Oliver Farms/Heritage Estates Flooding Study and Oliver Farms Preliminary Design

Flooding Study and Preliminary Design Report

Prepared for:
Town of LaSalle

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FINAL REPORT

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Sign-off Sheet

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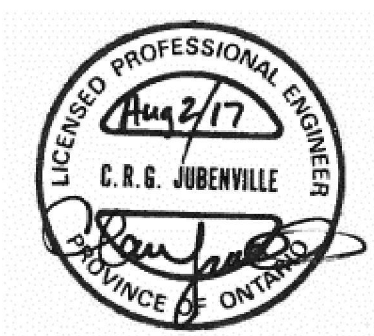
Alain Michaud, P. Eng.



Reviewed by ____
(signature)

Clarence Jubenville, P. Eng.

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Executive Summary

GENERAL

This report will discuss the Oliver Farms Preliminary Design as well as the findings of our flooding study for both the Oliver Farms and Heritage Estates residential developments, referred to as the study area.

The Oliver Farms area was constructed after the second World War and is in need of municipal infrastructure improvements. The Heritage Estates area was constructed in the 1980's. Both the Oliver Farms as well as the Heritage Estates areas have experienced basement flooding in the past few years.

SECTION 1.0

This section outlines the background and objectives of the study. The study area is located near the northeast limit of the Town of LaSalle and is bounded by the new Rt. Hon. Herb Grey Parkway to the north, Howard Avenue to the east, 6^{th} Concession to the south and Heritage Drive to the west. The objectives of the study are to:

- investigate the cause and solutions to basement flooding resulting from rainfall events that occurred in August of 2014 and July of 2015;
- eliminate surface ponding during minor events and providing flooding relief during major events;
- complete a preliminary design of infrastructure improvements in the Oliver Farms area.

SECTION 2.0

This section provides a description of the existing stormwater system within the study area as well as adjacent areas.

Through the original design of Oliver Farms, stormwater was collected via roadside ditches and all conveyed to the Lepain Drain, a municipal drain, which existed across the area that is now developed as Heritage Estates. In approximately 1957, some of the roadside ditches were enclosed. Currently, the Oliver Farms storm drainage outlets via an existing 675 mm dia. storm sewer.

The storm sewer system in the Heritage Estates area was constructed in the 1980's and designed based on the 1 in 5 year Yarnell curve storm.

The study area is the most upstream catchment of the LePain Drain subwatershed. Immediately downstream of the study area, the Heritage storm sewers outlet to the LePain Drain open channel. The LePain Drain also collects flow from the Head/D'Amore Development and discharges to the West Branch of the Cahill Drain which ultimately discharges into the Canard River.

At the time in which the study area was developed, there was no requirement for stormwater management from both a quantity or quality control perspective.

SECTION 3.0

This section discusses potential causes of basement flooding. The findings of our study suggest that the primary cause of the basement flooding is deficient private drainage systems (i.e. – cracked pipes, sump pump failure, tree roots, grading around the house, etc.).

The rainfall intensities that were experienced at the study area for August 11, 2014 and July 25, 2015 storm events significantly exceeded the sewer design capacity – resulting in significant surcharging and surface ponding. Surface ponding in itself is not a cause of basement flooding, however it can stress the private drainage system and aggravate any existing deficiencies.

SECTION 4.0

This section presents the findings of our evaluation of the existing stormwater systems. The existing storm sewer system experienced significant surcharging and surface ponding during both the August 2014 and July 2015 storm events. The August 2014 and July 2015 storms can both be classified by a return period of approximately 1 in 10 year storm when compared to historical rainfall data. Both storms had similar high-intensity rainfall periods which significantly exceeded the design rainfall intensity of the Heritage storm sewer system.

It should be noted that storm sewer systems throughout the County of Essex are generally designed to convey a 2 Year or 5 Year return period. Storm sewers within the County are not designed to fully convey the flows resulting from the above-mentioned storm events that occurred in 2014 and 2015.

SECTION 5.0

This section presents our review of alternative solutions. The study considered several alternative solutions (options) to address flooding issues which can be categorized as follows;

1. Maintaining/improving private drainage systems
2. Improving conveyance capacity of the storm system – Options 1 to 3
3. Adding storage capacity within the system to temporarily detain runoff from high intensity rainfall events – Options 4a to 4g

Maintaining private drainage systems is critical to ensure that surface water and groundwater surrounding the home is directed away from the home and towards the roadway/storm sewer system.

Improving conveyance capacity will limit the amount and frequency of sewer surcharging and subsequently alleviate stress on private drainage systems.

Adding storage capacity within the system will temporarily detain runoff from high intensity rainfall events to reduce sewer surcharging and surface ponding depth and duration.

All options provide a similar reduction in overall sewer surcharge and surface ponding which will alleviate stress on the private drainage systems. However, Option 4d – large wet pond in Heritage Park provides this reduction with the most easily implementable solution in terms of accessibility, constructability and lowest Total Stormwater Cost of **$5,401,000**, which includes improvements to both Oliver Farms and Heritage Estates storm systems.

