CITY OF VAUGHAN

EXTRACT FROM COUNCIL MEETING MINUTES OF OCTOBER 8, 2013

Item 19, Report No. 39, of the Committee of the Whole, which was adopted without amendment by the Council of the City of Vaughan on October 8, 2013.

19 PHASE II DRAINAGE STUDY
WARD 5 – VICINITY SOUTH OF CENTRE ST. BETWEEN DUFFERIN ST. & YONGE ST.

The Committee of the Whole recommends:

1) That the recommendation contained in the following report of the Commissioner of Engineering and Public Works and the Director of Development/Transportation Engineering, dated September 24, 2013, be approved; and

2) That the deputation of Ms. Esther Bergman, Franklin Avenue, Thornhill, be received.

Recommendation

The Commissioner of Engineering and Public Works and the Director of Development/Transportation Engineering recommend:

1. THAT the necessary funding for improvements to the Franklin Avenue storm drainage system be referred to the draft 2014 Capital Budget for Council consideration.

Contribution to Sustainability

The objectives of the City's Community Sustainability and Environmental Master Plan (Green Directions Vaughan, April 2009) have guided the completion of the Phase II Drainage Study. The conclusions and recommendations of this study having regards for:

- Supporting enhanced standards of storm water management and working with others to care for Vaughan's watersheds;
- Achieving sustainable growth and development;
- Supporting the implementation of Green Directions at all levels of City operations;
- The creation of a City with sustainable built form; and
- Sharing sustainable best practices and ideas between and among municipal staff and the community.

Economic Impact

There are no immediate economic impacts resulting from the adoption of this report. The cost to complete the Phase II Drainage Study is being expensed to the approved Capital Project No. DT-7026-09. The necessary funding for improvement works recommended in the Phase II Drainage Study will be referred to the draft 2014 Capital Budget.

The current funding structure is not expected to be sufficient to provide adequate and sustainable funding for the operation and renewal of the City's current and future storm drainage system. Accordingly, staff will be reviewing the existing funding structure in 2014 and then reporting to a future Finance and Administration Committee with a recommended strategy.

Communications Plan

The scope of the Phase II Drainage Study focused on data collection and analysis. Accordingly, there was no formal communication plan associated with this study. However, on January 22, 2013, staff met with a number of property owners abutting the existing Franklin Avenue storm

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water management pond. The purpose of the meeting was to provide an outline of the study and to present any preliminary findings and recommendations. Going forward, a Class Environmental Assessment will be undertaken to identify the preferred drainage solution for the Franklin Avenue area, which will include a public consultation process and communication plan.

Purpose

The purpose of this report is to inform Council of the findings and conclusions of the Phase II Drainage Study.

Background – Analysis and Options

On August 19th, 2005, the City of Vaughan and surrounding municipalities from Stratford to Pickering experienced a rainstorm event which caused considerable flooding resulting in significant damage to both private and public property. Notwithstanding the relatively short duration of this rainstorm, approximately 85% of the City experienced 100-year return period storm conditions or worse (based on statistical analysis, the intensity of the rainfall event was equal to, or in excess of, a rainfall event expected to occur at least once over a 100 year period).

The City's storm sewer system (minor system) and overland flow routes (major system) are typically designed to accommodate rainstorm flows from 5-year and 100-year return period storm events respectively. This is a commonly accepted design standard within the Province of Ontario. As a result of the high rainfall intensities over a short duration period (as experienced on August 19th, 2005) a significant amount of overland flow within City streets and overall system flooding would be expected and did occur at various locations throughout the City. The majority of private property damage and flooding complaints received by the City were in the older residential neighbourhoods of Woodbridge and Thornhill where changes to the drainage system may have occurred over time.

During the summer of 2008, localized and intense rainstorm events occurred once again in the east end of the City encompassing the older residential neighbourhoods of Thornhill. The intensity of these successive rainstorms resulted in overland flow and system flooding at various locations in the Thornhill area.

Most recently in July of 2013, an intense rainstorm event occurred throughout areas of Mississauga and Toronto, which reportedly resulting in extensive flooding and damage to both private and public property.

The increasing number of intense rainstorms is considered to be one of the effects of climate change

Short duration and intense rainstorms are becoming increasingly common throughout the Greater Toronto Area and are considered to be one of the effects of climate change. In 2009, the City in partnered with the Toronto and Region Conservation Authority and contributed $5,000 to a pilot study entitled "Methodologies to Improve Rainfall Intensity – Duration – Frequency Estimates" completed by Environment Canada's Climate Research Division. The Study recommends protocols for updating rainfall data (in a changing climate) which is used in sizing storm sewer systems. The study also notes further research work is required to support rainfall data updates given the gradual yet on-going effects of climate change. Staff continues to work with TRCA and municipal storm water management committees to address the implications of climate change of the City's municipal infrastructure.

A City-Wide Drainage Study was completed in 2009

In response to the severe rain events of 2005 and 2008, a City-Wide Drainage and Storm Water Management Criteria Study (Phase 1 Drainage Study) was completed in 2009. The purpose of this study was to better understand the existing storm drainage system conditions throughout the urbanized areas of the City and to develop mitigation plans for potential flood susceptible areas.

Comprehensive mapping of the City's existing drainage and storm water management systems was completed. The Study also identified data gaps and improvements required to develop a more comprehensive drainage system inventory of the major and minor systems throughout the City using Geographic Information System (GIS) data.

A preliminary assessment of twenty reported flooding sites (based on the August 19, 2005 storm event) throughout the City was completed in conjunction with the City-wide study. Based on this initial assessment, the study recommended that a more detailed analysis be conducted on seven out of the twenty sites. These seven sites are located within the older areas of the Thornhill Community.

The findings and recommendations of the City-wide Drainage Study were presented to Council in June 2009.

A Phase 2 Drainage Study was carried out to complete a detailed drainage system performance assessment of seven reported flooding areas in Thornhill

A Phase II Drainage Study was deemed necessary to complete a more detailed micro-drainage system analysis for seven reported flooding areas in Thornhill and to establish accurate baseline conditions such that specific remediation works may be recommended where necessary. The scope of the Study also addressed data gaps and necessary adjustments to improve the GIS based drainage system inventory. In May 2011, the City retained Cole Engineering to undertake the Phase II Drainage Study.

