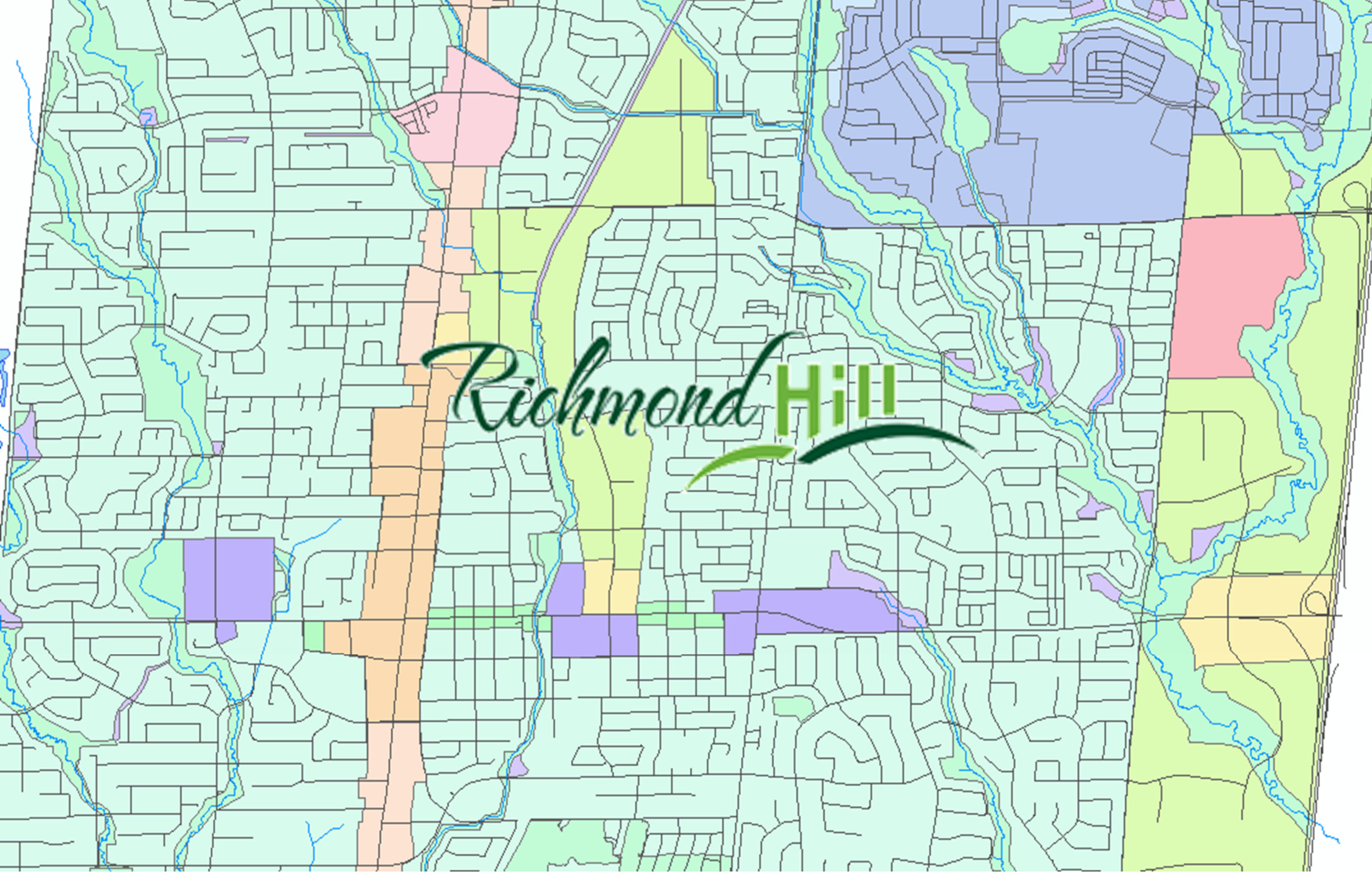

Servicing Impact Report

Housing Accelerator Fund Project

Municipal Servicing Review

November 2024 – TYLin Contract # 100359

City of Richmond Hill

Richmond Hill | TYLin

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1 Introduction

1.1 Project Description

In November 2023, the City of Richmond Hill announced a $31 million investment from the Federal Government's Housing Accelerator Fund (HAF) to help provide more affordable housing options. The Housing Accelerator Fund allows the City to advance multiple actions to encourage owners and builders to create affordable housing. The funding can help Richmond Hill to create increased affordable housing and advance infrastructure that unlocks residential development at a faster pace.

Subsequently, Gladki Planning Associates, with TYLin, LGA Architectural Partners and Aird & Berlis LLP, was retained by the City of Richmond Hill to provide professional planning consulting services to proposed amendments to the Official Plan and Zoning By-Law to permit up to four residential units within a single lot and four storeys within the major transit station areas (MTSA) along Highway 7 and Yonge Street and Major Mackenzie Drive East and GO Rail corridor. This project will include public consultation and recommendations to Council.

The potential redevelopment of single-family homes, semi-detached homes, and townhomes into as many as four total units may have impacts on the transportation network. This project provides the opportunity for the City to understand the potential positive and adverse impacts of this change so that policies can be established to ensure that the level-of-service to all residents and businesses is preserved through this period of transition.

1.2 Project Site Description

The City of Richmond Hill is bounded by Bathurst Street in the west, Bloomington Road to the north, Highway 404 in the east and Highway 7 in the south. Overall, the City spans over 100 km^2 and is located within the Regional Municipality of York.

This project review will span the entire City of Richmond Hill and includes a 4-storey as well as a 4-unit approach. The 4-story component is concentrated on the intensification areas within the municipal boundary, with a focus on the MTSA areas along Highway 7 and Yonge Street, and Major Mackenzie Drive East and the GO rail corridor. The 4-unit component is focused on residential neighbourhoods. The housing changes will impact all urban residential zones that permit single detached, semi-detached, and townhouses, as well as MTSAs that intersect rapid transit corridors.

1.3 Report Purpose

The objective of this municipal servicing study is to identify key issues and considerations relating to how the adoption of the HAF objectives could impact – or be impacted by – the level-of-service objectives. Three additional residential units will be proposed in all zones that permit single detached houses, semi-detached houses and townhouses. Four-storeys as-of-right will be permitted in the MTSAs along the Yonge Street and Highway 7 priority transit corridors where there is a mixed-use centre or corridor designation in the Official Plan, and Richmond Hill GO Station MTSA.

This report gives an overview of analyses undertaken in support of the Municipal Servicing Review, identifies potential servicing challenges, and provides recommendations to monitor the uptake in ARUs across the City such that upgrades to municipal services may be implemented to mitigate potential impacts to servicing and the level-of-service provided to existing residents and businesses in Richmond Hill.

1.4 Acknowledgments

This analysis and the recommendations contained herein were developed following significant coordination with and support from Richmond Hill's Infrastructure Planning and Development Engineering Division.

2 Analysis Methodology

2.1 Richmond Hill Hydraulic Models

TYLin were provided with Richmond Hill's current hydraulic models, which were created in the InfoWorks and InfoWater modelling platforms. These models are tools which the City uses to continually update servicing calculations based on recent developments and long-term planning forecasting to assess the systems' ability to provide the desired level-of-service to all properties within the city.

The models generally consist of the following:

- Pipe network information (pipe geometry and physical properties, such as diameter, pipe grade, and roughness);
- Boundary conditions established by York Region's facilities;
- Water Demands and Wastewater Flows, which are generally distributed across the networks as averages based on calibration points in the networks; and,
- A series of standard hydraulic calculations.

With any system-wide model, there is a degree of averaging which occurs across the systems, based on calibration points (locations where detailed information is available). The averaging can be on a geographical scale (across a neighbourhood that ultimately drains through a flow monitoring location, as an example), or on a time scale (water consumption and wastewater flow generation are influenced by year-to-year weather patterns – especially rainfall).

System-wide models are typically very good at flow projections for trunk networks, as these service larger overall areas, and the averages that the model inputs are based on are typically more reliable at that scale. Conversely, if an analysis is focussed on generating results on a small street, there are a number of local influences which could mean that the system-wide averages don't necessarily apply as reliably in that particular location.

As the focus of this study is to consider the overall system impacts relating to the possible addition of ARUs in all areas of the City, the models are an appropriate tool.

2.2 Consideration for Additional Residential Units

One of the significant challenges relating to this study, is that there is very little data available to support *where* ARUs will ultimately be constructed, nor how quickly. The intent of the HAF is to permit all homeowners (of single-family, semi-detached or townhouse units) to consider providing additional residential units, and not only homeowners in specific areas of the city.

While it might be reasonable to assume that ARUs would be more attractive in certain areas versus others, there is no way to quantify that at this time.

Based on information provided by the City, we know that ARUs have been provided at approximately 0.3% of the "ARU-eligible" properties (single-family, semi-detached, and townhouse units) across the City. Generally all have been for a *single* ARU, despite the current bylaw permitting two ARUs per property.

For this Study, we assumed that **one in every ten** ARU-eligible properties would add the full three units permitted under the provisions of the HAF (to a total of four units on those parcels):

- While it is not anticipated that all applications for ARUs will be to the maximum permitted density, this assumption is essentially equivalent to three in every ten parcels adding a single ARU. In a neighbourhood of 500 homes, this assumption would mean that 50 of those homes would add three ARUs each, resulting in a neighbourhood of 650 total residential units;
- Conversely, if 30 percent of the homes in this same neighbourhood (150 of 500 homes) added a single ARU, the net increase would also be 150 units across the neighbourhood;
- Since the ARUs would be smaller than a standard residence, it is assumed that these units would accommodate 2.7 persons/unit, versus 3.8 persons in the original dwellings. This effectively results in a population increase within these neighbourhoods of approximately 19% overall;
- This assumption applies to all ARU-eligible parcels across the City, though it is anticipated that some areas will have greater demand for (or interest in) ARUs than others.

Considering a historical annual uptake of 0.3%, this assumption of 10 percent adding three units – or 30 percent adding one – represents approximately a 100-year supply of ARUs. While this exceeds normal planning horizons (often 25 years), we feel that this is a reasonably-conservative estimate for the purposes of this study given the following:

- The adoption of this By-Law could increase interest amongst homeowners;
- Increasing housing prices might lead to greater interest in homeowners investing in ARUs for their properties;
- As ARU uptake begins, these will become more visible and additional homeowners might consider undertaking similar improvements to their properties;

So while a 100-year supply based on limited data from the past four years might seem excessive, if the rate of uptake doubles, then the assumption would only represent a 50-year supply. If it doubles again, it would represent a 25-year supply.

Another important consideration to this assumption is that there may well be individual neighbourhoods where ARUs are ultimately more popular than others. As such, this potentially conservative assumption on a *city-wide* basis may actually be quite reasonable in these individual areas.

2.3 Level of Service Objectives

Municipal infrastructure is sized based design criteria and level-of-service standards which are fairly consistent across municipalities.

For wastewater collection systems, it is common-practice to size sewer pipes such that these are not expected to flow at greater than 80% of their maximum capacity. This 20% buffer generally allows for some future intensification (note that the assumption adopted for this study would be equivalent to a population increase of 19 percent), as well as a gradual increase in flow in the sewers as they age (groundwater incursion into sanitary sewers can increase over time due to gradual pipe degradation).