Residents have expressed concerns with the Wet Pond Solution. A commendable effort was undertaken by a group of local residents to visit every home in Heritage Estates (664 homes) and ask residents if they would be prepared to sign a petition with the message "**Preserve Heritage Park for Future Generation. No Storm Water Pond in Heritage Park**". The petition provided signatures from 562 residents (440 homes), representing 66% of all homes and 90% of all responding residents, with the remaining 10% of responding residents refusing to sign the petition. The petition signatures appear to have ranged from November 27, 2016 to December 7, 2016 (i.e. both before and after PIC No. 3 held on December 1, 2016).

The study originally planned for two Public Information Centres. A third Public Information Centre was held to allow residents the final opportunity to provide feedback on the proposed pond in Heritage Park and proposed storm system improvements in Oliver Farms. The PIC No. 3 presented conceptual plans of the proposed pond solution as well as expanded options in lieu of the pond. The PIC was held on Thursday, December 1, 2016 and was attended by 75 residents.

Below is a synopsis of comments received during the PIC as well as from comment sheets received from 44 residents:

The general consensus was that the residents habitually use and are unwilling to lose the open space that the park currently provides. Many residents also were strongly against the wet pond due to wet pond related concerns (lack of maintenance, breeding of mosquitos/disease, habitat for insects and vermin, safety hazards of open water and thin ice, geese fecal matter and/or attacks, poor aesthetics – odor and appearance). While the PIC display boards presented and discussed design approaches and mitigating measures to address these wet pond concerns, the residents generally maintained their disapproving position on wet ponds.

To mitigate the loss of the park's green space and provide economically viable options in lieu of a wet pond, expanded options considered adding storage capacity via the use of a polypropylene and polyethylene elliptical arch shaped chambers (StormTech) as an economical alternative to provide underground storage. Options 4d2 to 4g provide expanded options using StormTech chambers for underground storage in the park as well as using the chambers in lieu of a standard storm sewer design (circular concrete pipe designed for 1:5 Year Storm conveyance).

The expanded options are all similar in regards to technical and natural environment impacts. Where the expanded options differ is in their socio-cultural and economic impacts. As evidenced by the petition and comments received from PIC No.3, the residents strongly oppose a wet pond type of stormwater management. Thus, the balance between economic and socio-cultural and impacts has shifted with the final recommendation to implement option 4f2 – underground storage with a dry pond (depressed floodplain area) for surface storage during extreme events. Option 4f2 would incur an added cost of **$1,364,000** as compared to the original preferred option 4d (from a total stormwater cost of **$5,401,000** to **$6,765,000**).

For perspective on the frequency of ponding in the depressed floodplain area, the storm system model estimates that the area would not have ponded during the July 25, 2015 and would have ponded for only 2 ¼ hours under the August 11, 2014 event. In summary, the depressed floodplain area will maintain all of the current open space that the park provides and it will not experience surface water ponding for most rainfall conditions.

SECTION 6.0

This section discusses study conclusions and provides recommendations. **The most effective way to reduce the risk of flooding involves a two-part solution that aims to:**

Solution A. Maintain/Improve private drainage systems to ensure adequate drainage of surface, roof and groundwater around the home, supplemented with;

Solution B. Improvements to the Town's stormwater system to reduce the duration and frequency of sewer surcharging during intense rainfall events – thereby alleviating stress on the private drainage systems.

<u>**Solution A**</u>

- **Private Drainage System Maintenance**

  Periodic maintenance and repairs to private drainage systems is important to ensure that surface water and groundwater surrounding the home is directed away from the home and towards the roadway/storm sewer system.

- **Sump Pump Systems**

  The sump pump is the most critical element in dewatering the groundwater surrounding the home and should not be neglected. Adequate power outage protection (i.e. power generator) or a backup pump with alternative power supply is strongly recommended. It is also recommended that the backup pump be equal to or better than the main pump.

Equally important, the sump pump discharge must be effectively directed away from the home. When a pump discharges into a cracked or clogged private storm drain, water is not effectively directed away from the home.

- **Downspout Disconnection**

When feasible, disconnection of the roof downspouts from the underground sewer system can significantly reduce the direct inflow of water to the private drainage system. However, care must be taken to direct roof water to the street and/or rear yard drainage inlet and not on neighbouring property. Do not disconnect downspouts at sidewalks or driveways.