The seven sites are generally located in the area bounded by Dufferin Street to the west, Yonge Street to the east, the CN Railway to the south and Highway 407 to the north. Based on the drainage system, the study area was further subdivided into two sub-watersheds. An easterly sub-watershed (between Yonge Street and Bathurst Street) and a westerly sub-watershed (between Bathurst Street and Dufferin Street) as shown on Attachment No. 1. Flooding sites (Areas) 1 through 6 are contained within the easterly sub-watershed while Area 8 is contained within the westerly sub-watershed.

The first deliverable of the Phase II Study was to address data gaps in the existing GIS based mapping such that ground surfaces, flow paths and sewer systems were accurately represented. Next, a detailed hydrological computer model was created to simultaneously evaluate both ground surface and sewer capacities within each sub-watershed area containing the seven flooding sites. This detailed assessment is referred to as a "micro-drainage analysis".

Completion of the micro-drainage analysis for the seven areas provides an accurate assessment of existing flood protection and be used to develop specific retrofit and / or remediation recommendations where necessary.

An overview of the seven areas analyzed in the Phase 2 Drainage Study together with recommended mitigation works is provided below.

Phase 2 Drainage Study concludes that only routine maintenance is required to address flooding risk for Areas 1 and 8

Area 1: Thornridge Drive

Area 1 is located at the north-west corner of Charles Street and Thornridge Drive. The drainage system in the area is comprised of roadside ditches and storm sewers as shown on Attachment No. 2.

During the August 2005 storm event, it was reported that surface runoff reached the side of the existing house located on this property, and entered through cracks in the foundation wall, window wells or other low-lying openings. Based on the findings of the Phase II Drainage Study, the flooding at Area 1 was likely attributed to localized grading issues on private property and high water levels in the adjacent roadside ditches.

In 2008, the house on the affected lot was reconstructed. Grading and drainage improvements were completed in conjunction with the new house construction which is expected to have resolved the flooding risk on this property.

Area 8: Charlton Avenue

Charlton Avenue is located east of Dufferin Street at the southerly limits of the overall study area. The Charlton Avenue area receives drainage from a large upstream area. In addition, an overland channel conveys flows from south of Centre Street into this area. A portion of the channel runs parallel to Charlton Avenue with residential properties backing directly on to the channel as shown on Attachment No. 3. The channel flows southerly across Charlton Avenue via box culverts south of Clark Avenue. During the August 2005 rainstorm, it was reported that overland flooding took place along Charlton Avenue and within the existing channel between Joseph-Aaron Boulevard and Marisa Court.

As part of the Phase II Drainage Study, a micro-drainage analysis was carried out that determined that the existing drainage system provides the required 100 year storm level of service. Accordingly, it was concluded that overflow likely occurred during the rainfall intensities experienced in 2005 at the culvert locations within the channel because they were partially obstructed by debris. Obstructing the inlet would result in elevated water levels and could lead to flooding on the properties backing onto the channel. Further south, the channel also crosses the CN railroad tracks via culverts. Again, there is a potential for ponding and backwater conditions depending on culvert inlet conditions on the north side of the railroad tracks during large events.

The Study findings conclude the flooding experienced at Area 8 during the August 2005 storm was the result of storm intensities exceeding a 100-year return period and partial obstruction of the culvert inlets and catchbasin grates by debris. Accordingly, no specific remedial work is required for Areas 1 and 8; however, regular maintenance works will be required to ensure the drainage system is functioning as efficiently as possible and to reduce the risk of the existing culverts and grates being obstructed by debris in the future.

Construction of the proposed Gallanough Park Storm Water Management Pond will address the drainage system deficiencies in Areas 4, 5 and 6

Area 4 (Brooke Street)
Area 5 (Arnold Avenue, Thornridge Drive and Yonge Street)
Area 6 (Tanjo Court and Springfield Way)

Areas 4, 5 and 6 are generally located south of Centre Street within the easterly sub-watershed of the overall study area as shown on Attachment No. 1. Overland flow and flooding on private property was experienced during the storm events of 2005. The flooding in these areas was

attributed to existing minor and major system conveyance capacity limitations, ill-defined overland drainage routes and ponding in low lying areas. Also, the overland flow routes and storm drainage system in these areas may be more susceptible to blockage due to the structure and age of the infrastructure.

Following the 2005 storm event, and given the drainage situation in this area, the City completed a drainage study in 2008 entitled the "Thornhill Storm Drainage Improvement Study". The findings of this study recommended the replacement of deficient culverts, construction of a new storm water management facility within the Gallanough Park and a storm sewer by-pass along Thornridge Drive to divert flows to the Brooke Street trunk sewer.

The proposed storm water management pond will play an important role in the overall drainage improvements for the area. The storage volume created by the proposed pond will attenuate peak flows during large storm events and create capacity in the downstream Brooke Street sewer to accept flows from the proposed by-pass sewer. The combination of these works will greatly improve overall system capacity and efficiency.

In 2009, certain roads in the Thornhill area were reconstructed which included the replacement of a number of deficient culverts.
In 2010, the City completed a Municipal Class Environmental Assessment Study for the Gallanough Park storm water management facility. This study recommended the construction of a new by-pass storm sewer on Thornridge Drive and Arnold Avenue and established the preferred design of the Gallanough Park storm water management facility. The estimated cost for the proposed storm water management pond is approximately $900,000. The detailed design process for the Gallanough Park Pond and the preliminary design of associated storm sewers has been initiated with completion anticipated by the end of 2014.

The detailed analysis completed as part of the Phase II Drainage Study for Areas 4, 5 and 6 considered all previously planned remedial works noted above and confirmed their effectiveness to improve the overall drainage system within the Thornhill community.