Wastewater systems also account for Rainfall Derived Inflow and Infiltration (RDI-I) which understands that a degree of rainfall runoff will ultimately find its way into sanitary sewer systems. This can result in temporary high flows in the sewers, and it is accepted – under significant storm events – that some surcharging of the sewers can occur. When surcharging occurs, the water levels in the sewer system can rise above the tops of the pipes, with the water level getting closer to the ground surface for larger storms (this would potentially be visible in manholes). As water levels in the sewer system rise, there is a risk that wastewater could bak-up along residential service connections and flood basements. The City of Richmond Hill assesses basement flooding risk based on an extreme storm event having a 1-in-100 year probability, and a risk criteria of a water level in the sewers of less than 2.0 m below ground level. This depth is selected as the risk criteria as basements are commonly approximately 1.8 m (6 feet) deep.

In water systems, the level-of service objectives are related to the pressure at which the system delivers the water to individual properties. The City generally strives to provide at least 350 kPa of pressure (50 psi) during peak demand periods and 140 kPa (20 psi) during maximum day plus fire flow periods. Pressure loss in water systems is related to the velocity of the flow in the pipes, so additional users on a system would ultimately reduce pressures somewhat.

As Richmond Hill's water system is designed for domestic use and fire protection, the fire-protection requirements (which are usually quite large, relative to domestic demands) generally govern when it comes to sizing the watermains. With respect to the consideration of ARUs, the fire protection guidelines generally recommend an increase fire flow consideration for neighbourhoods where there is a higher overall development density, represented as the distance separating one unit from another. This is based on the fire protection practice of applying water to structures adjacent to structure that is on fire, in an attempt to prevent the fire from spreading to the adjacent structures. In Richmond Hill, the fire protection requirement for single-family homes is 65 L/s, but it is 100 L/s for townhouse developments. As the inclusion of ARUs in existing neighbourhoods will effectively increase the overall density of developments (particularly if garden suites are constructed.

3 Servicing Assessment Results

3.1 Modelling Results

The modelling completed for this study considered the following scenarios, which were included in the models provided by the City:

- Existing Conditions (2024 development and infrastructure);
- Existing Conditions, optimized to address current system constraints; and,
- 2051 Conditions (2051 development, including proposed future infrastructure).

To these scenarios TYLin added an additional sub-scenario to each in order to account for the inclusion of ARUs, accounting for the uptake described in Section 2.2 (ten percent uptake to three ARUs).

The modelling results are presented in a separate Technical Memorandum included in this Final Report as **Appendix A**. This separate techmemo details:

1) The analysis approach;
2) The technical representation of the ARUs in the models; and,
3) Detailed results from the six main sub-scenarios described above for both the water and wastewater systems individually.

3.1.1 Results Representation

Traditionally, hydraulic modelling results are represented through colour-coding and annotations assigned to the links and nodes, representing the system pipes and manholes/junctions. As this study relates to properties and how ARUs on individual properties can impact – or be impacted by – pipe capacities, the model results have been transferred to the individual ARU-eligible parcels based on the proximity of a parcel’s centroid to an individual model node.

Models generate data – water pressures, flow velocities, flow rate as a percentage of pipe capacity as examples – which is often represented on colour-coded maps showing the numerical results graphically. Model results are an indication of what conditions could occur in the system given a certain set of conditions. Where undesirable conditions are identified in a model, there is often additional investigation initiated to determine whether the modelling results are truly representative of the actual conditions, and potentially to confirm how big of a problem the potential “failure” to meet the intended level-of-service might be. The need for further investigation and review is more prevalent in system-wide modelling.

So while models can generate very precise results, that degree of precision is sometimes inconsistent with the real-life variability in system flows and demands. Models often display results in a very binary "pass/fail" system, where this really represents a degree of *risk of failure*, as opposed to a *guarantee*.

There are some known locations within the system where – under certain conditions – there is a risk that the existing level-of-service standards might not be met. There is always some degree of risk. Models can be also be used to quickly assess system upgrades aimed at lower that identified risk, but we don't immediately implement upgrades. Where system planners and engineers become aware of a given risk, they will typically assess the risk and make a recommendation. The risk assessment process often consists of a more detailed study of a specific service area, often aided by additional data collection in the system.

The degrees of risk within the servicing infrastructure is represented in the modelling results maps based on the criteria identified in Table 3-1.

Table 3-1 Definition of Risk Categories

Risk Category	Water System Criteria	Wastewater System Criteria
Low (Green)	Modelled available Fire Flow exceeds the 100 L/s objective for townhouse development	Modelled water level in sewers is greater than 2.0 m below grade
Medium (Orange)	Modelled available Fire Flow between 80 L/s and 100 L/s	Modelled water level is 1.8 m to 2.0 m below grade
High (Red)	Modelled available Fire Flow below 80 L/s	Modelled water level is less than 1.8 m below grade

It is important to note that "low risk" does not mean "no risk". While the modelling results might indicate that conditions are such that a failure to meet the level of service (risk of flooding, as an example) is low, there could be a specific circumstance that could arise that could result in a failure in the system.

Similarly, "high risk" does not mean "failure is imminent". An available fire flow of less than 80 L/s does not mean that a particular area is unsafe, especially since the level-of-service objective for single-family homes is presently 67 L/s in Richmond Hill.

Models can identify potential system impacts for even a single additional residential unit. In reality, a single unit would result in no noticeable impact in a system. But while adding a single unit produces no measurable impact/risk, adding a single unit *many times over* will ultimately increase the level of risk.

3.1.2 Water Maps, Wastewater Maps, and Combined Maps

The results maps have been prepared based on water system results only, wastewater system results only, and the combination of both. Where the degree of servicing risk for an individual parcel is different from a water perspective versus a wastewater perspective, the more stringent risk will be represented. As an example, if the water risk is identified as "low" (green), and the wastewater risk is "high" (red), the risk on the combined map will be identified as "high" (red).

3.1.3 Discussion on Model Scenarios

The modelling scenarios for this study were established based on the modelling results available through the City's ongoing asset management activities. The City is continually updating the models based on new development details, new infrastructure as it is built/replaced, and new details relating to per-capita water demands which is generally available through water billing records or wastewater modelling activities.

The **Existing Conditions** model scenarios are intended to represent 2024 conditions, both in terms of the infrastructure that is in place, and the developments and populations which are currently allocated to the systems. Some developments which are under-construction or even approved are accounted for in these models, as they have servicing capacity allocation. There are locations identified in these model results which indicate that there are sections in the city which are currently not providing the desired level-of-service.

The **Existing Conditions, Optimized** scenarios show the 2024 developments with modifications to the sewer and watermain systems aimed at addressing the more critical areas identified as not meeting the level-of-service standards in the Existing Conditions models. While there are some capital improvements being contemplated at this time, it is not known when each of these identified improvements will be implemented. Generally-speaking, any system improvements identified in the Optimized models should also result in lower risk resulting from potential development of ARUs. As new infrastructure is constructed, it is generally sized to have some additional reserve capacity for future intensification. ARUs are a form of intensification.

The **2051 Conditions** models account for forecasted growth in accordance with the city's Official Plan, and additional new infrastructure and infrastructure improvements aimed at meeting the servicing needs of this additional growth.

In all scenarios, the modelling results "with ARUs added" include the full ARU assumption of 10 percent of ARU-eligible parcels going to a full three ARUs (to a total of four units on those parcels). The results, therefore, account for the unrealistic situation where "full ARU buildout" were to occur before any infrastructure upgrades could be contemplated. This approach identifies the greatest risk to the system, and allows infrastructure planning activities to consider these potential future demands in upcoming infrastructure planning.

4 Selected Modelling Results Mapping

In support of the discussion from the previous section, three results maps are provided here:

- The map included in Figure 4-1 shows the results from the Existing Conditions water modeling WITH ARUs;
- The map included in Figure 4-2 shows the results from the Existing Conditions wastewater modeling WITH ARUs; and,
- The map included in Figure 4-3 shows the combined results from the Existing Conditions water and wastewater modelling WITH ARUs.

These particular results are provided as these represent the potential conditions at the time that the HAF bylaw is potentially adopted, but with the identified system optimization to address existing potential servivcing risks. Again, these consider that the full buildout of ARUs (based on the assumption that 10 percent of ARU-eligible parcels will add three ARUs each would occur.

All of the results maps from all scenarios are included in the Techmemo included in **Appendix A**.