- **Completely Isolated Private Drainage System**

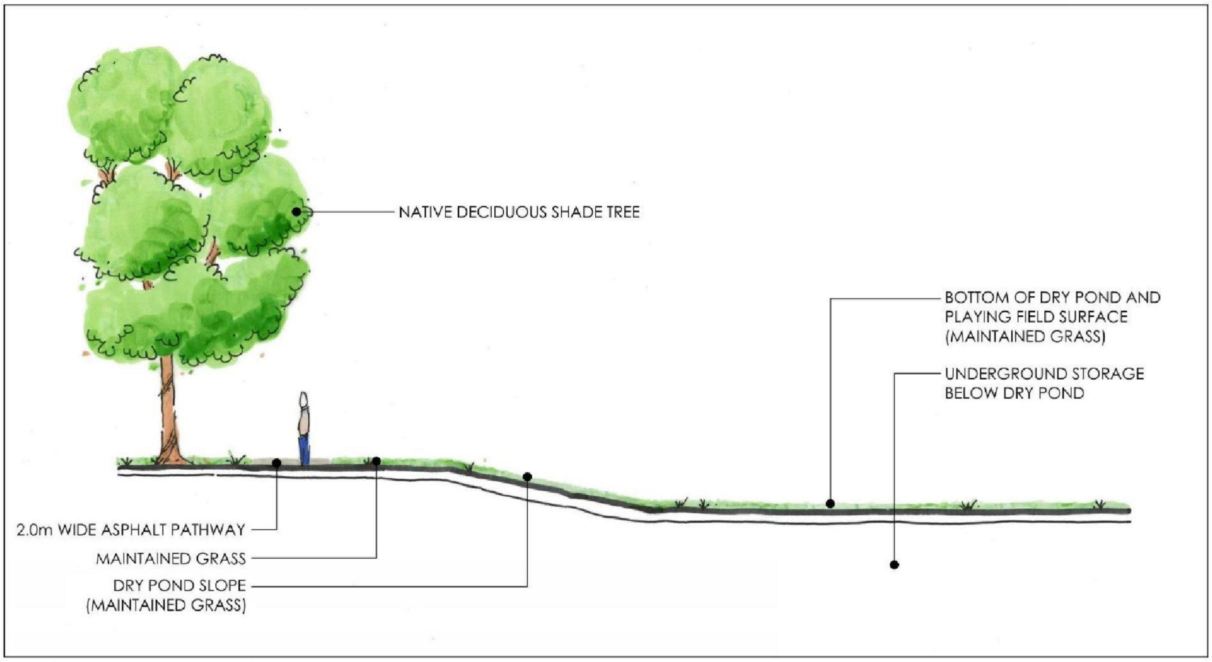
When feasible, complete isolation from the Town sewer system typically provides the best protection against basement flooding. Complete isolation eliminates drainage issues resulting from deficient private drains and protects the home of backflow from the Town's sewer systems.

Solution A is most critical in reducing the risk of flooding and protecting the home. **This solution is the first line of defense and can be implemented immediately**. It is strongly recommended that the homeowner take an active role in implementing home improvements to reduce the risk of basement flooding.

<u>**Solution B**</u>

Option 4f2 – Add Underground Storage with Dry Pond in Heritage Park

The recommended **Solution B** to improve the Town's stormwater system consists of adding storage capacity within the system to temporarily detain runoff from high intensity rainfall events and reduce peak flows to the storm sewer. The recommended **Option 4f2** consists of underground storage with a dry pond (depressed floodplain area) in Heritage Park for surface storage during extreme events. This option will maintain the park's green space as illustrated on the previous page. The illustration below depicts a typical dry pond cross section. The proposed dry pond is to have a maximum depth of 1.2 metres (4 feet).



TYPICAL DRY POND CROSS SECTION

Option 4f2 is the recommended Solution B which can be implemented in two independent phases (i.e. Phase 2 can be implemented before Phase 1):

Phase 1 – Oliver Farms Improvements

- Replace approximately 2,360 metres of existing Oliver Farms storm sewers with one row of MC4500 StormTech underground chambers (approximately 10,000 cubic metres of storage).
- Replace approximately 260 metres of existing storm sewer in greenway from Montgomery Drive to the south end of walkway off Carriage Lane with one row of MC4500 StormTech underground chambers (approximately 1,100 cubic metres of storage).
- Install a 900 mm dia. flow control orifice with backflow prevention connecting StormTech chambers to 1200 mm dia. storm sewer in walkway from Carriage Lane.