Improvements to the existing storm drainage system in Area 2 and 3 (Franklin Avenue) are recommended

Area 2: Franklin Avenue (north leg)

Franklin Avenue is located south of Centre Street and east of Bathurst Street within the eastern sub-watershed of the overall study area. The lots on Franklin Avenue back onto an existing storm water management pond as shown on Attachment No. 4. This pond was constructed in the late 1980s and designed to provide a 100-year level of service. Later in 1991, additional drainage area was added to the pond to facilitate the expansion of the neighbourhood. The drainage reports that were submitted in conjunction with the development indicated that the existing pond would continue to provide a 100-year level of service with the additional contributing drainage area so no modifications were made to the pond.

During the 2005 rainstorm, a number of properties located next to the south end of the pond were flooded when the water level in the pond exceeded the backyard crest elevation and spilled onto the backyards. The water reportedly entered through window wells or other low lying openings resulting in basement flooding. During the 2008 rainstorm, the pond apparently overtopped again flooding the same backyards but to a lesser extent.

The micro-drainage analysis completed as part of the Phase II Drainage Study revealed that the available storage volumes in the existing storm water management pond can only accommodate flows up to a 50-year storm event, which is less than the City's current standard of 100 year storm event protection.

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Accordingly, the Phase II Drainage Study identified two potential engineering solutions that would increase the level of service of the drainage system in this area including:

Potential Solution 1:

- Increase the storage capacity of the Franklin Avenue pond by re-grading within the pond limits and modifying the pond outlet structure to increase the discharge from the pond. This option is expected to have an impact on the existing vegetation within the pond;
- Construct a berm at the northerly limits of the existing Franklin Avenue pond to reduce drainage into the pond;
- Expand the existing Pondview pond to compensate for increased flows from Franklin Avenue pond; and
- Implement local drainage improvements at the intersection of Franklin Avenue and Markwood Lane.

Potential Solution 2:

- Modify the Franklin Avenue pond outlet to increase the discharge from the pond;
- Interconnect the Franklin and Pondview Ponds by way of pipe or swale to optimize the available water detention storage;
- Expand the storage volume in the Pondview Pond and modify the existing outlet structure;
- Construction of a berm at the northerly limits of the existing Franklin Avenue pond to reduce drainage into the pond; and
- Implement local drainage improvements at the intersection of Franklin Avenue and Markwood Lane.

In addition to the above options, there may be an opportunity to utilize areas within the adjacent Hefhill Park to temporarily store excess water from the Franklin Avenue pond. These potential solutions are generally illustrated on Attachment No.4.

An Environmental Assessment will need to be undertaken to identify the preferred storm drainage solution for the Franklin Avenue area. The estimated cost for the environmental assessment study, detailed design and construction for any one of the above noted solutions will be approximately $550,000. These recommended works will be referred to the 2014 Capital Budget process for Council consideration.

Area 3: Franklin Ave (south leg)

This area is located at the junction of Markwood Lane and Franklin Avenue. The property in question has a reverse sloped driveway. The overland flows and storm sewer systems from both roads converge in this area as shown on Attachment No. 4.

During the August 2005 storm event, overland flow and minor system surcharging caused water to spill onto private property via the reverse slope driveway. This situation can be mitigated by slightly elevating the existing sidewalk and boulevard grades along the frontage of the property together with drainage improvements at the intersection of Franklin Avenue and Markwood Lane. This work could be completed as a component of the overall proposed drainage improvement works for the Franklin Avenue area in consultation with the property owner.

Drainage system database improvements allow more effective management of the City's drainage and storm water management systems

As a deliverable of the Phase II Drainage Study, the City's GIS based storm drainage system inventory has been updated to include culvert crossings and bridge and road overpass crossings. These are key components of both the minor and major systems.

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The City has recently developed data submission standards for storm water management facilities in new development areas. Data submission standards for culvert crossings and bridges have also been developed as part of the Phase II Drainage Study.

The improved storm drainage system database will assist with planning inspections, assessing overall conditions, conducting routine maintenance and repairs, evaluating system capacity, and upgrading or replacing infrastructure as deemed necessary.

A classification system for private and public property within flood plain areas was developed as part of the Phase 1 Study. This is referred to as the Flood Emergency Response Index (FERI). It has now been updated with the addition of building envelopes. The index or ranking system prioritizes sites using depth of flooding and land use information. Flood vulnerable structures (FVS) and flood vulnerable roads (FVR) have been identified for various return period storm events. For flood vulnerable structures, the FERI equations consider the type of building and land use; while for flood vulnerable roads the FERI equations consider individual roadway classification.

The City's Flood Emergency Response Index and drainage system base mapping will inform and enhance emergency flood response planning, and assist in prioritizing the City's regular storm drainage system inspection and maintenance program.

An adequate and sustainable funding source is needed to provide for the operation and renewal of the City's growing storm drainage system infrastructure

The City's current storm drainage system comprises of approximately 800 Kilometres of storm sewers, 13,000 manholes, 20,000 catchbasins and 105 storm water management facilities with a historical asset value of over $760 million dollars. Based on the City's growth plan, the extent of the City's storm drainage infrastructure is expected to increase considerably over the next 15 to 20 years. The operation, maintenance and renew costs of the City's storm drainage infrastructure is currently being funded from water/wastewater rates and gas tax. This funding source is not expected to be sufficient to maintain an appropriate level of service, especially given the increasing risk presented by climate change. Accordingly, staff will be reviewing the current funding structure in 2014 to ensure an adequate and sustainable funding source is available going forward for the operation, maintenance and capital renewal of the City's storm drainage system and then report to a future Finance and Administration Committee with a recommended funding strategy.

Relationship to Vaughan Vision 2020/Strategic Plan

In consideration of the strategic priorities related to Vaughan Vision 2020, the recommendations of this report will assist in:

- The pursuance of excellence in service delivery;
- Demonstrating leadership initiatives, promoting environmental and financial sustainability;
- Effective governance;
- Enhancing productivity, cost effectiveness and innovation;
- Maintaining assets and infrastructure; and
- Planning and managing growth, and economic vitality.
- Ensuring and enhancing community safety, health and wellness;
- Leading and promoting environmental sustainability; and
- Ensuring financial stability

This report is therefore consistent with the priorities previously set by Council.

Regional Implications

There are no Regional implications resulting from the adoption of this report.