Figure 4-1 Existing Conditions Optimized plus ARUs,Water Only

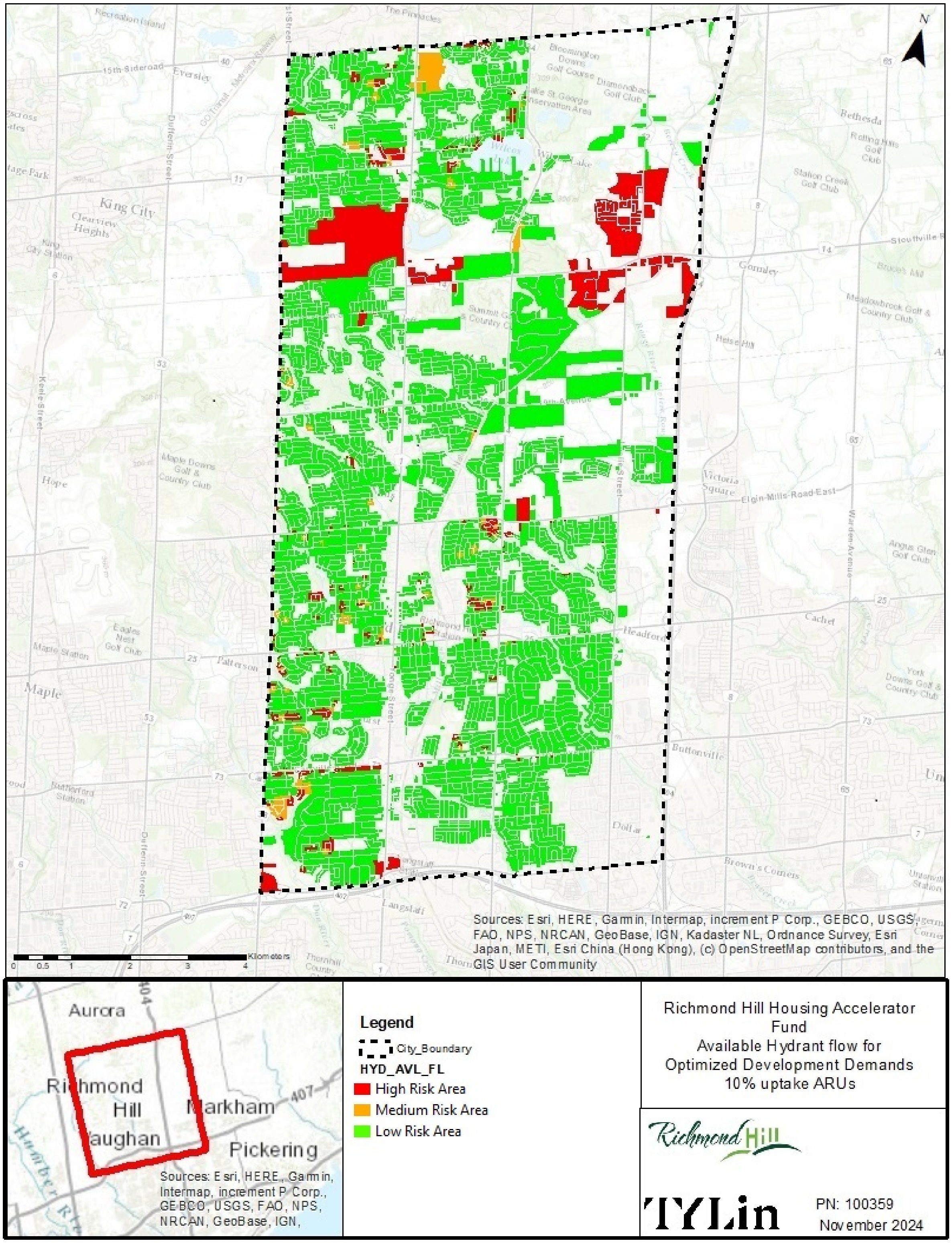


Figure 4-2 Existing Conditions Optimized plus ARUs, Wastewater Only

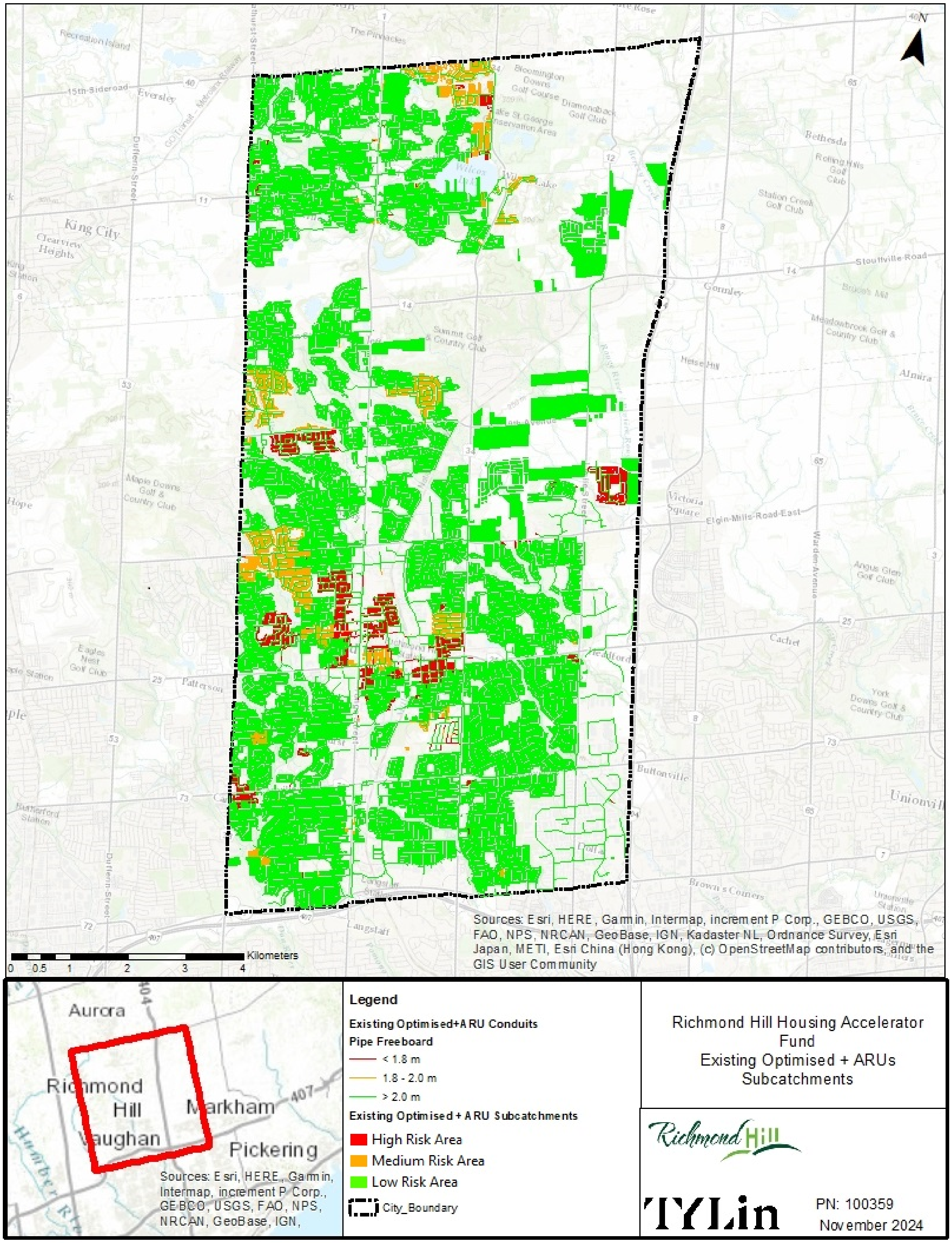
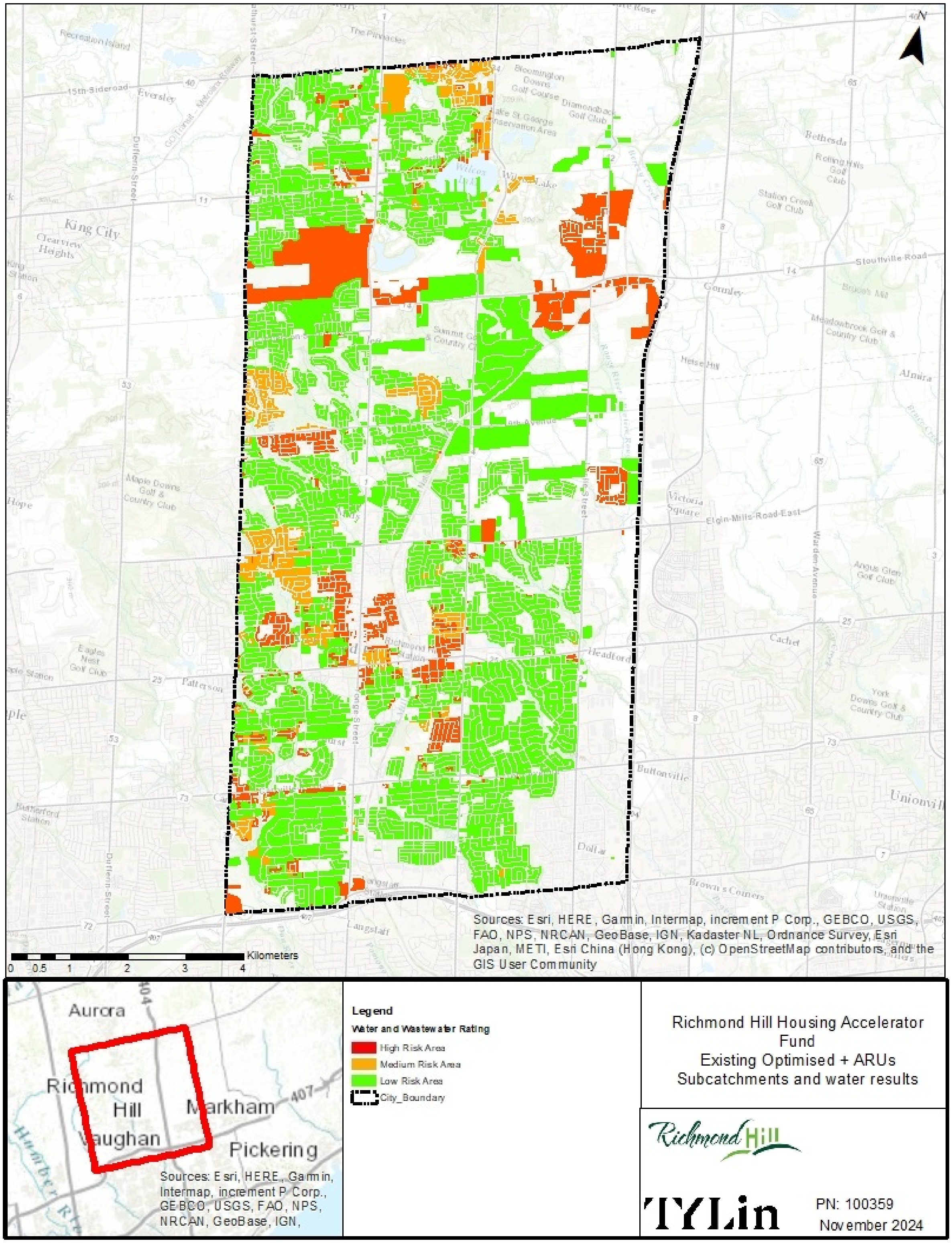


Figure 4-3 Existing Conditions Optimized plus ARUs, Combined Water and Wastewater



5 Conclusions and Recommendations

While best efforts have been undertaken in order to assess the potential impacts of ARUs across Richmond Hill, there is significant uncertainty regarding what the actual impacts to servicing will be. The models identify potential impacts, and specific locations where the risk of an impact will be high, versus locations where the risks will be more moderate, or even very low.

Much of this uncertainty centres around where ARUs will ultimately be constructed, and the overall rate of uptake over time. The City is continually collecting data from within their water and wastewater systems, and this data – combined with data about ARU applications and approvals – will assist in decision-making over time.

In the short-term, one of the deliverables from this process will be a tool for tracking the addition of ARUs and updating the hydraulic models to represent these in future analyses. This will assist future infrastructure planning efforts in re-assessing the risks in certain areas of the City

It may be necessary to upgrade some elements of the networks in order to reduce the risks, or to consider not permitting ARUs in some areas until the risks can be reduced.

Appendix A Servicing Results with Maps

Memorandum

Project:	Richmond Hill Housing Accelerator Fund
TYLin Project #:	100359
To	Gladki Planning Associates
From	TYLin
Date	November 14, 2024
Subject	Richmond Hill HAF – Servicing Results and Recommendations

1 INTRODUCTION

The primary objective of adopting the Housing Acceleration Fund is to provide Richmond Hill's homeowners with additional options as to how they use their properties. Under the HAF, all ground-related residential properties (single-family homes, semi-detached homes, and townhouses) could add three additional residential units (ARUs), to a total of four separate residences per property.

Existing infrastructure through the City was sized for much lower densities than those which could result from the adoption of the HAF densities.

The City's infrastructure planning efforts have already identified system constraints within the built water and wastewater pipe networks. Approving ARUs where there are existing constraints will risk making the adverse conditions worse and compromise the desired level of service.

While construction of a single residential unit may have an immeasurable impact to servicing, the City has a responsibility to anticipate and plan for a more significant uptake, and plan accordingly.

1.1 Basis of Analysis

For the purposes of this study, we are focusing on the three-ARU scenario, as the opportunity of increasing to two ARUs is already available to homeowners in Richmond Hill.

From a servicing planning perspective, we are considering ARUs as comparable to standard apartment unit. ARUs will therefore assume a population density of 2.7 persons per unit. Based on this, any property adopting the opportunity to add three ARUs will effectively be adding a population of 8.1 residents on average.

From a fire flow perspective, we are assuming that the infill associated with the potential for back-yard garden suites will result in a fire servicing objective comparable to a townhouse block (100 L/s, versus 63 L/s for a single-family property).

1.2 Assessment of ARU Impacts

We are considering three main scenarios:

- Existing Conditions

- Existing Conditions with improvements to address current system constraints
- 2051 Conditions

In all cases, we are showing existing constraints to accommodating ARUs, and also identify how servicing levels-of-service could be impacted assuming a 10% uptake in three-ARUs. For comparison purposes, one in ten homes adopting three ARUs would be hydraulically-equivalent to three in ten homes adding a single ARU.

We cannot predict where nor how many homeowners will take advantage of the opportunity to add units, so we are considering a 10% uptake for all eligible properties (single-family, semi-detached, and townhouses) across the City.

2 ANALYSIS APPROACH

We are presenting the results as follows:

Existing Constraints:

There are known constraints, and permitting ARUs in areas serviced through constrained infrastructure could worsen existing conditions. We are showing areas of the City as "constrained" in the context of ARUs.

Existing Planned improvements:

This demonstrates that – with the planned improvements – the constraints to permitting ARUs will be relaxed.