Phase 2 – Heritage Estates Improvements

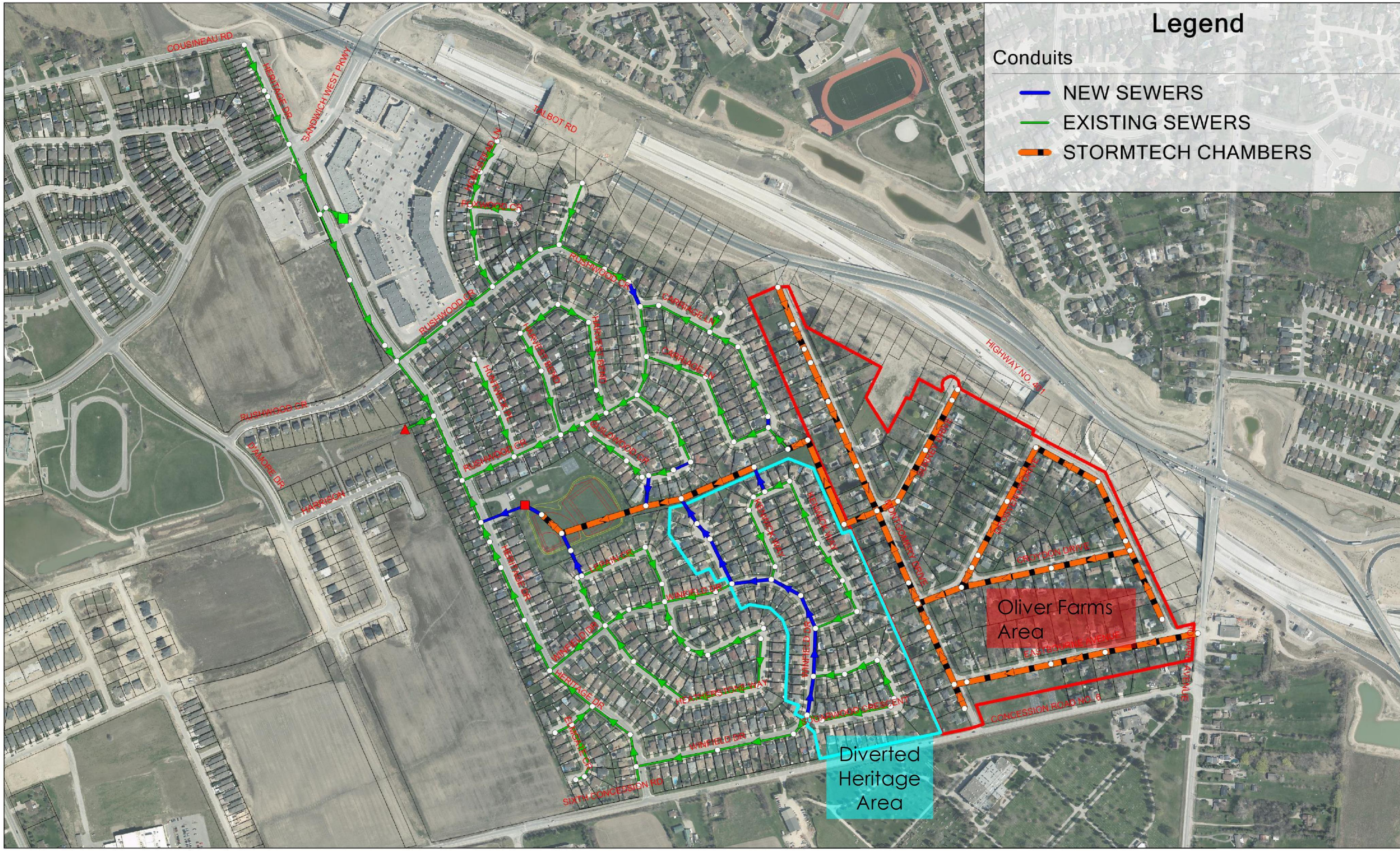
- Install approximately 260 metre length of one row of MC4500 StormTech chambers within greenway from Kenwick Way overflow sewer to Heritage Park lands.
- Install approximately 3,200 cubic metres of StormTech underground chambers under Heritage Park with configuration to be determined at detailed design.
- Construct shallow dry pond (shallow depressed area) up to maximum 1.2 metre (4 foot) depth in Heritage Park to provide 11,000 cubic metres of surface storage at a maximum water surface elevation of 184.0m.
- Install surface catch basins in depressed areas for surface runoff drainage as well as interconnections between underground and surface storage. Ensure sufficient routing capacity in interconnections for underground storage to rise up and fill surface storage during extreme events.
- Install 525 mm dia. storm sewer outlet from Heritage Park underground storage chambers to Heritage Drive storm sewer.
- Install 900 mm dia. storm sewer along Winfield Dr. and Coachwood Pl. to divert 10.74 hectares to the greenway storm sewer /pond.
- Install overflow relief sewers to connect existing storm sewers to the greenway storm sewer/pond through walkways at Lepain Cr. (600 mm dia.), Kenwick Way (600 mm dia.) and Guildwood Cr. (450 mm dia.), complete with flap gates.
- Construct interconnection sewers on Rushwood Cr. (375 mm dia.), Carriage Lane (375 mm dia.) and Guildwood Cr. (300 mm dia.).
- Disconnect existing 750mm dia. sewer in manhole at Winfield Dr. and Coachwood Pl. such that all flows are diverted northerly via new storm sewer along Coachwood.
- Disconnect existing 600mm dia. storm sewer in manhole at Sugarwood Cr. and Winfield Dr. such that all flows are diverted northerly via new storm sewer along Winfield.

Refer to **Figure 4** on the next page for a storm sewer plan of Option 4f2.

Solution B will help to mitigate risk of flooding by alleviating stress on the private drainage system caused by sewer surcharging and prolonged surface ponding. It will improve level of service of the storm sewer system such that the 5 Year design storm event will not result in any surface ponding. In other words, Solution B will result in less frequent and shorter durations of surface ponding.

However, Solution B is ultimately only a supporting measure that does not, in itself, provide long-term protection against basement flooding and should not be relied upon without implementation of Solution A.

Figure 4 – Option 4f2 Storm Sewer Replacement Plan



Funding Solution B

It is important to note that any and all options presented have not been included in any current capital plan approved by Council. In developing a financial strategy to implement any solution the Town will require assistance/funding from senior levels of government, may need to issue debt to fund the ultimate solution, or otherwise re-prioritize existing projects. Given these financial circumstances and realities the construction of any solution may be beyond the 5 year horizon unless significant senior government funding is obtained, other projects are re-prioritized, and/or debt issued.

With the issuance of debt will come the corresponding required debt repayment. The annual amount of the debt repayment could be funded by an increase in taxes (which will effect all properties Town wide), or the implementation of a local improvement assessment (which will effect only the directly benefitting properties), and/or some combination of both. **Table 4** below outlines cost allocations for both neighbourhoods.