Conclusion

Given the increasing frequency of unusually intense and localized rainstorm events in recent years, proactive measures have been taken by the City to ensure flood risks to private and public property are minimized where reasonably possible.

Completion of the Phase II Drainage Study and subsequent implementation of the various recommendations resulting from the above noted studies has improved our:

- understanding of the existing drainage systems;
- operation and maintenance procedures and practices; and
- design criteria and standards such that the City remain in step with the reality of a changing climate.

In order to minimize the future risk of flooding in the Franklin Avenue area, it is recommended that the necessary funding for an Environmental Assessment study and capital improvements to the Franklin Avenue storm drainage system be referred to the draft 2014 Capital Budget for Council consideration.

The City currently owns and operates a storm drainage system worth over $760 million, which will be expanded considerably through the implementation of the City's growth plan. Accordingly, staff will be reviewing the current funding structure for storm drainage infrastructure in 2014 to ensure an adequate and sustainable funding source is available going forward for the operation, maintenance and capital renewal of the City's storm drainage system and then report to a future Finance and Administration Committee with a recommended funding strategy.

Attachments

1. Overall Study Area
2. Area 1: Thornridge Drive
3. Area 8: Charlton Avenue
4. Areas 2 and 3: Franklin Avenue

Report prepared by:

Saad Yousaf, Storm Drainage Engineer, Engineering Planning & Studies, Ext. 8251
Michael Frieri, Manager of Engineering Planning & Studies, Ext. 8729

(A copy of the attachments referred to in the foregoing have been forwarded to each Member of Council and a copy thereof is also on file in the office of the City Clerk.)

COMMITTEE OF THE WHOLE – SEPTEMBER 24, 2013

PHASE II DRAINAGE STUDY
WARD 5 – VICINITY SOUTH OF CENTRE ST. BETWEEN DUFFERIN ST. & YONGE ST.

Recommendation

The Commissioner of Engineering and Public Works and the Director of Development / Transportation Engineering recommend:

1. THAT the necessary funding for improvements to the Franklin Avenue storm drainage system be referred to the draft 2014 Capital Budget for Council consideration.

Contribution to Sustainability

The objectives of the City's Community Sustainability and Environmental Master Plan (Green Directions Vaughan, April 2009) have guided the completion of the Phase II Drainage Study. The conclusions and recommendations of this study having regards for:

- Supporting enhanced standards of storm water management and working with others to care for Vaughan's watersheds;
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Economic Impact

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Communications Plan

The scope of the Phase II Drainage Study focused on data collection and analysis. Accordingly, there was no formal communication plan associated with this study. However, on January 22, 2013, staff met with a number of property owners abutting the existing Franklin Avenue storm water management pond. The purpose of the meeting was to provide an outline of the study and to present any preliminary findings and recommendations. Going forward, a Class Environmental Assessment will be undertaken to identify the preferred drainage solution for the Franklin Avenue area, which will include a public consultation process and communication plan.

Purpose

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Background – Analysis and Options

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initial assessment, the study recommended that a more detailed analysis be conducted on seven out of the twenty sites. These seven sites are located within the older areas of the Thornhill Community.

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A Phase II Drainage Study was deemed necessary to complete a more detailed micro-drainage system analysis for seven reported flooding areas in Thornhill and to establish accurate baseline conditions such that specific remediation works may be recommended where necessary. The scope of the Study also addressed data gaps and necessary adjustments to improve the GIS based drainage system inventory. In May 2011, the City retained Cole Engineering to undertake the Phase II Drainage Study.

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The first deliverable of the Phase II Study was to address data gaps in the existing GIS based mapping such that ground surfaces, flow paths and sewer systems were accurately represented. Next, a detailed hydrological computer model was created to simultaneously evaluate both ground surface and sewer capacities within each sub-watershed area containing the seven flooding sites. This detailed assessment is referred to as a “micro-drainage analysis”.

Completion of the micro-drainage analysis for the seven areas provides an accurate assessment of existing flood protection and be used to develop specific retrofit and / or remediation recommendations where necessary.

An overview of the seven areas analyzed in the Phase 2 Drainage Study together with recommended mitigation works is provided below.

Phase 2 Drainage Study concludes that only routine maintenance is required to address flooding risk for Areas 1 and 8

Area 1: Thornridge Drive

Area 1 is located at the north-west corner of Charles Street and Thornridge Drive. The drainage system in the area is comprised of roadside ditches and storm sewers as shown on Attachment No. 2.

During the August 2005 storm event, it was reported that surface runoff reached the side of the existing house located on this property, and entered through cracks in the foundation wall, window wells or other low-lying openings. Based on the findings of the Phase II Drainage Study, the flooding at Area 1 was likely attributed to localized grading issues on private property and high water levels in the adjacent roadside ditches.

In 2008, the house on the affected lot was reconstructed. Grading and drainage improvements were completed in conjunction with the new house construction which is expected to have resolved the flooding risk on this property.

Area 8: Charlton Avenue

Charlton Avenue is located east of Dufferin Street at the southerly limits of the overall study area. The Charlton Avenue area receives drainage from a large upstream area. In addition, an overland channel conveys flows from south of Centre Street into this area. A portion of the channel runs parallel to Charlton Avenue with residential properties backing directly on to the channel as shown on Attachment No. 3. The channel flows southerly across Charlton Avenue via box culverts south of Clark Avenue. During the August 2005 rainstorm, it was reported that overland flooding took place along Charlton Avenue and within the existing channel between Joseph-Aaron Boulevard and Marisa Court.

As part of the Phase II Drainage Study, a micro-drainage analysis was carried out that determined that the existing drainage system provides the required 100 year storm level of service. Accordingly, it was concluded that overflow likely occurred during the rainfall intensities experienced in 2005 at the culvert locations within the channel because they were partially obstructed by debris. Obstructing the inlet would result in elevated water levels and could lead to flooding on the properties backing onto the channel. Further south, the channel also crosses the CN railroad tracks via culverts. Again, there is a potential for ponding and backwater conditions depending on culvert inlet conditions on the north side of the railroad tracks during large events.