2.1 Considering Risk:

Where existing constraints exist, there is theoretically no remaining service capacity. In that context no development of any kind should be considered in that area. In a more practical sense, these "constrained areas" really present *a risk* that allowing any number of new units could result in servicing conditions which fail to meet the intended level of service. As the total number of additional units in an area increases, so does the risk of a potential adverse impact. While not a comprehensive list, the city's levels of service for water and wastewater are as follows:

- Water:
  - Minimum of 40 psi of pressure under peak hour demand conditions; and,
  - Minimum of 20 psi under maximum day plus fire flow conditions.
- Wastewater:
  - No pipe surcharging during dry-weather flows; and,
  - A Hydraulic grade line no less than 2.0 m below grade during a 100-year rainfall event. The City has updated its IDF curves to reflect future climate change impacts, incorporating a 15% increase in rainfall intensities. The updated 100-year storm IDF curve was applied in the model to assess both Existing Conditions with improvements and projected 2051 Conditions.

2.2 Degrees of Servicing Risk

We have identified the potential impacts of ARUs based on a measurement of risk:

- Water:
  - Areas where at least 100 L/s of fire flow are available are classified as "Low Risk Area";
  - Areas with 80 to 100 L/s of available fire flow carry a risk and are classified as "Medium Risk Area";
  - Areas with less than 80 L/s available are classified as "High Risk Area" and are not suitable for ARUs without corresponding infrastructure improvements.
- Wastewater:
  - Areas where the 100-year hydraulic grade line does not rise to within 2 meters of surface are classified as "Low Risk Area";
  - Areas where the 100 year hydraulic grade line reaches 1.8 to 2 meters below surface carry a risk and are classified as "Medium Risk Area"; and,
  - Areas where the hydraulic grade line rises to less than 1.8 meters below surface are considered are classified as "High Risk Area" and are not suitable for ARUs without corresponding infrastructure improvements.

In our analysis, we considered 2 population scenarios:

- Existing Population: Documenting where the addition of ANY ARUs could be considered, would incur some risk or be considered "constrained"; and,

10% Uptake: Documenting whether a 10% uptake or three ARUs per property does not compromise the level of service, where it would carry a degree of risk, or whether progressing to a 10% uptake would compromise the system.

3 RESULTS

3.1 Existing Conditions

This condition represents the existing (2024) systems. These results reflect the expected results of the current system, with no ARUs or planned growth.

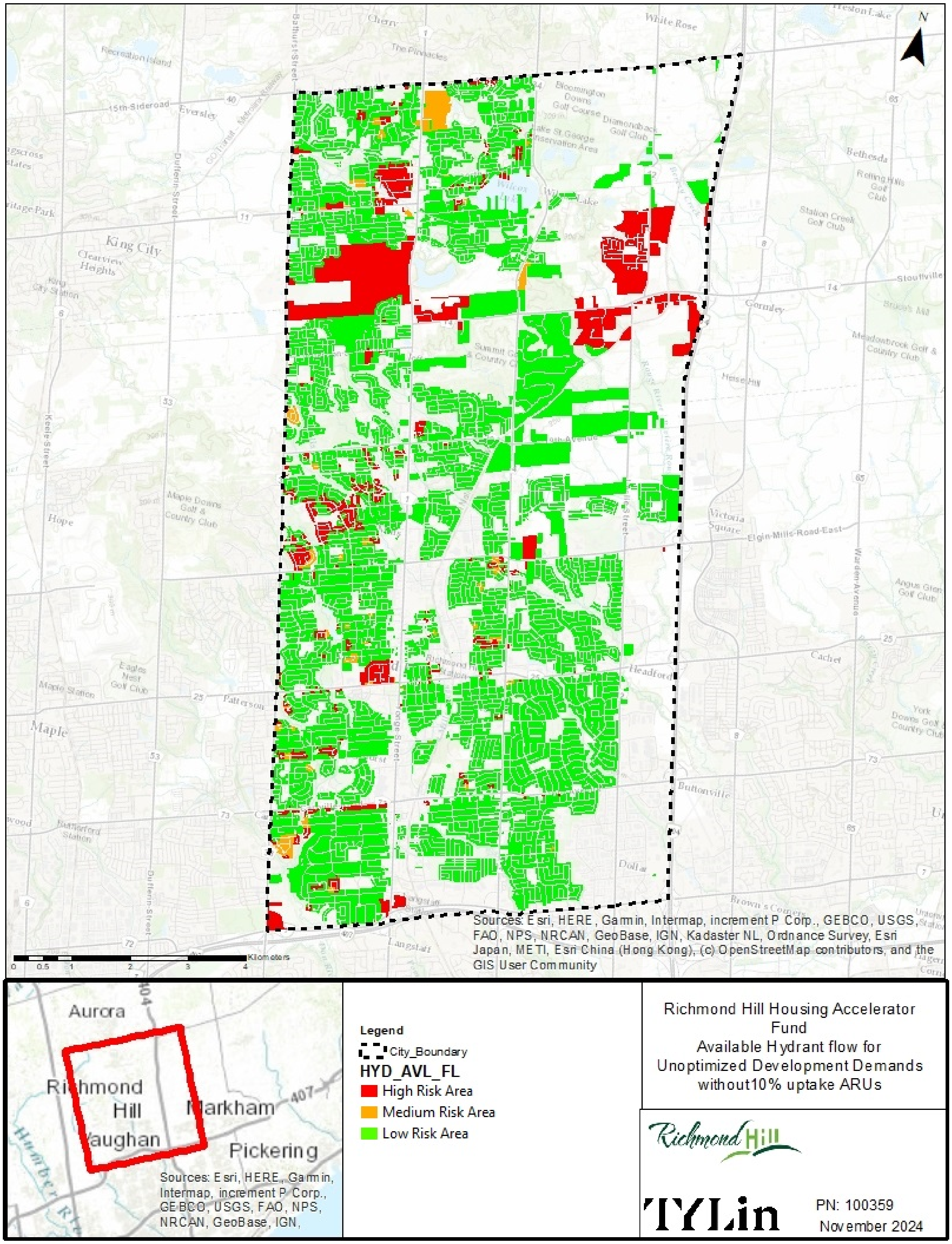
3.1.1 WATER

The existing results demonstrate pockets across the City where the system is already constrained. The majority of the constrained (less than 80 L/s) junctions are found along main roads and cul-de-sacs (which is an already known constraint).

There is a pocket of constrained junctions along the west side of Yonge Street and north of King Road. This area is a well-established area.

Another pocket of constrained junctions exists west of Bathurst St between 19th Avenue and Elgin Mills Road. This is another well-established area of the City. This area contains constrained junctions and some junctions with a risk of adverse conditions.

Figure 1 Existing Conditions – Water



3.1.2 WASTEWATER

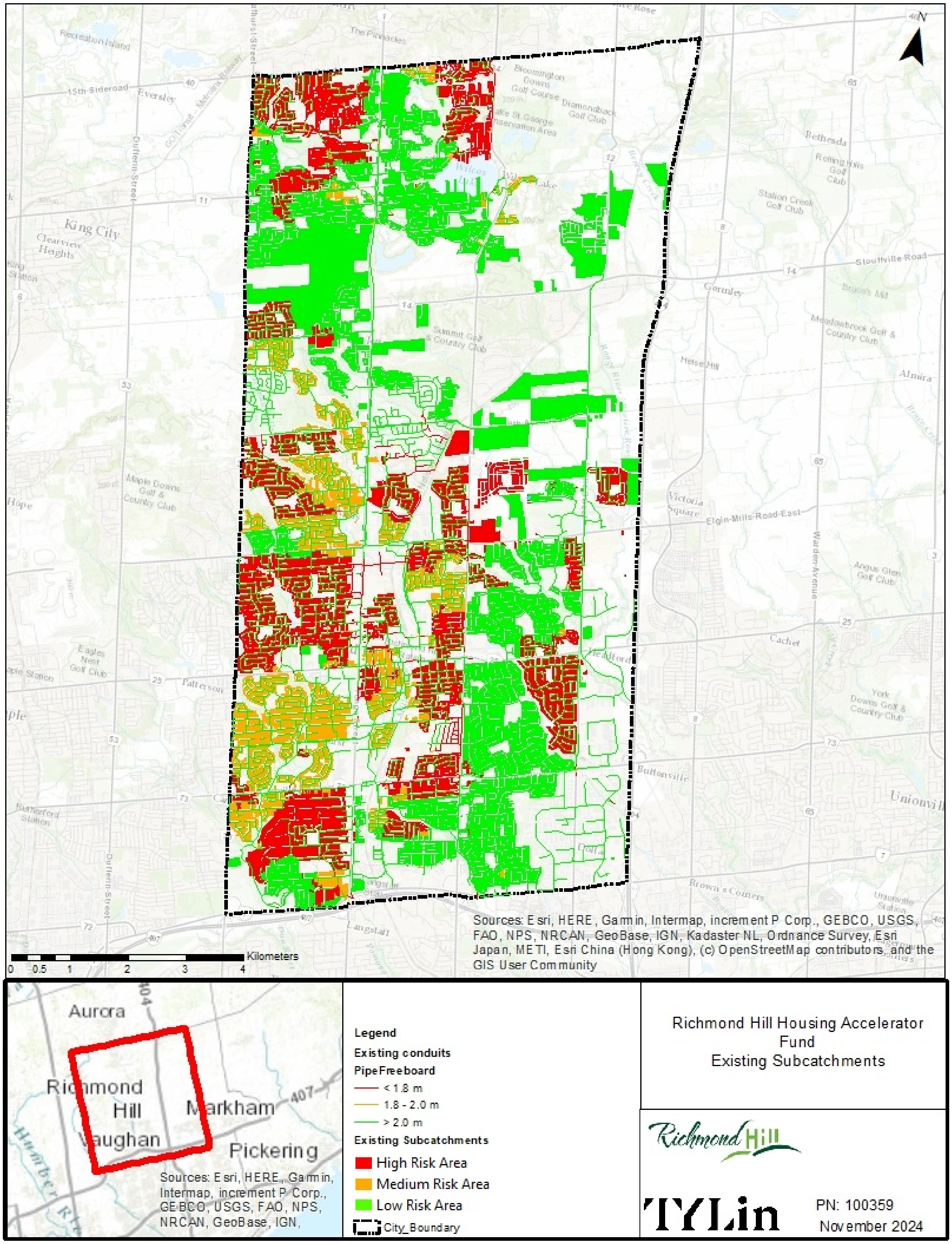
The existing results demonstrate pockets across the City where the system is already constrained. The majority of the constrained (less than 1.8m freeboard) areas are found between Bathurst St and Bayview Avenue and 19th Avenue and 16th Avenue.

These areas represent areas of the City where any development could worsen the downstream conditions.

There are also many areas that are at a risk of adverse condition. These areas indicate that they are nearing capacity and additional development could cause the sewers to experience a failure condition.

There are large pockets of the City that are not constrained.