Table 4 – Cost Allocations for Recommended Solution B (Option 4f2)

	Oliver Farms Neighbourhood	Heritage Estates Neighbourhood	TOTAL
Total Number of Homes	119	664	783
Total Approximate Residential Assessment	20,300,000	123,400,000	143,700,000
Total Approximate Commercial Assessment	---	25,000,000	25,000,000
Total Stormwater Cost	**3,996,000[1]**	**2,769,000**	**6,765,000**

Note 1: Proposed Oliver Farms Improvements also include watermain replacement, road reconstruction and street lighting replacement for a total cost of $9,079,000. See section 7.0 for details.

Town Council has not determined method in which the project(s) will be financed nor the timelines for commencement as both factors may be subject to funding from senior levels of government. The ultimate method of financing will be the subject further public consultation.

SECTION 7.0

This section discusses the preliminary design of Oliver Farms area improvements, including road reconstruction urban road cross-section, new sidewalks, watermain replacement, storm sewer replacement, stormwater management, evaluation of existing street lighting to meet current Town Standards, utility coordination and approvals. The probable cost of the proposed improvements is $ 9,079,000.

Table 5 below provides a summary of the probable cost of the proposed Oliver Farms improvements.

Table 5 – Probable Cost of Oliver Farms Improvements

Description	Probable Cost
Storm Sewer Replacement/ Stormwater Management	3,996,000
Watermain	1,478,000
Roadway	3,538,000
Street Lighting	67,000
TOTAL COST	**9,079,000**

Abbreviations

cms	cubic metres per second flow rate
dia.	diameter
mm	millimetre
m	metre
Mun. nos.	Municipal numbers
PIC	Public Information Centre

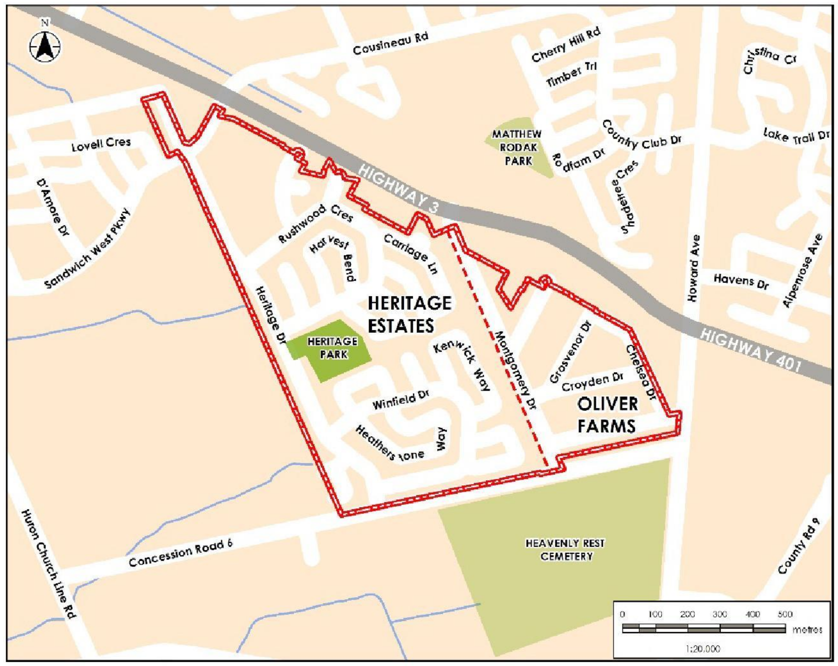
Glossary

1:5 year storm event (also referred to as 5 year storm)	A storm event with a 1:5 year return period or 20% probability of occurrence in any given year.
Hydrodynamic	Hydrodynamics is the study of motion of liquids, and in particular, water. A hydrodynamic model is a tool able to describe or represent in some way the motion of water.
Hydrograph	A hydrograph is a graph showing the rate of flow (discharge) versus time.
Hyetograph	A hyetograph is a graphical representation of the distribution of rainfall over time.
Major	In the context of stormwater, major relates to a major storm event. For purposes of design, the major storm event is quantified as a 1:100 year storm event.
Minor	In the context of stormwater, minor relates to a minor storm event. For purposes of design, the minor storm event is typically specified as a 1:5 year storm event.
Obvert	Elevation at the highest point of the inner surface of a pipe (i.e. interior top of pipe)
Return period	A return period, also known as a recurrence interval is an estimate of the likelihood of an event, such as an earthquake, flood or a river discharge flow to occur
Runoff	Surface water, from precipitation, that flow over the land surface.
Stormwater	Stormwater is the water from rain or melting snow that is not absorbed into the ground. It flows over land or impervious surfaces such as streets, parking lots and roofs.
Subcatchment	An area of land where all surface runoff converges or is assigned to a single point along a drainage feature. E.g. a storm sewer manhole.
WSEL	Water Surface Elevation

1.0 INTRODUCTION

1.1 BACKGROUND

Figure 1 – Study Area



The study area consists of approximately 93.6 hectares (ha) of primarily residential land use with 783 homes and 7.6 ha occupied by the commercial Windsor Crossing area at the northwest corner of the study area. The study area is divided by two separate developments – Heritage Estates and Oliver Farms developments.

The study area is located near the northeast limit of the Town of LaSalle and is bounded by the new Rt. Hon. Herb Grey Parkway to the north, Howard Avenue to the east, 6th Concession to the south and Heritage Drive to the west. **Figure 1** above depicts the study area outlined in red.