The Study findings conclude the flooding experienced at Area 8 during the August 2005 storm was the result of storm intensities exceeding a 100-year return period and partial obstruction of the culvert inlets and catchbasin grates by debris. Accordingly, no specific remedial work is required for Areas 1 and 8, however, regular maintenance works will be required to ensure the drainage system is functioning as efficiently as possible and to reduce the risk of the existing culverts and grates being obstructed by debris in the future.

Construction of the proposed Gallanough Park Storm Water Management Pond will address the drainage system deficiencies in Areas 4, 5 and 6

Area 4 (Brooke Street)
Area 5 (Arnold Avenue, Thornridge Drive and Yonge Street)
Area 6 (Tanjo Court and Springfield Way)

Areas 4, 5 and 6 are generally located south of Centre Street within the easterly sub-watershed of the overall study area as shown on Attachment No. 1. Overland flow and flooding on private property was experienced during the storm events of 2005. The flooding in these areas was attributed to existing minor and major system conveyance capacity limitations, ill-defined overland drainage routes and ponding in low lying areas. Also, the overland flow routes and storm drainage system in these areas may be more susceptible to blockage due to the structure and age of the infrastructure.

Following the 2005 storm event, and given the drainage situation in this area, the City completed a drainage study in 2008 entitled the “Thornhill Storm Drainage Improvement Study”. The findings of this study recommended the replacement of deficient culverts, construction of a new storm water management facility within the Gallanough Park and a storm sewer by-pass along Thornridge Drive to divert flows to the Brooke Street trunk sewer.

The proposed storm water management pond will play an important role in the overall drainage improvements for the area. The storage volume created by the proposed pond will attenuate peak flows during large storm events and create capacity in the downstream Brooke Street sewer to accept flows from the proposed by-pass sewer. The combination of these works will greatly improve overall system capacity and efficiency.

In 2009, certain roads in the Thornhill area were reconstructed which included the replacement of a number of deficient culverts.

In 2010, the City completed a Municipal Class Environmental Assessment Study for the Gallanough Park storm water management facility. This study recommended the construction of a new by-pass storm sewer on Thornridge Drive and Arnold Avenue and established the preferred design of the Gallanough Park storm water management facility. The estimated cost for the proposed storm water management pond is approximately $900,000. The detailed design process for the Gallanough Park Pond and the preliminary design of associated storm sewers has been initiated with completion anticipated by the end of 2014.

The detailed analysis completed as part of the Phase II Drainage Study for Areas 4, 5 and 6 considered all previously planned remedial works noted above and confirmed their effectiveness to improve the overall drainage system within the Thornhill community.

Improvements to the existing storm drainage system in Area 2 and 3 (Franklin Avenue) are recommended

Area 2: Franklin Avenue (north leg)

Franklin Avenue is located south of Centre Street and east of Bathurst Street within the eastern sub-watershed of the overall study area. The lots on Franklin Avenue back onto an existing storm water management pond as shown on Attachment No. 4. This pond was constructed in the late 1980s and designed to provide a 100-year level of service. Later in 1991, additional drainage area was added to the pond to facilitate the expansion of the neighbourhood. The drainage reports that were submitted in conjunction with the development indicated that the existing pond would continue to provide a 100-year level of service with the additional contributing drainage area so no modifications were made to the pond.

During the 2005 rainstorm, a number of properties located next to the south end of the pond were flooded when the water level in the pond exceeded the backyard crest elevation and spilled onto the backyards. The water reportedly entered through window wells or other low lying openings resulting in basement flooding. During the 2008 rainstorm, the pond apparently overtopped again flooding the same backyards but to a lesser extent.

The micro-drainage analysis completed as part of the Phase II Drainage Study revealed that the available storage volumes in the existing storm water management pond can only accommodate flows up to a 50-year storm event, which is less than the City's current standard of 100 year storm event protection.

Accordingly, the Phase II Drainage Study identified two potential engineering solutions that would increase the level of service of the drainage system in this area including:

<u>Potential Solution 1:</u>

- Increase the storage capacity of the Franklin Avenue pond by re-grading within the pond limits and modifying the pond outlet structure to increase the discharge from the pond. This option is expected to have an impact on the existing vegetation within the pond;
- Construct a berm at the northerly limits of the existing Franklin Avenue pond to reduce drainage into the pond;
- Expand the existing Pondview pond to compensate for increased flows from Franklin Avenue pond; and
- Implement local drainage improvements at the intersection of Franklin Avenue and Markwood Lane.

Potential Solution 2:

- Modify the Franklin Avenue pond outlet to increase the discharge from the pond;
- Interconnect the Franklin and Pondview Ponds by way of pipe or swale to optimize the available water detention storage;
- Expand the storage volume in the Pondview Pond and modify the existing outlet structure;
- Construction of a berm at the northerly limits of the existing Franklin Avenue pond to reduce drainage into the pond; and
- Implement local drainage improvements at the intersection of Franklin Avenue and Markwood Lane.

In addition to the above options, there may be an opportunity to utilize areas within the adjacent Hefhill Park to temporarily store excess water from the Franklin Avenue pond. These potential solutions are generally illustrated on Attachment No.4.

An Environmental Assessment will need to be undertaken to identify the preferred storm drainage solution for the Franklin Avenue area. The estimated cost for the environmental assessment study, detailed design and construction for any one of the above noted solutions will be approximately $550,000. These recommended works will be referred to the 2014 Capital Budget process for Council consideration.

Area 3: Franklin Ave (south leg)

This area is located at the junction of Markwood Lane and Franklin Avenue. The property in question has a reverse sloped driveway. The overland flows and storm sewer systems from both roads converge in this area as shown on Attachment No. 4.

During the August 2005 storm event, overland flow and minor system surcharging caused water to spill onto private property via the reverse slope driveway. This situation can be mitigated by slightly elevating the existing sidewalk and boulevard grades along the frontage of the property together with drainage improvements at the intersection of Franklin Avenue and Markwood Lane. This work could be completed as a component of the overall proposed drainage improvement works for the Franklin Avenue area in consultation with the property owner.