Figure 2 Existing Conditions – Wastewater



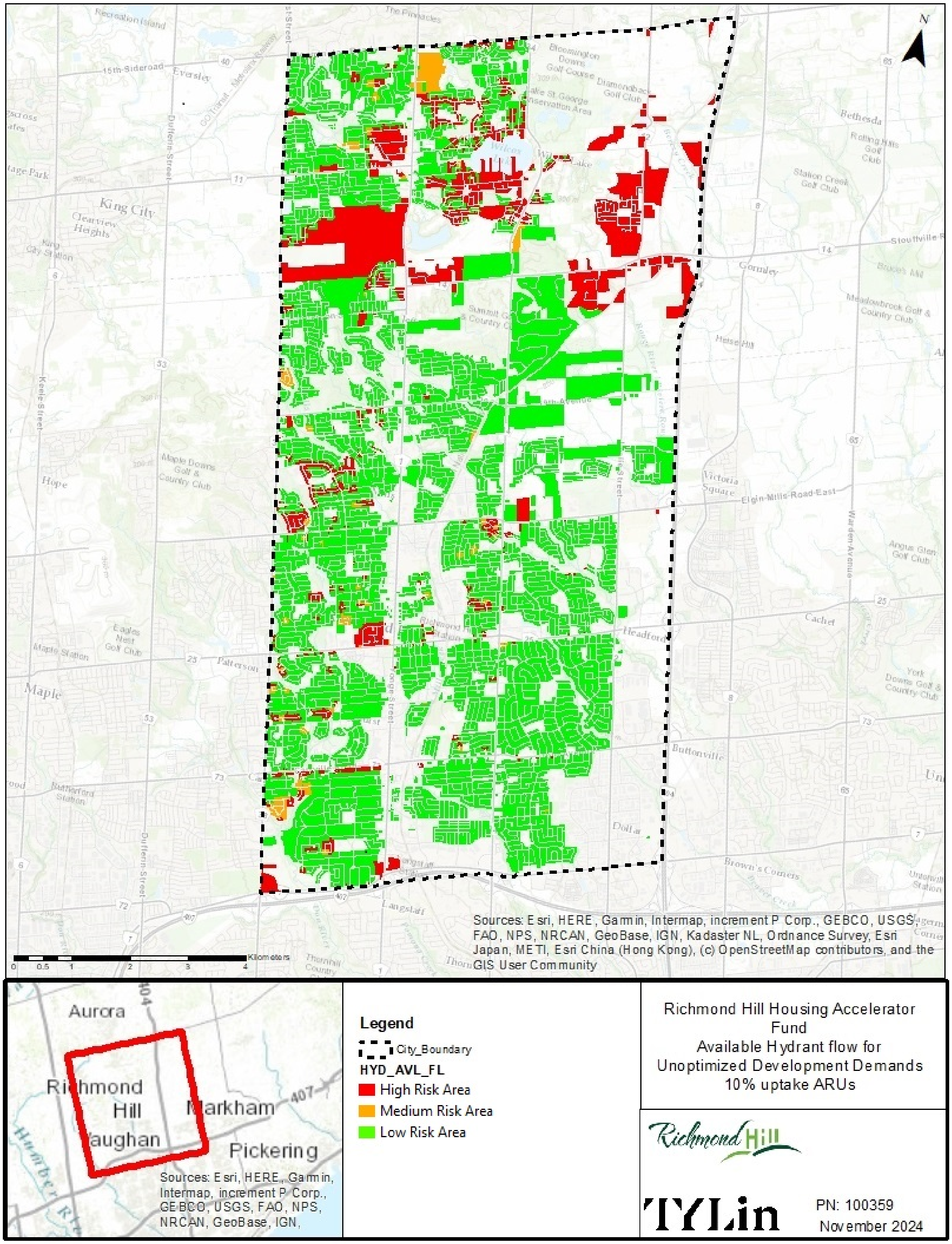
3.2 Existing Conditions with ARUs

This condition represents the existing (2024) systems with 10% ARU uptake. This condition shows how the existing system can or cannot accommodate 10% ARU uptake.

3.2.1 WATER

As expected, the constrained junctions are increased with the addition of ARUs.

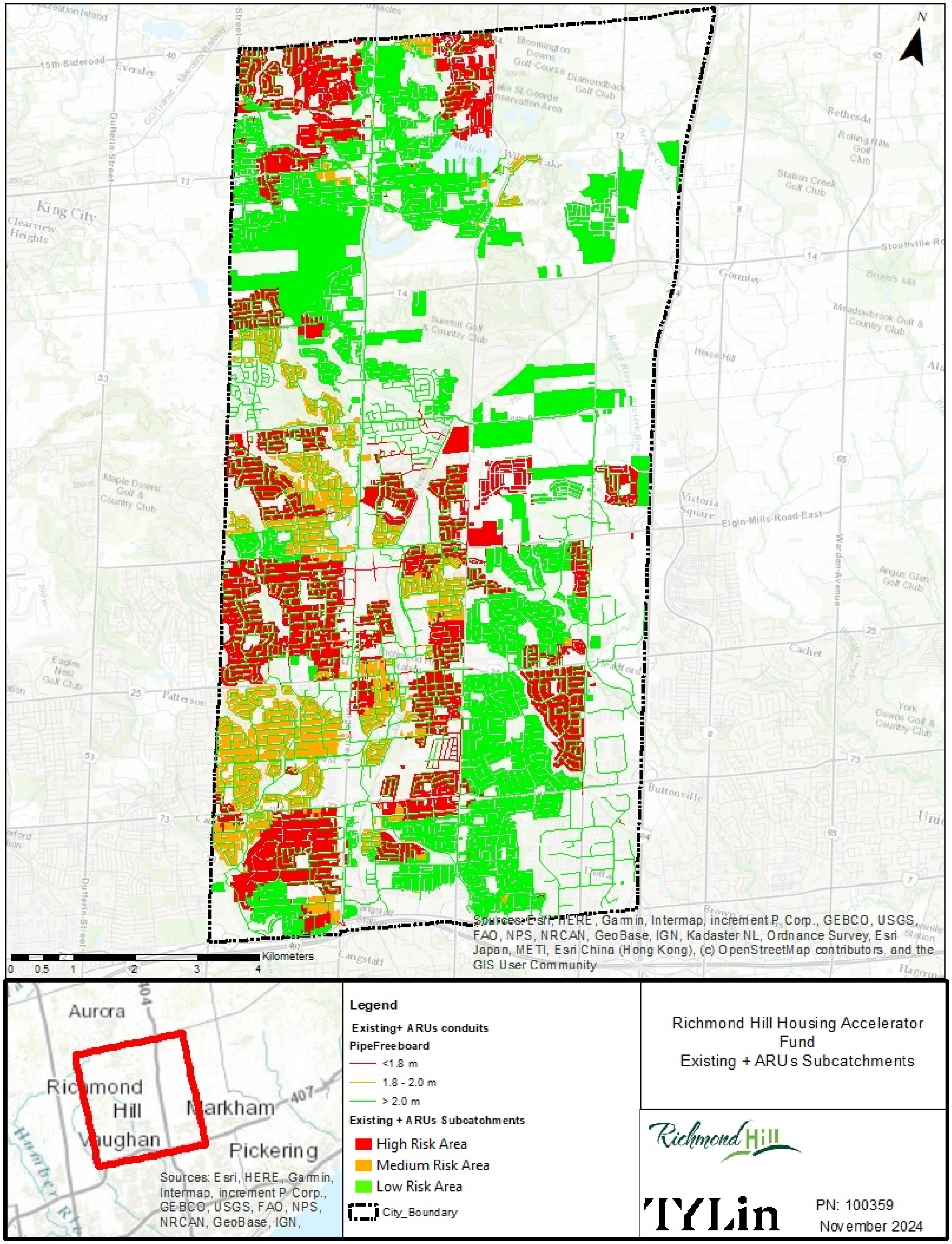
Figure 3 Existing Conditions and ARUs - Water



3.2.2 WASTEWATER

The constrained areas did not change with the addition of ARUs. This reinforces that the existing system cannot accommodate ARUs.

Figure 4 Existing Conditions and ARUs - Wastewater



3.3 Existing Conditions Optimized

This condition represents the existing systems optimized. This scenario includes identified and planned improvements by the City. It is assumed that these improvements will be constructed in the next 5 – 10 years.

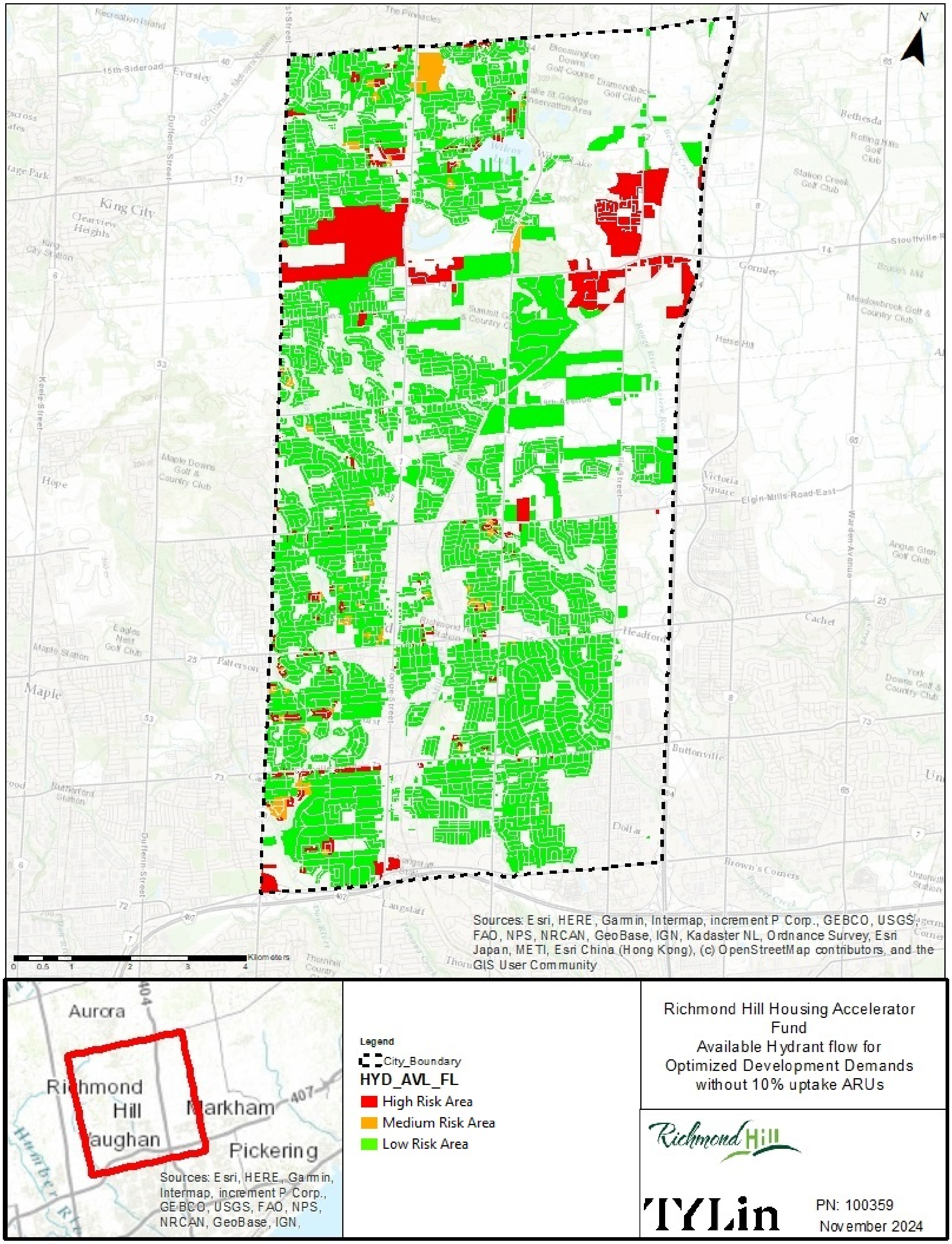
3.3.1 WATER

Under this condition, the constrained junctions are less than that of the existing conditions scenario. This is expected as this condition includes planned infrastructure improvements.

The constraints west of Leslie Street, north of Stouffville Road remain, as does some of the constraints near Yonge Street and King Road.