Homes within the study area have experienced basement flooding over the past few years, some homes on more than one occasion. This report will discuss the findings of the flooding study.

1.2 OBJECTIVES

The primary objective of this study was to investigate the cause and solutions to basement flooding resulting from rainfall events that occurred in August of 2014 and July of 2015. The study consists of a complete and comprehensive hydrologic and hydraulic analysis of the Oliver Farms and Heritage Estates areas, with the objective of eliminating surface ponding during minor events and providing flooding relief during major events. This report will discuss the findings of our analysis and potential solutions to mitigate the risk of future basement flooding.

The study's objective was also to complete a preliminary design of infrastructure improvements in the Oliver Farms area, including road reconstruction, new sidewalks, watermain replacement, storm sewer replacement and evaluation of existing street lighting to meet current Town Standards. Section 7 of this report summarizes the Oliver Farms preliminary design.

2.0 DESCRIPTION OF EXISTING STORMWATER SYSTEM

2.1 OLIVER FARMS

Oliver Farms was developed after the Second World War through the Veterans Land Act. This development was also referred to as Maryland Subdivision. This area was originally developed with large estate size lots, with a rural type of road cross section (i.e. no curbs and open ditches).

Through the original design, stormwater was collected via roadside ditches and all conveyed to the Lepain Drain, a municipal drain, which existed across the area that is now developed as Heritage Estates. In approximately 1957, some of the roadside ditches were enclosed.

Currently, the Oliver Farms storm drainage outlets via an existing 675 mm dia. storm sewer through the greenway at the intersection of Montgomery Drive/Surrey Drive, connecting to the Heritage Estates storm sewer system along Carriage Lane through an easement between mun. nos. 1281 and 1285 Carriage Lane. The Heritage Estates storm sewer system was designed to convey flows from Oliver Farms area based on a 1 in 5 year Yarnell curve storm event with a corresponding design peak flow of 0.94 cms. However, the existing Oliver Farms storm sewer system has limited capacity and would require upgrades to convey the design peak flow of 0.94 cms.

2.2 HERITAGE ESTATES

Heritage Estates was developed over a number of phases beginning approximately in 1980 and finishing over approximately a 10 year period. Heritage Estates was designed to municipal standards at that time, complete with full urban cross section, watermains, storm sewers and sanitary sewers. As part of the development of Heritage, the existing Lepain Drain was enclosed through the developed lands and Oliver Farms drainage was directed through the enclosed storm sewer system installed as part of Heritage.

The Heritage Estates storm sewer network outlets to the Lepain Drain, where the outlet is located through an easement between mun. nos. 1179 and 1183 Heritage Drive, approximately 100 m south of Rushwood Crescent. The storm sewer system in the Heritage Estates area was designed for the 1 in 5 year Yarnell curve storm with a corresponding design peak flow of 3.84 cms.

2.3 LEPAIN DRAIN SUBWATERSHED

The study area is the most upstream drainage catchment of the LePain Drain subwatershed. Immediately downstream of the study area, the Heritage storm sewer network outlets to the LePain Drain open channel, which also collects flow from the Head/D'Amore Development. The Lepain Drain discharges to the West Branch of the Cahill Drain which ultimately discharges into the Canard River. Currently, a stormwater management pond exists within the Head/D'Amore Development with a top of bank elevation of approximately 181.20m, which is 0.86m below the

Heritage Estates outlet obvert elevation of 182.06m. Thus, the hydraulic capacity of the storm sewer system within the study area is not adversely impacted by the pond water levels.

2.4 PARKWAY

As a potential cause of the recent basement flooding in the study area, it has been suggested that the Parkway may have contributed to the issue. It should be noted that the Parkway drainage is intended to be contained within its property limits and collected/conveyed to the Wolfe Drain, which discharges to the Cahill Drain and is ultimately discharged into Turkey Creek – i.e. the Parkway catchment is meant to drain into a separate watershed (Turkey Creek watershed) than that of the study area (Canard River watershed). However, it has been observed and confirmed that surface runoff from the Parkway property was spilling into the study area as the highway was under construction in August 2014.

This study was not intended to investigate the interim drainage condition during construction in 2014 nor can the Town confirm that the construction of the current perimeter drainage system was fully completed by July of 2015. As such, this study cannot quantify the level of impact from the Parkway surface runoff in the Aug 2014 event and potentially the July 2015 event. Notwithstanding the Parkway's runoff contribution and potential impact on the study area, the findings of this study point to other factors that likely contributed to basement flooding.

In response to comments received from public meetings, the Town requested that Stantec expand the original scope to include a review of the relevant Parkway drainage reports/drawings as well as the as-constructed condition of the perimeter drainage. As such, Stantec performed a field investigation in the Spring of 2016 to confirm the as-constructed condition of the perimeter drainage. Stantec's review of the drawings and field observations conclude that the Parkway has provided perimeter drainage to collect and contain stormwater within the Parkway lands.