Drainage system database improvements allow more effective management of the City's drainage and storm water management systems

As a deliverable of the Phase II Drainage Study, the City's GIS based storm drainage system inventory has been updated to include culvert crossings and bridge and road overpass crossings. These are key components of both the minor and major systems.

The City has recently developed data submission standards for storm water management facilities in new development areas. Data submission standards for culvert crossings and bridges have also been developed as part of the Phase II Drainage Study.

The improved storm drainage system database will assist with planning inspections, assessing overall conditions, conducting routine maintenance and repairs, evaluating system capacity, and upgrading or replacing infrastructure as deemed necessary.

A classification system for private and public property within flood plain areas was developed as part of the Phase 1 Study. This is referred to as the Flood Emergency Response Index (FERI). It has now been updated with the addition of building envelopes. The index or ranking system prioritizes sites using depth of flooding and land use information. Flood vulnerable structures (FVS) and flood vulnerable roads (FVR) have been identified for various return period storm events. For flood vulnerable structures, the FERI equations consider the type of building and land

use; while for flood vulnerable roads the FERI equations consider individual roadway classification.

The City's Flood Emergency Response Index and drainage system base mapping will inform and enhance emergency flood response planning, and assist in prioritizing the City's regular storm drainage system inspection and maintenance program.

An adequate and sustainable funding source is needed to provide for the operation and renewal of the City's growing storm drainage system infrastructure

The City's current storm drainage system comprises of approximately 800 Kilometres of storm sewers, 13,000 manhholes, 20,000 catchbasins and 105 storm water management facilities with a historical asset value of over $760 million dollars. Based on the City's growth plan, the extent of the City's storm drainage infrastructure is expected to increase considerably over the next 15 to 20 years. The operation, maintenance and renew costs of the City's storm drainage infrastructure is currently being funded from water/wastewater rates and gas tax. This funding source is not expected to be sufficient to maintain an appropriate level of service, especially given the increasing risk presented by climate change. Accordingly, staff will be reviewing the current funding structure in 2014 to ensure an adequate and sustainable funding source is available going forward for the operation, maintenance and capital renewal of the City's storm drainage system and then report to a future Finance and Administration Committee with a recommended funding strategy.

Relationship to Vaughan Vision 2020/Strategic Plan

In consideration of the strategic priorities related to Vaughan Vision 2020, the recommendations of this report will assist in:

- The pursuance of excellence in service delivery;
- Demonstrating leadership initiatives, promoting environmental and financial sustainability;
- Effective governance;
- Enhancing productivity, cost effectiveness and innovation;
- Maintaining assets and infrastructure; and
- Planning and managing growth, and economic vitality.
- Ensuring and enhancing community safety, health and wellness;
- Leading and promoting environmental sustainability; and
- Ensuring financial stability

This report is therefore consistent with the priorities previously set by Council.

Regional Implications

There are no Regional implications resulting from the adoption of this report.

Conclusion

Given the increasing frequency of unusually intense and localized rainstorm events in recent years, proactive measures have been taken by the City to ensure flood risks to private and public property are minimized where reasonably possible.

Completion of the Phase II Drainage Study and subsequent implementation of the various recommendations resulting from the above noted studies has improved our:

- understanding of the existing drainage systems;
- operation and maintenance procedures and practices; and
- design criteria and standards such that the City remain in step with the reality of a changing climate.

In order to minimize the future risk of flooding in the Franklin Avenue area, it is recommended that the necessary funding for an Environmental Assessment study and capital improvements to the Franklin Avenue storm drainage system be referred to the draft 2014 Capital Budget for Council consideration.

The City currently owns and operates a storm drainage system worth over $760 million, which will be expanded considerably through the implementation of the City's growth plan. Accordingly, staff will be reviewing the current funding structure for storm drainage infrastructure in 2014 to ensure an adequate and sustainable funding source is available going forward for the operation, maintenance and capital renewal of the City's storm drainage system and then report to a future Finance and Administration Committee with a recommended funding strategy.

Attachments

1. Overall Study Area
2. Area 1: Thornridge Drive
3. Area 8: Charlton Avenue
4. Areas 2 and 3: Franklin Avenue

Report prepared by:

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Respectfully submitted,

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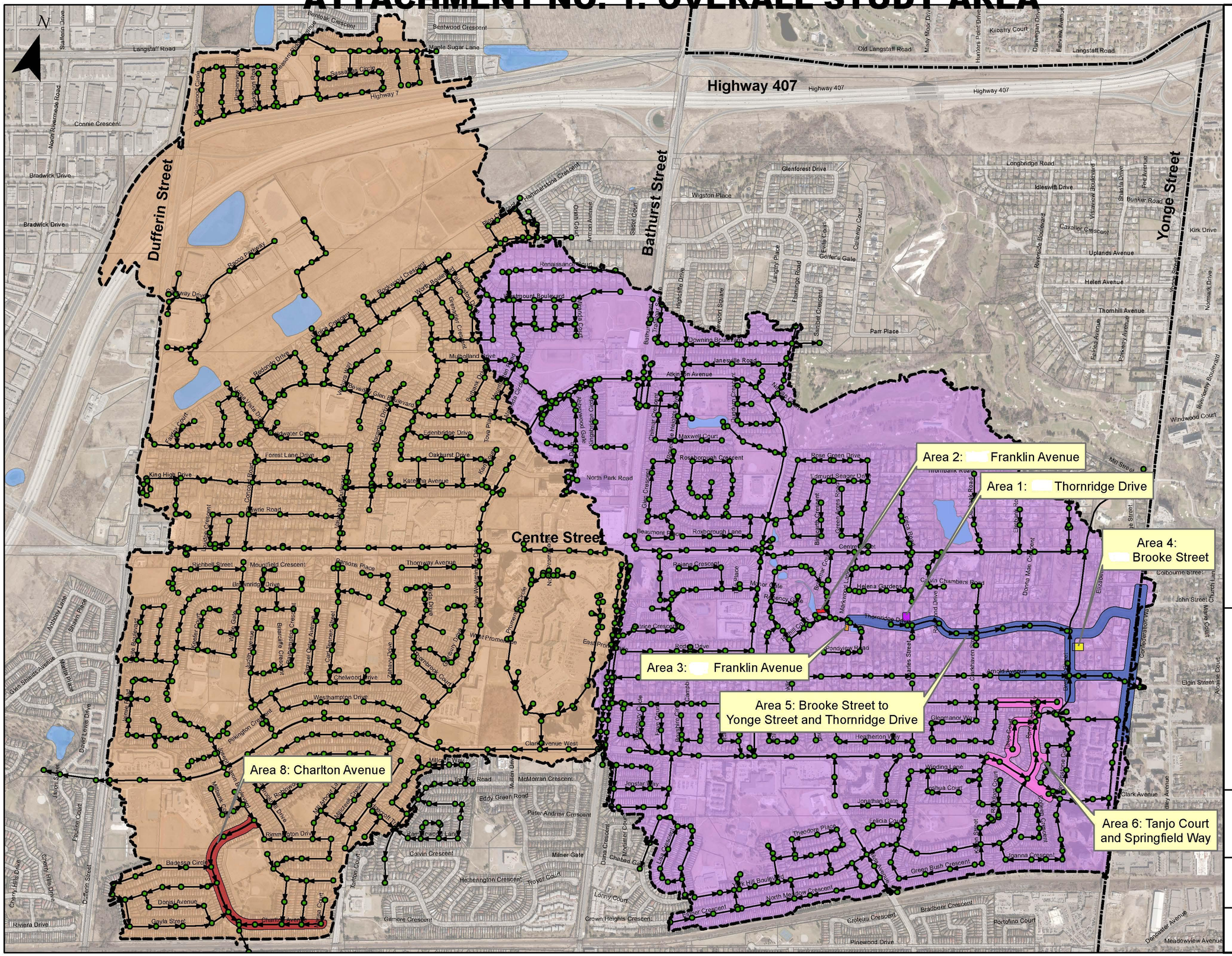
Commissioner of Engineering
And Public Works