Overall, there are less constrained junctions City-wide when compared to the unoptimized scenario (Section 5.1).

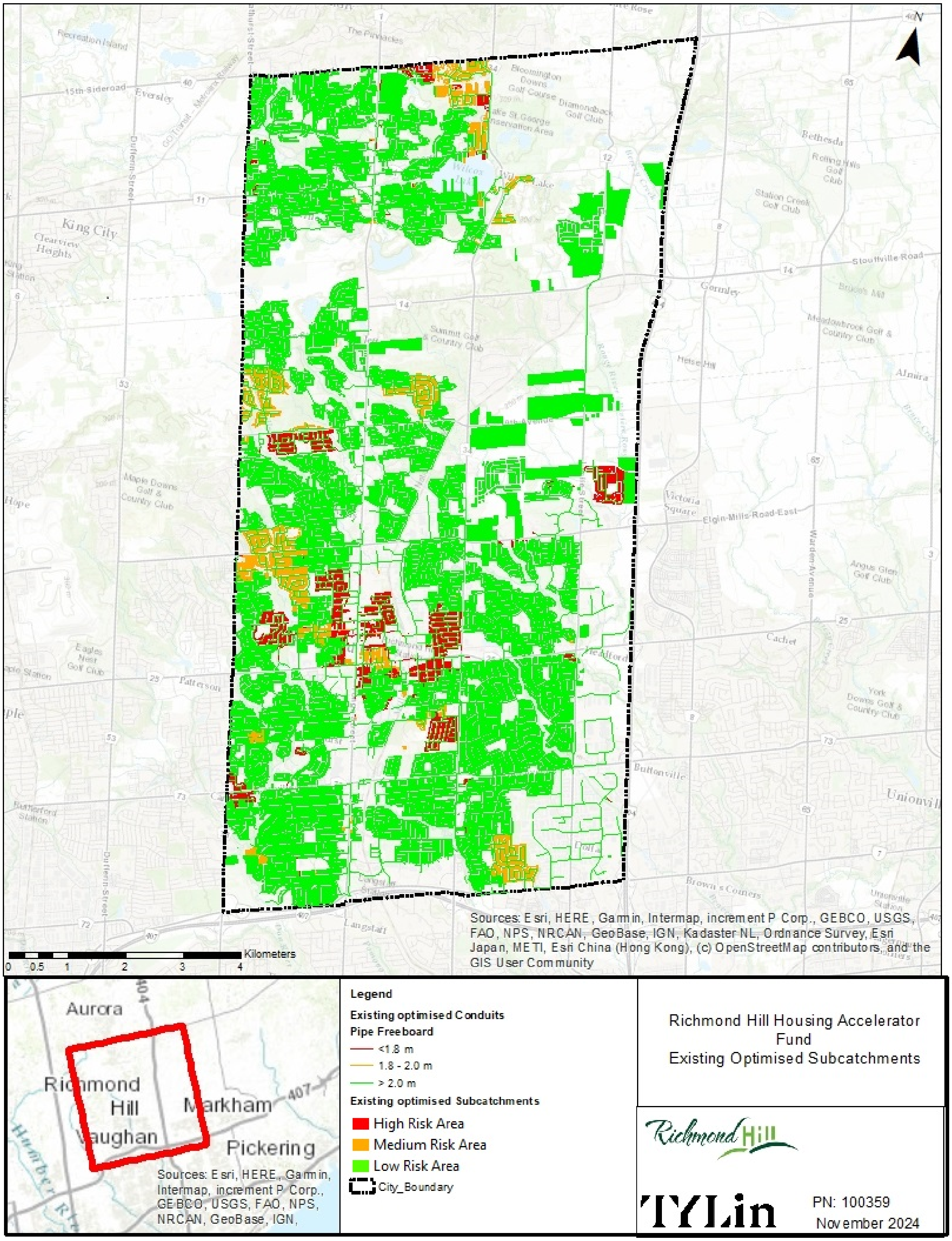
Figure 5 Existing Conditions Optimized - Water



3.3.2 WASTEWATER

With the planned infrastructure improvements, most of the constrained areas are resolved. This would mean there would be limited constrained areas if all the identified improvements were implemented.

Figure 6 Existing Conditions Optimized - Wastewater



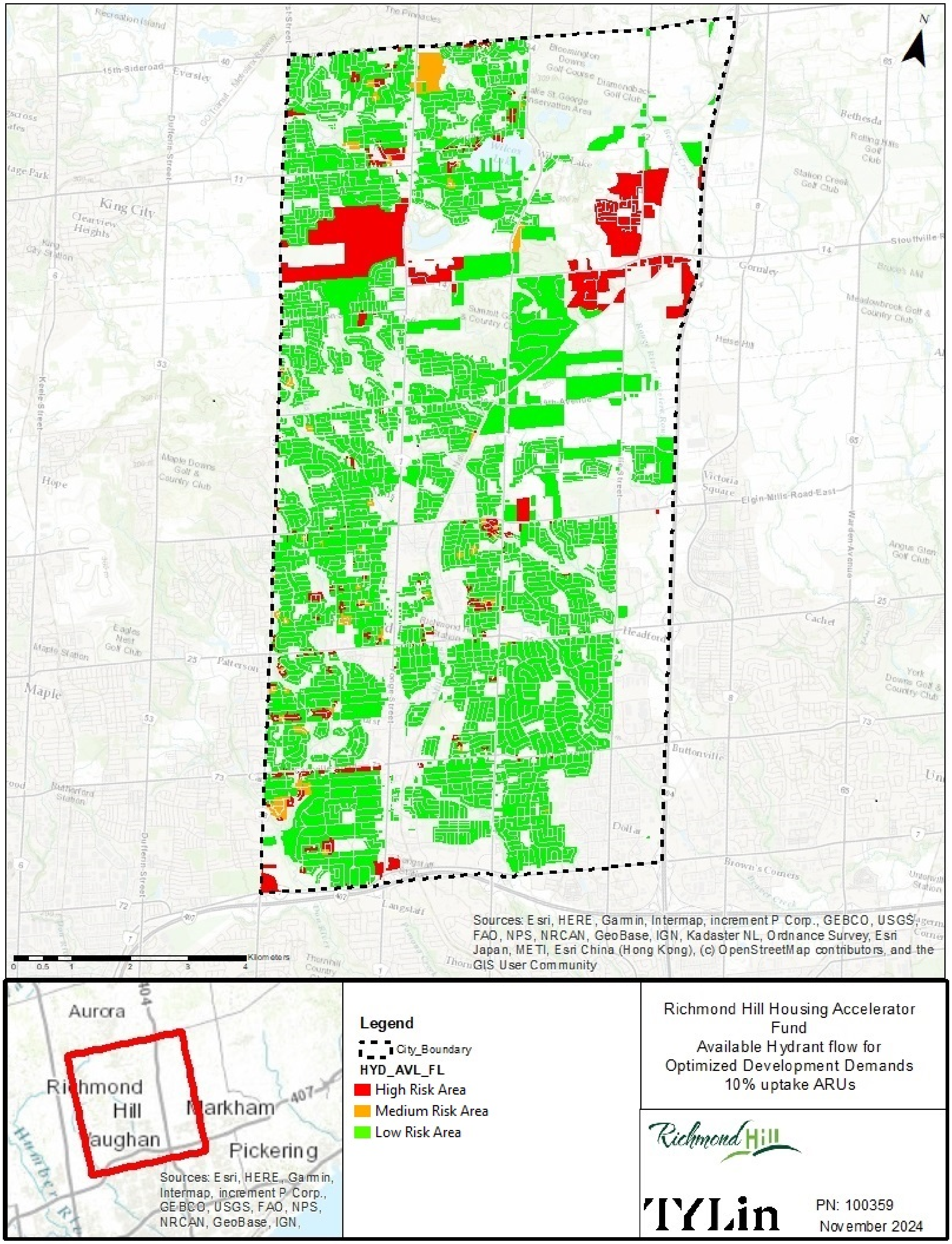
3.4 Existing Conditions Optimized with 10% ARU Uptake

This condition represents the existing systems optimized with 10% ARU uptake. This scenario includes identified and planned improvements by the City and an estimate of 10% ARU uptake City-wide.

3.4.1 WATER

These results are very similar to the results presented in Section 5.3. This implies that adding 10% ARU uptake will have minimal impact on the existing system once the improvements have been implemented.

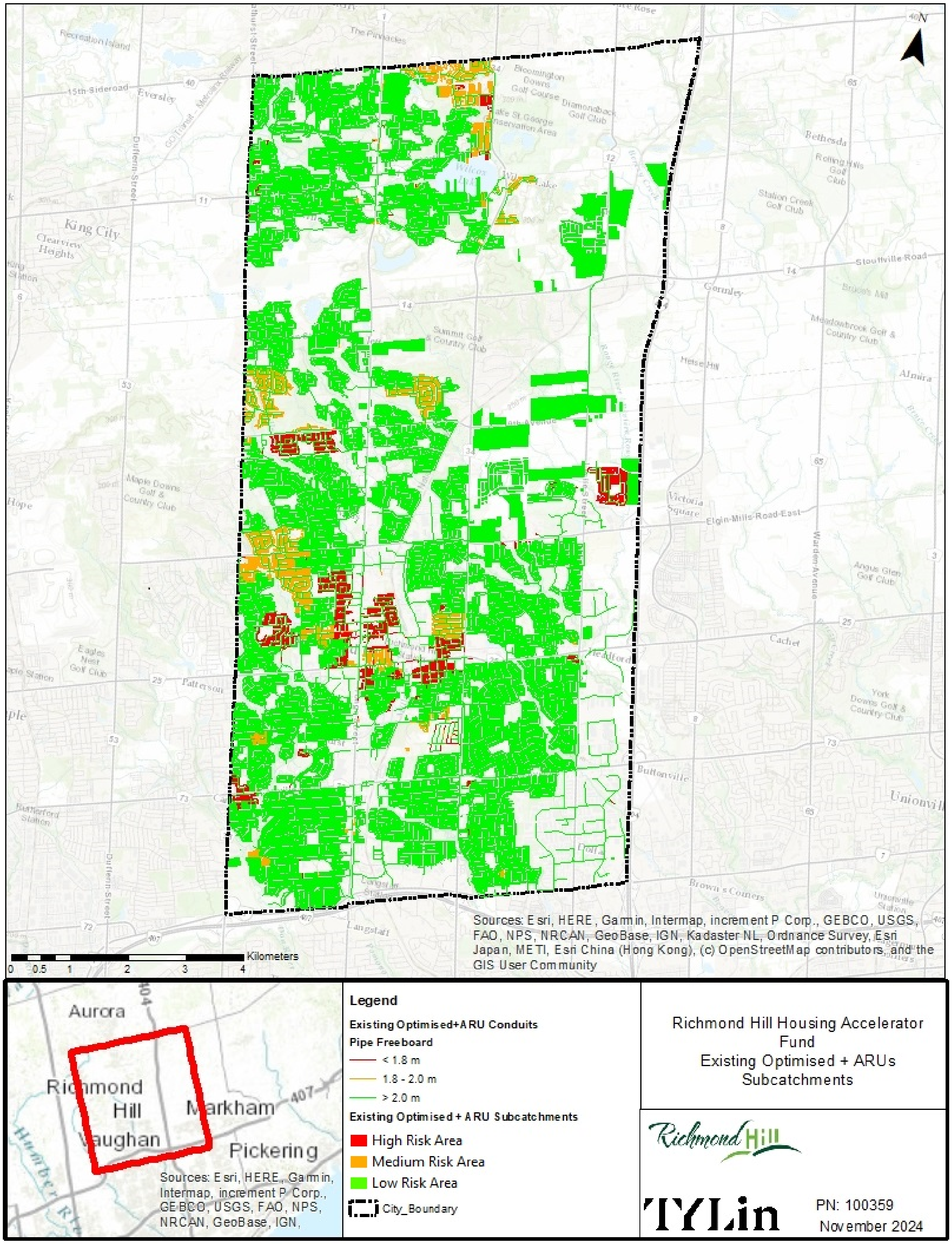
Figure 7 Existing Conditions Optimized and ARUs - Water



3.4.2 WASTEWATER

Under this condition, there is no additional constrained areas with 10% ARU uptake. Additional improvements would be required to unlock the feasibility of 10% ARU uptake in any constrained areas.