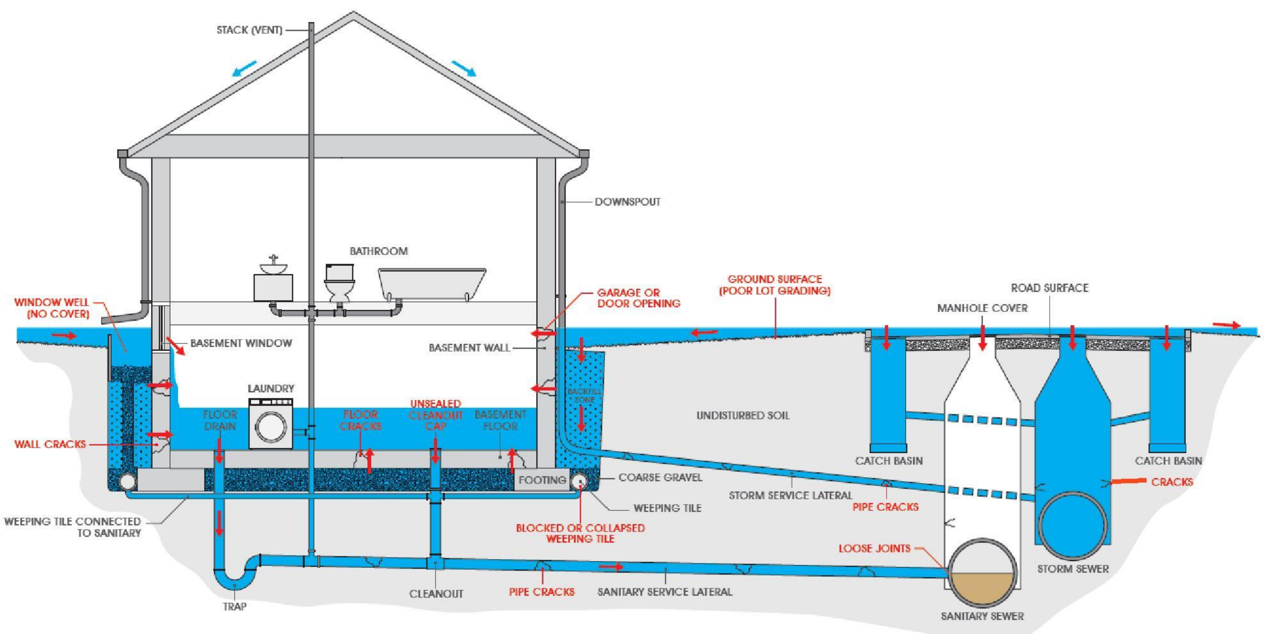
2.5 STORMWATER QUALITY AND QUANTITY CONTROL

At the time in which the study area was developed, there was no requirement for stormwater management from both a quantity or quality control perspective. Furthermore, there was no consideration to provide overland flow routing to mitigate surface ponding under major storm events conditions. However, a review of the existing grading confirms that the roadway does provide overland flow relief for the study area with flows converging to Heritage Drive at the intersection of Rushwood Avenue and Sandwich West Parkway. The latter two roadways convey overland flows westerly through the Head/D'Amore Development and ultimately to the LePain Drain. Current standards require that overland flow routes be provided to adequately convey major stormwater flows to the receiving watercourse or stormwater management facility and restrict surface ponding to a maximum of 0.3m. The existing road grading includes some locations where ponding depths exceed the current standard with ponding depths of up to 0.4m. While these depths exceed current standards by 0.1m, the existing roadways will provide overland relief before the surface ponding reaches the home entrances/windows.

3.0 POTENTIAL CAUSES OF BASEMENT FLOODING

3.1 HOW DOES WATER GET IN?

Basement flood waters can enter a home via many pathways. Stormwater can seep through cracks in the foundation walls or basement floors. Stormwater can also enter via an overflowing sump pit where foundation drainage inflow to the pit exceeds the sump pump discharge rate (i.e. stormwater flowing into the pit is greater than stormwater being pumped out). In some cases, the basement is flooded with grey water from the sanitary sewer system which enters the basement via the floor drain and/or an unsealed cleanout cap.



The above illustration shows a sectional view of a house and identifies potential sources of basement flooding.

3.2 TYPICAL CAUSES OF BASEMENT FLOODING

Under normal rainfall events, the storm sewer system operates as designed. However, during extreme storms, the following occurs:

- Stormwater flow exceeds the storm sewer capacity and overloads the storm sewer system.
- Stormwater surcharges the storm sewer system and backs up into the private drainage systems. Backfill areas surrounding foundation walls become saturated with water.

- Where private drainage systems are deficient (i.e. – cracked pipes, sump pump failure, tree roots, grading around the house, etc.), water that accumulates in backfill areas surrounding foundation walls and sewer trenches cannot be properly drained, resulting is water pressure forcing water through foundation wall and floor cracks, window wells, door openings, unsealed pipe openings, floor drains and overflowing sump pits.
- At low lying areas, water accumulates (ponds) and enters the sanitary sewer system through manhole covers or cleanouts.

3.3 WHAT CAUSED FLOODING IN THE STUDY AREA?

The exact cause of basement flooding at each individual home within the study area is difficult to identify and can be a result of one or many circumstances. The findings of our study suggest the following:

- The primary cause of the basement flooding is believed to be deficient private drainage systems (i.e. – cracked pipes, sump pump failure, tree roots, grading around the house, etc.). The private drain pipes are believed to have been strapped to the foundation wall at 2 foot intervals. The photo below shows a private drain pipe strapped at the current standard 1 foot interval. When the backfilled soil settles around the house, if the piping is not properly supported, it could crack the pipe or displace the pipe joints.