Andrew D. Pearce
Director of Development / Transportation
Engineering

ATTACHMENT NO. 1: OVERALL STUDY AREA



Legend

- Storm Manholes
- Storm Sewers
- SWM Ponds
- Study Areas 1-6
- Study Area 8
- Parcels
- City Boundary
- Roads

Flooding Areas:

- 1
- 2
- 3
- 4
- 5
- 6
- 8

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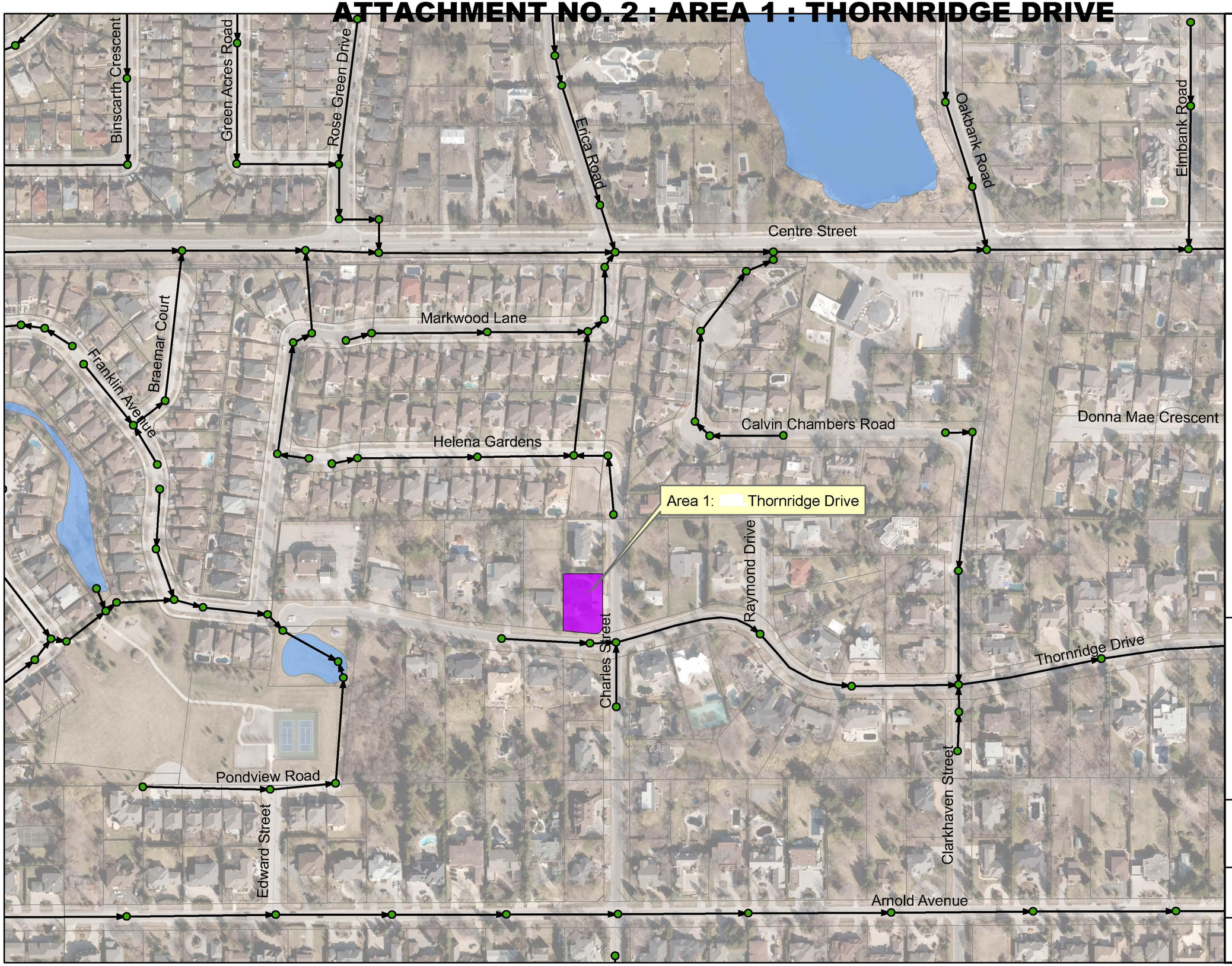
Figure 7-1
Flooding Areas (7 Sites)