Figure 8 Existing Conditions Optimized with ARUs - Wastewater



3.5 2051 Conditions Optimized

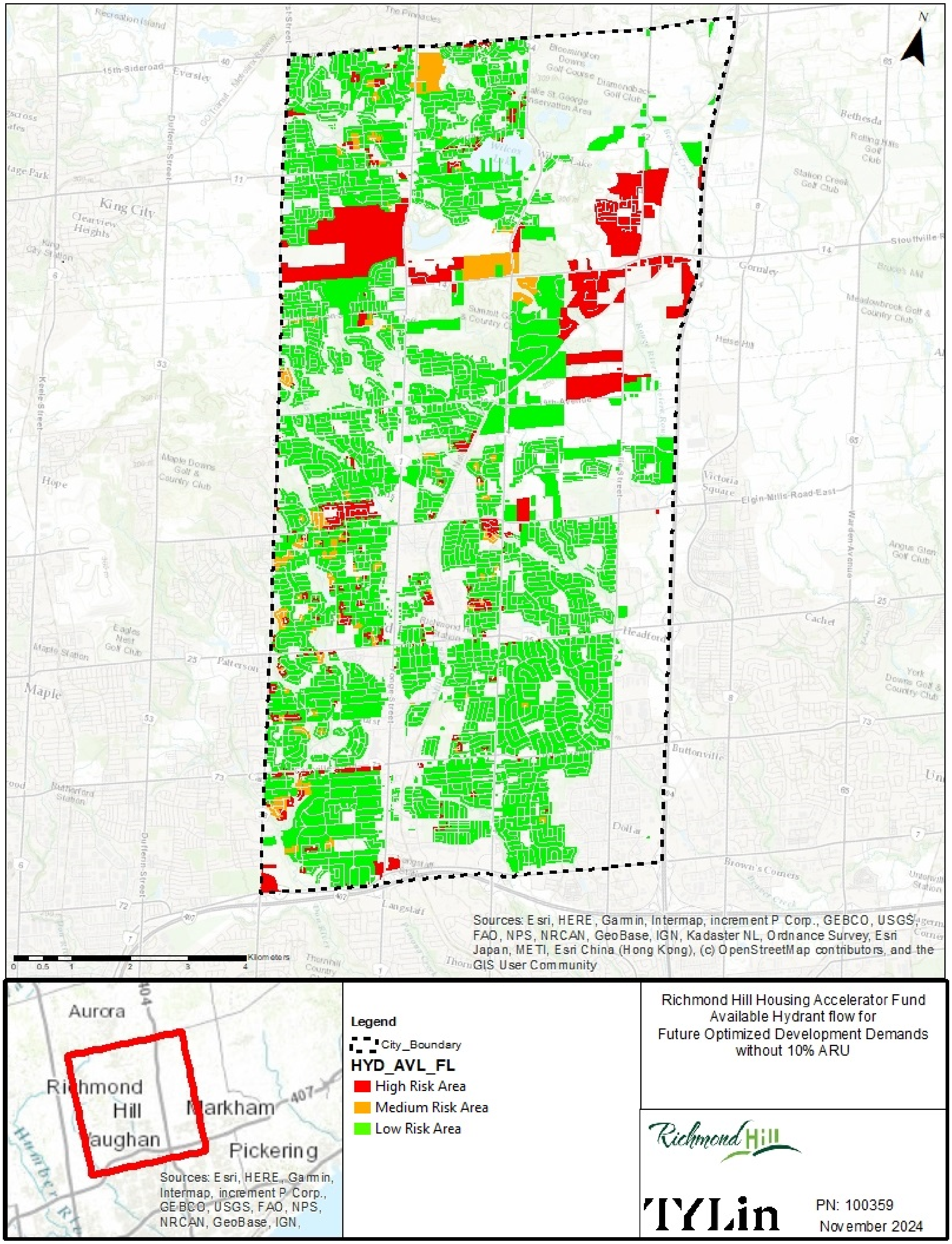
This condition represents the 2051 systems optimized. This scenario includes identified and planned improvements by the City to accommodate 2051 growth.

3.5.1 WATER

The 2051 Optimized results are better than the existing conditions optimized. This makes sense as the 2051 optimized results should build upon the existing conditions and further improve the system.

There is a pocket of constrained junctions north of Elgin Mills Road East, west of Yonge Street. These constrained junctions were not constrained under existing conditions. This implies that the 2051 growth in the area has caused the available fire flow to be decreased.

Figure 9 2051 Optimized - Water



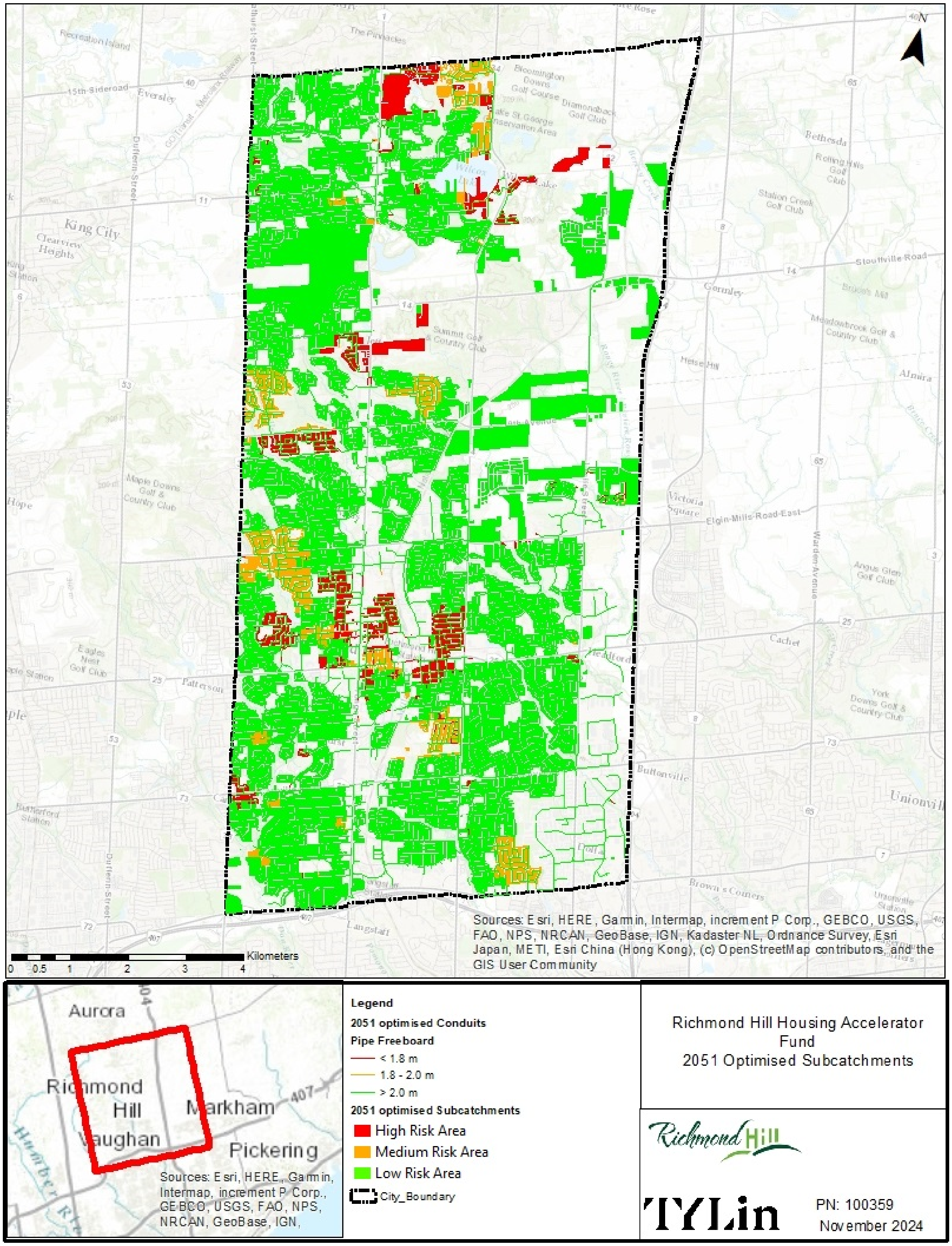
3.5.2 WASTEWATER

Under this condition, there are several areas that are constrained. These areas are triggered by manholes/sewers with an HGL within 2.0m of surface with the 2051 growth.

There are constrained areas were not part of the existing condition optimized results, implying that they are a result of the 2051 growth.

There are several manholes/sewers at risk of adverse condition.

Figure 10 2051 Optimized - Wastewater



3.6 2051 Conditions Optimized with 10% ARU Uptake

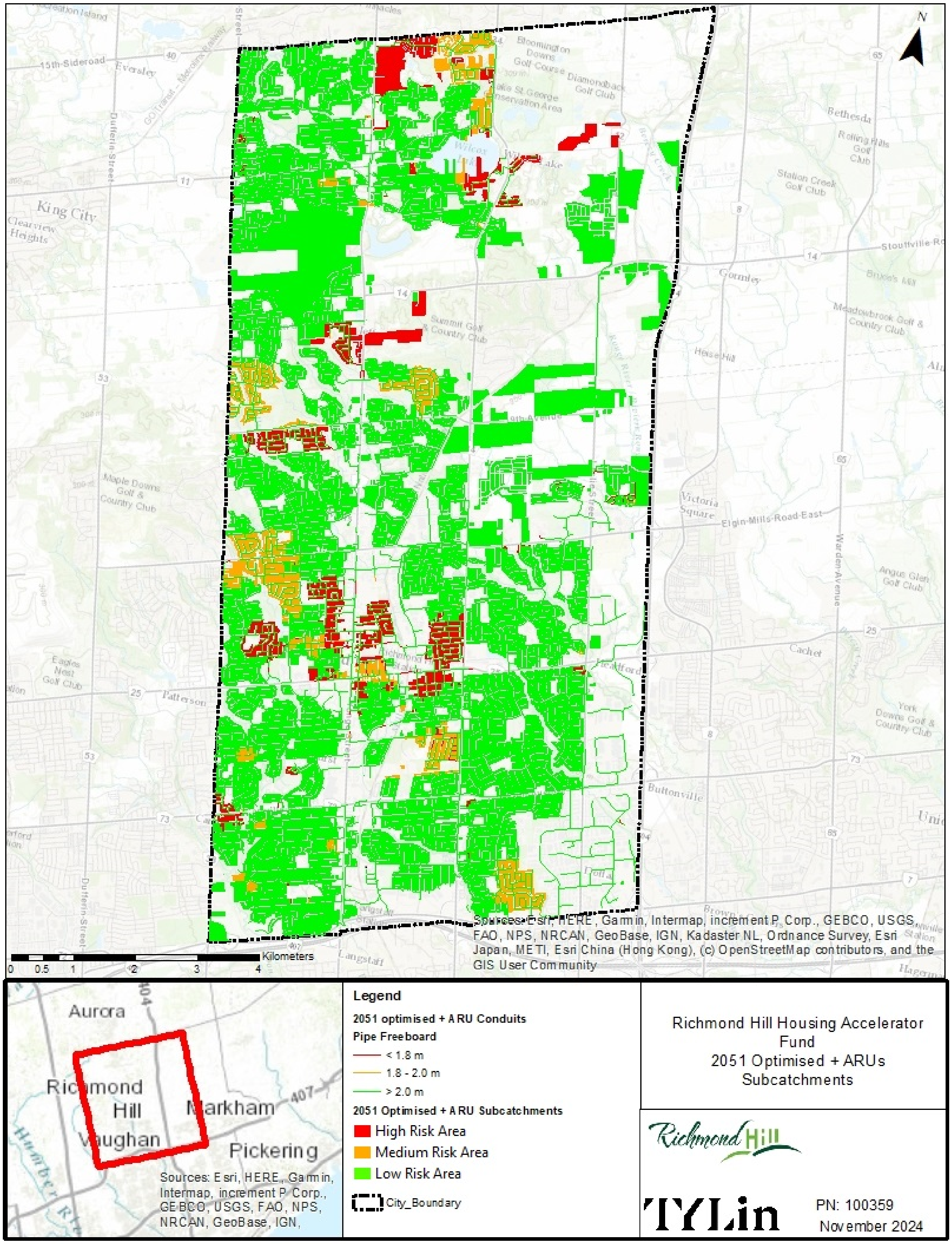
This condition represents the 2051 systems optimized with 10% ARU uptake. This scenario includes identified and planned improvements by the City to accommodate 2051 growth and how the system can or cannot accommodate 10% ARU uptake.

