition of the Leitrim expansion lands, approximately 200 L/s of new peak wet weather flow is expected to enter the existing trunk sewer system. Step 1 established the need for a servicing solution due to insufficient capacity at the existing Leitrim PS. Step 2 addresses this with the following proposed servicing solution: an on-site pumping station to convey the expansion land growth flows from the new Leitrim lands to the off-site Conroy Road Trunk sewer. The Conroy Road Trunk Sewer will require upsizing between specific extents identified through the recent IMP.

The Conroy Road Trunk Phase 1 and Phase 2 upgrades were strategically oversized in the WWMP based on post-2046 growth horizon projections (2101), to provide additional post-period trunk capacity. The Leitrim expansion lands will utilize this additional capacity and can be accommodated through this upsizing. As the project is necessary to service the new expansion area, these sewer upgrades are being expedited by the City to provide the additional required trunk capacity and enable development in the Leitrim expansion area. Design for the Conroy Road Trunk sewer upgrade is expected to begin in 2026 and the upsized sewer is expected to be in service by 2030.

A new on-site pumping station is recommended to convey flows from the Leitrim expansion lands to the existing trunk sewer system. Conveying the expansion lands' flows to the Conroy Road Trunk via a new pumping station was the strategy previously identified during the draft 2023 IMP, when MMAH initially added the Leitrim lands as expansion area "S-5 East" before subsequently removing it from the Official Plan.

The hydraulic assessment confirmed that this configuration, combined with the planned trunk upgrades from the IMP, can accommodate the proposed Leitrim expansion area flows while maintaining the City's target LOS. Residual capacity remains available in the downstream trunk sewer system under this scenario.

Overall, the model confirms that the expansion of the Leitrim lands can be accommodated without requiring additional downstream trunk sewer upgrades beyond those proposed and sized in the IMP, as it is able to capitalize on the post-period capacity established by oversizing the Conroy Road Trunk Phase 1 and Phase 2 project.

It should be noted that the scope of this assessment is specific to the evaluation of off-site servicing solutions, such as the Conroy Road Trunk Phase 1 and Phase 2 upgrades. On-site works, such as the proposed pumping station, are the responsibility of the developer to determine through the Future Neighbourhood Plan, where functional and detailed design occurs. Class D cost estimates for these on-site works are similarly the responsibility of the developer and have not been calculated through Steps 1 and 2 of this sanitary assessment.

The servicing strategy is mapped in Figure 10 along with the hydraulic modelling results.

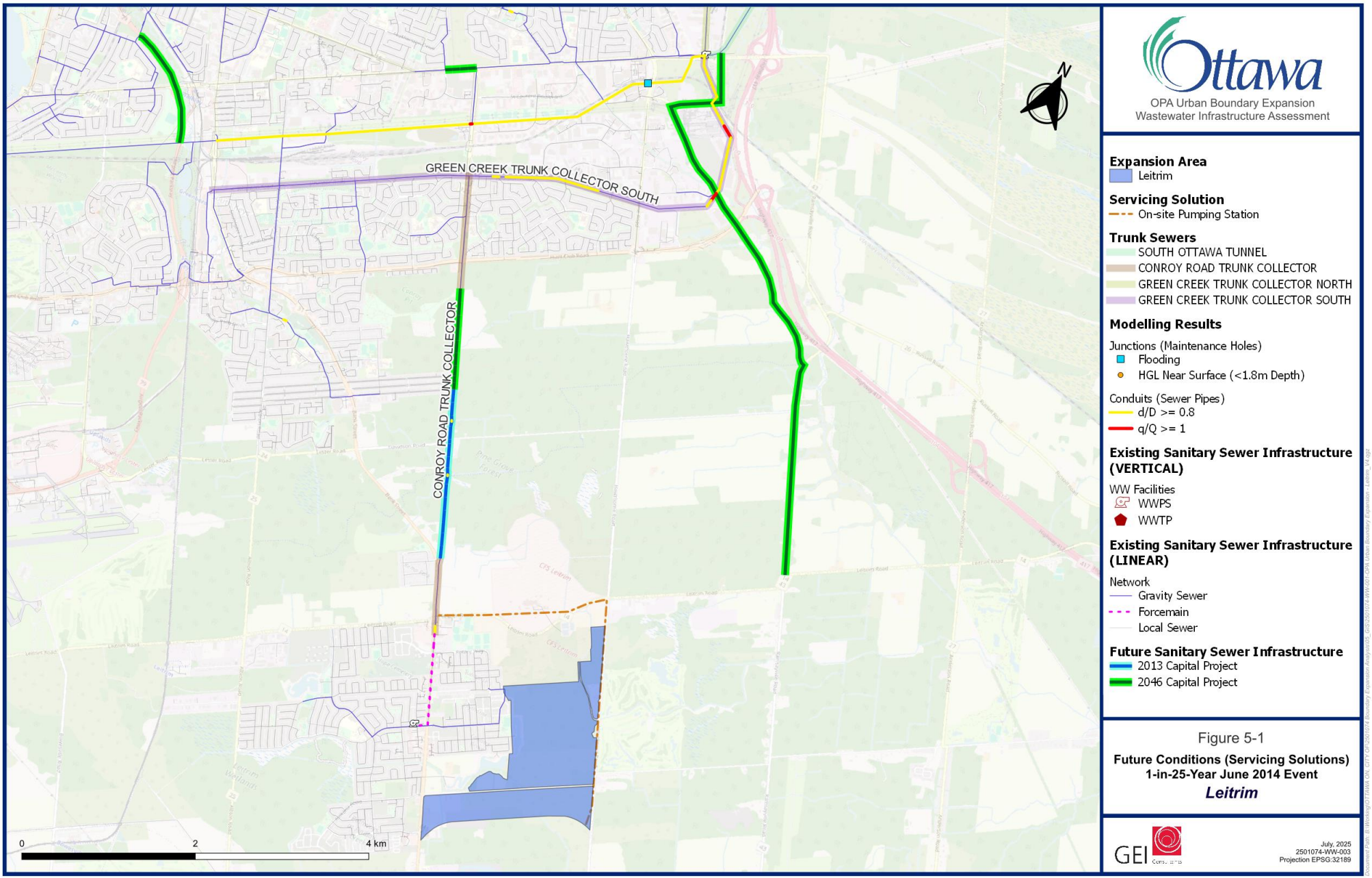

Figure 10: Map view of future conditions, with Leitrim lands and servicing solutions