Drawn By: J.H. Date: March 11, 2013

0 125 250 500 Meters

ATTACHMENT NO. 2 : AREA 1 : THORNRIDGE DRIVE



Legend

- Storm Manholes
- Storm Sewers
- SWM Ponds
- Parcels
- City Boundary
- Roads

N

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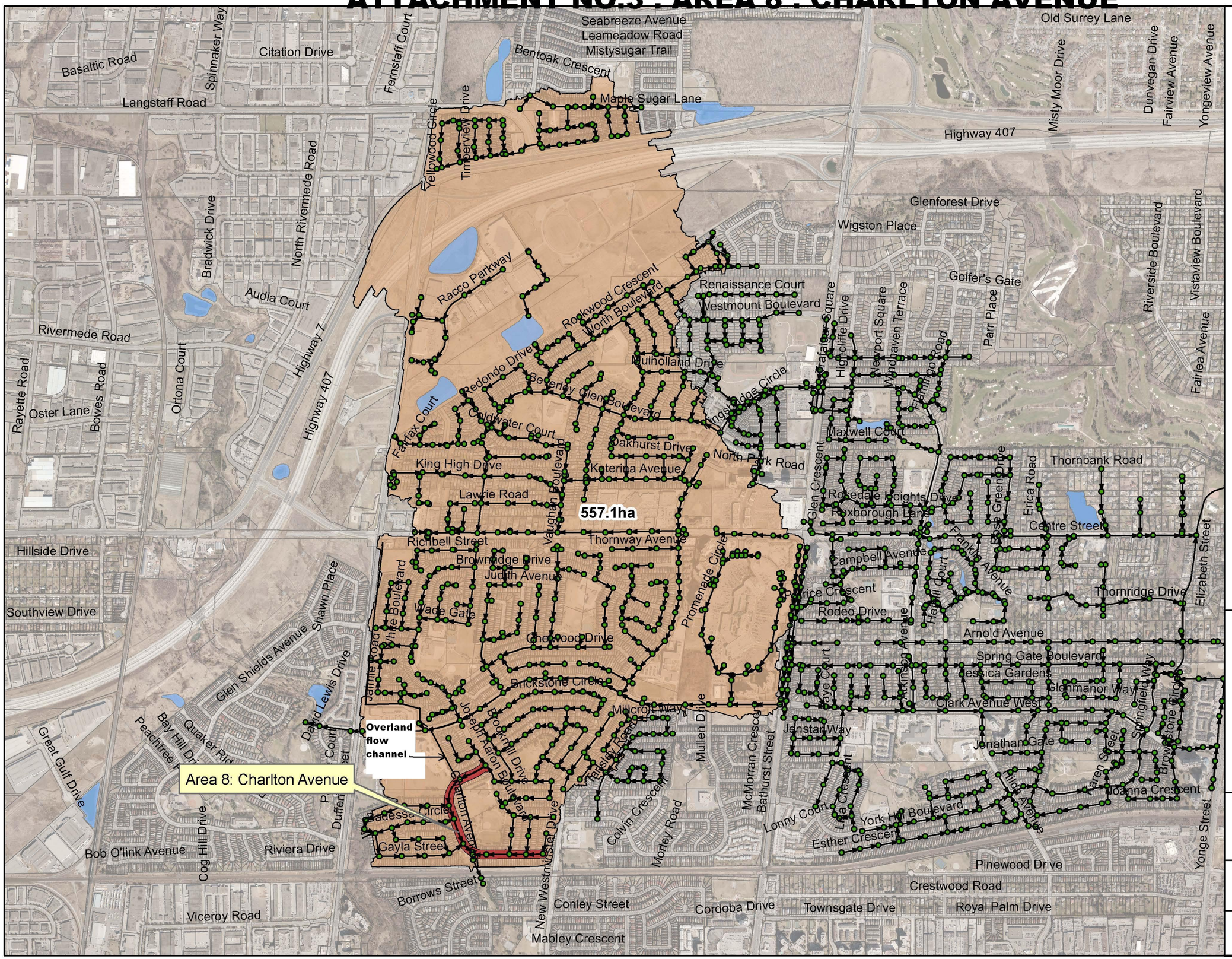
Figure 7-2
Flooding Site Location
(Area 1: Thornridge Drive)

Drawn By: J.H. Date: March 11, 2013

0 25 50 100 Meters

ATTACHMENT NO.3 : AREA 8 : CHARLTON AVENUE



Legend

- Storm Manholes
- Storm Sewers
- Major System Drainage Area
- SWM Ponds
- Parcels
- City Boundary
- Roads

N

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Figure 7-9
Flooding Site Location
(Area 8: Charlton Avenue)

Drawn By: J.H. Date: March 11, 2013

0 125 250 500
Meters

ATTACHMENT NO.4: AREAS 2 & 3: FRANKLIN AVENUE / POTENTIAL DRAINAGE IMPROVEMENT SOLUTIONS

Raise Hillock 0.6m from 190.6 m to 191.2 m

Existing 100 year water surface elevation = 188.01 m

Increase existing 200 mm diameter pipe to 350 mm

outlet pipe from Franklin Ave to Pondview Pond:
Diameter= 450 mm
Length=180 m
Invert = 185.7 m

Franklin Ave. Existing Backyard

diversion of 3 catchbasins from Franklin Ave. storm sewer to Pondview Pond

Pondview Pond

Pond outfall

Pondview Pond Outlet **Modification**

Centre Street
Manor Gate
Braemar Court
Markwood Lane
Helena Gardens
Regency Gate
Maimonides Court
Hefhill Court
Atkinson Avenue
Franklin Avenue
Pondview Road
Edward Street
Thornridge Drive
Charles Street
Arnold Avenue

Legend

- Existing Catchbasins
- Existing Storm Manholes
- Existing storm sewers
- Proposed storm sewers
- Watercourse
- Existing SWM Ponds

N

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Figure 9-3 - Franklin Avenue Proposed Remedial Measures (1:100 year Design Storm Event)

Drawn By: J.H. Date: March 11, 2013

0 25 50 100 Meters