3.6.1 WATER

When compared to 2051 Optimized (Section 5.5) or is clear that there are additional constrained junctions and additional junctions at risk of an adverse condition. This is to be expected as the addition of 10% ARU uptake will add pressure to the water systems.

Some junctions at risk of adverse conditions under 2051 optimized (Section 5.5.1) are now considered constrained with the 10% ARU uptake.

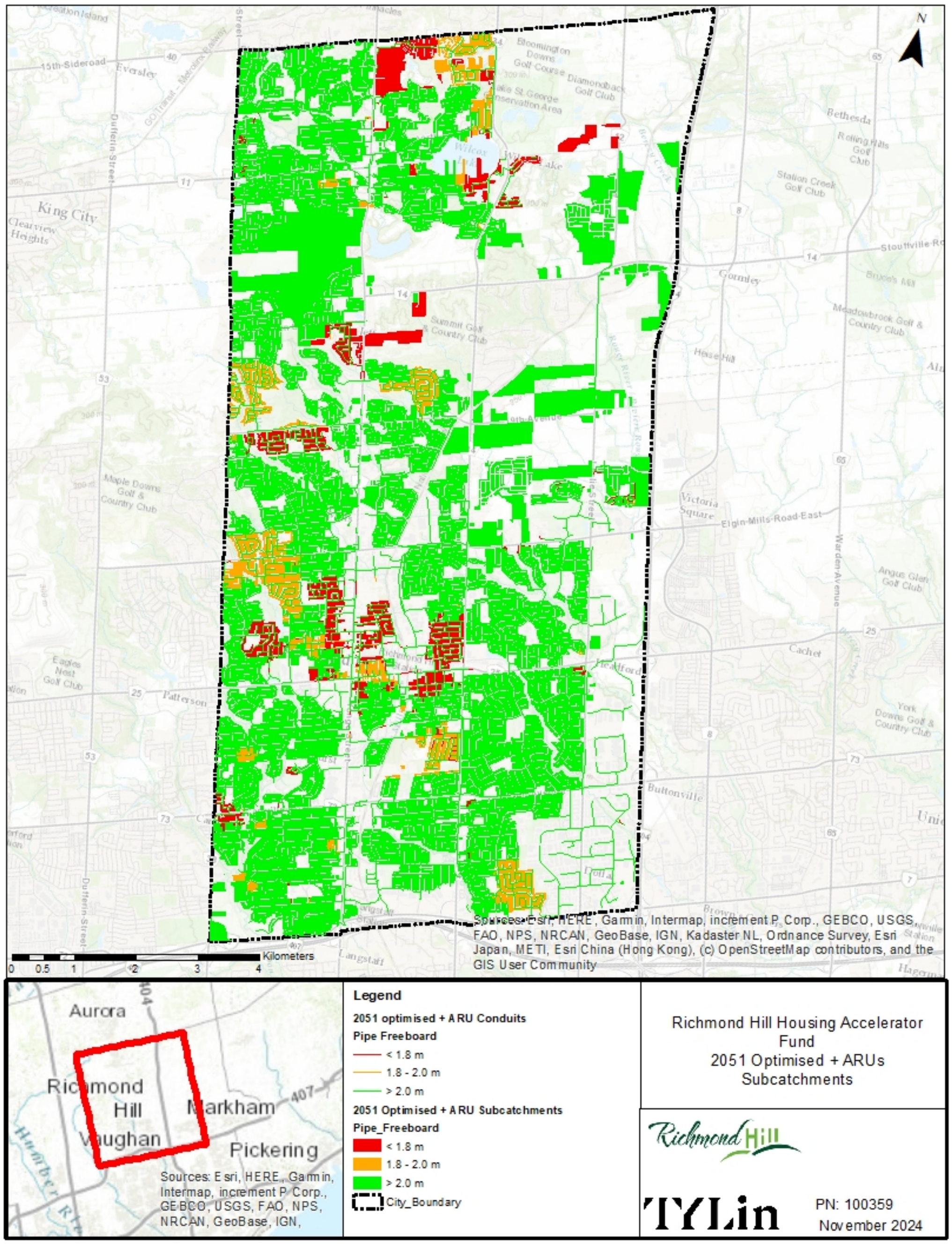
Figure 11 2051 Optimized with ARUs - Water



3.6.2 WASTEWATER

With the inclusion of 10% ARU uptake, no additional areas are further constrained. Additional manholes/sewers are at risk for an adverse condition with the 10% ARU uptake, but they are not yet constrained.

Figure 12 2051 Optimized with ARUs - Wastewater



4 DISCUSSION AND RECOMMENDATIONS

At present, there are locations within the city which can permit ARUs. There are other areas where existing constraints in the water and wastewater networks indicate that the consideration of ARU's should be constrained.

While the city has identified projects aimed at removing existing constraints from the water and wastewater networks, this will not permit ARU's to be constructed in all areas without introducing a degree of risk. Additional system upgrades may need to be considered in order to “unlock” all areas of the City.

The impact of ARUs on the City’s servicing will ultimately depend on where and when these are built. It is anticipated that uptake will take years to achieve the 10% uptake assumption carried in this servicing analysis. In order to fully understand and anticipate the true impacts, the City should track ARU uptake and continue to monitor water pressures and wastewater flows as uptake progresses.

The figure below (Figure 13) shows the constrained water junctions and the constrained wastewater areas under existing conditions with 10% ARU uptake. In most cases, where there are constrained water junctions, there are also constrained wastewater areas.

The area of north Richmond Hill (between 15th Sideroad and Stouffville Road) shows large pockets of constrained water junctions that do not overlap with constrained wastewater areas.

Figure 14 demonstrates the existing optimized with 10% ARU uptake and the water and wastewater constraints identified. In most areas where there are constrained water junctions, there are also constrained wastewater areas.

In the constrained areas, it is recommended that future investigations and studies be undertaken to identify what (if any) system improvements could be proposed to resolve the restrictions and permit ARUs.

Figure 13 Existing Conditions with ARUs - Water Constraints and Wastewater Areas

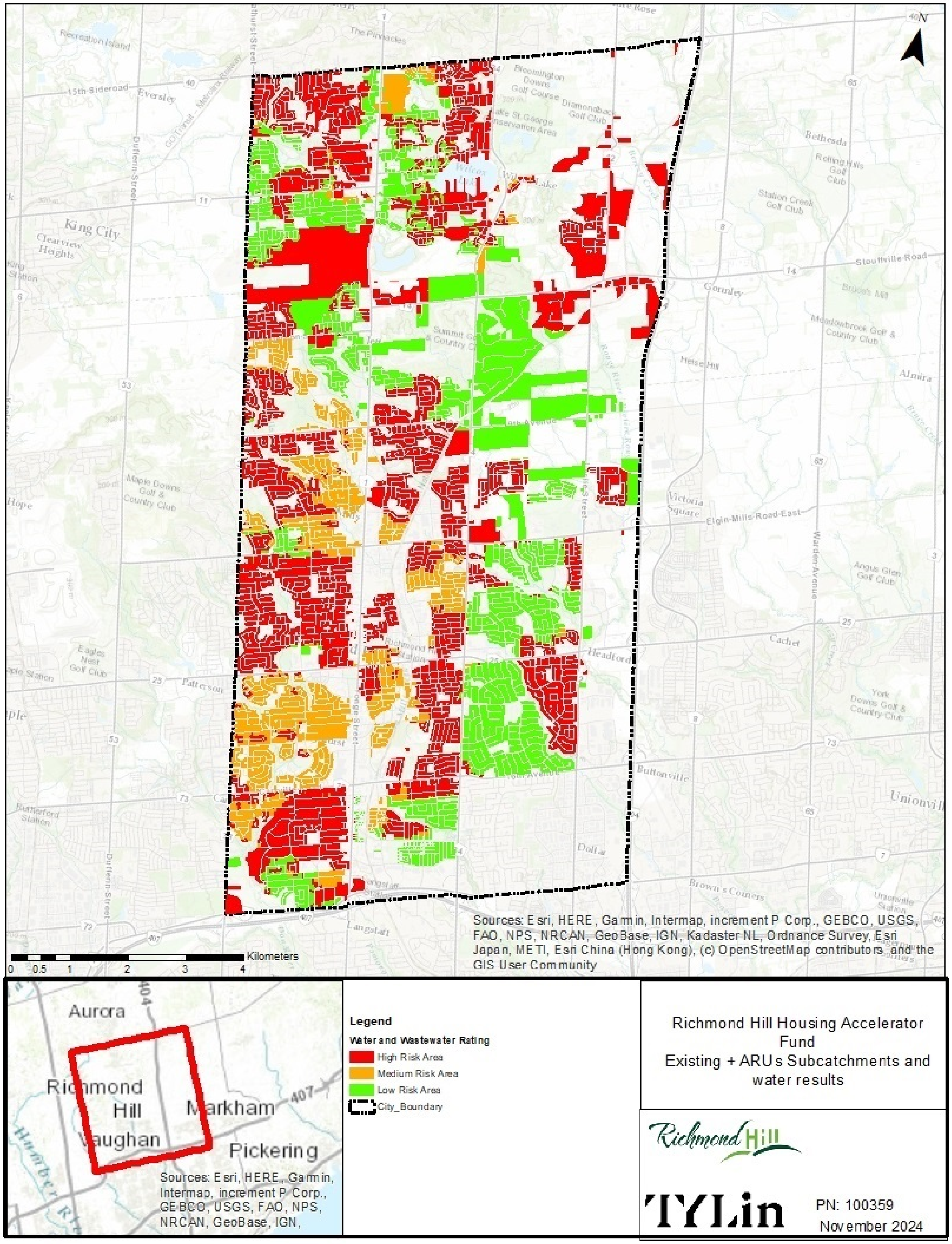


Figure 14 Existing Conditions Optimized with ARUs - Water Constraints and Wastewater Areas