- The rainfall intensities that were experienced at the study area for August 11, 2014 and July 25, 2015 storm events significantly exceeded the sewer design capacity – resulting in significant surcharging and surface ponding. Surface ponding in itself is not a cause of basement flooding, however it can stress the private drainage system and aggravate any existing deficiencies.

Many of the homes that flooded in the study area were inspected and found to have deficient private drainage systems which saturated the soils at the house and resulted in stormwater entering the home via sump pits and basement wall cracks. A few home reported flooding via the floor drain which would suggest that the sanitary sewer system was overwhelmed. It is possible that the sanitary sewer system experienced stormwater inflows from surface ponding entering through manhole covers or cleanouts. It was also confirmed by residents that basements flooded by stormwater were draining via the floor drain or being pumped into the laundry tub, thus resulting in a significant inflow to the sanitary sewer system.

4.0 EVALUATION OF EXISTING STORMWATER SYSTEM

The study area has experienced flooding issues in the past years with notable surface ponding. As such, a dynamic dual drainage system model was undertaken to evaluate the interaction of the storm sewer system (minor system) and overland flow via the roadway (major system). A dual drainage model provided a comprehensive hydrodynamic analysis of the overall stormwater system, including simultaneous surface ponding, street flooding and surcharged pipes.

4.1 MODEL APPROACH

Source: Computational Hydraulics Int.

Stantec developed an Existing Condition dual drainage model using most current PCSWMM 2016 Professional 2D software (currently version 6.0.1958). PCSWMM provides innovative tools for fast, accurate major/minor system modeling, analysis and design. PCSWMM dual drainage modeling allows for flexible inlet control, catchbasin flooding and reverse flow, street/gutter flow and overland routing, accurate surcharge and pressure flow pipe modeling, inlet/outlet controls, flooded and ponded areas, dynamic analysis of tailwater conditions.

Hydrologic routing for the proposed development was developed using the SWMM Runoff module within PCSWMM. Individual runoff hydrographs were created for subcatchment areas draining to catch basins (i.e. roadway + driveways + front yards) and subcatchment areas draining via storm sewer connections (i.e. roof + side & rear yards). Runoff hydrographs from all areas were then hydraulically routed through the dual drainage system of storm sewers and roadways as dictated by the sewer conveyance capacity as well as inlet capacity of the catch basins and storm sewer connections (e.g. a storm sewer may not necessarily flow at full capacity if the catch basins and storm service connections cannot supply the equivalent flow to the sewer).

Source: Computational Hydraulics Int.

4.2 RAINFALL ANALYSIS

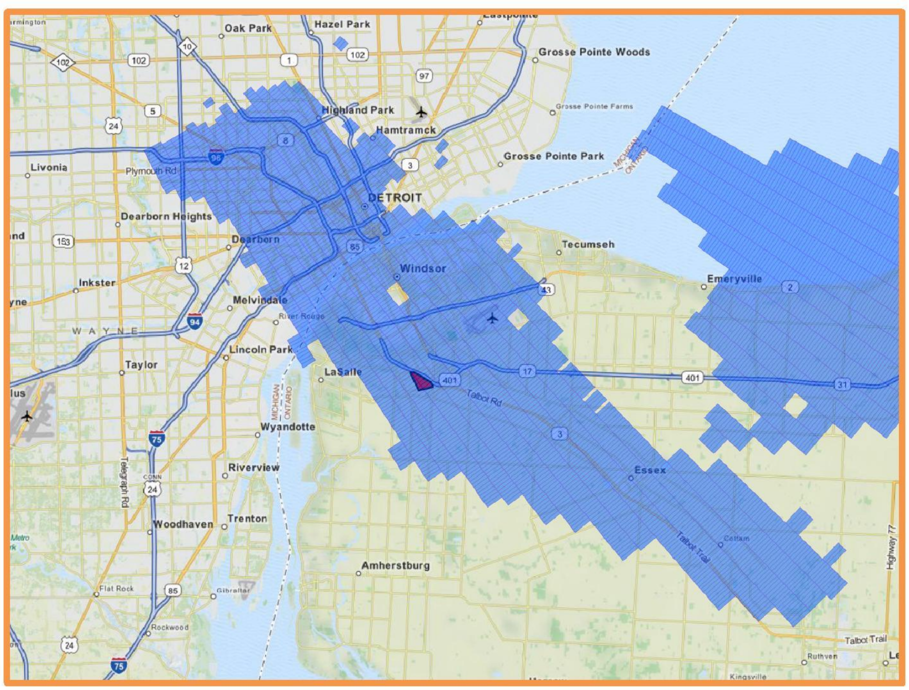
A variety of storm events (synthetic and historical) were selected to evaluate existing stormwater system capacity under typical minor storm return periods such as the 1:5 year design event as well as the 1:100 year major storm event. The evaluation also considered various synthetic storm durations to represent regional type storms with large amounts of rain as well as isolated high-intensity thunderstorms.

With regards to historical storm events, Stantec reviewed radar rainfall data to best derive the actual rainfall characteristics that the study area experienced during the storm events of July 2015 and August 2014, both of which resulted in flooding issues.

Available rain gauge data was reviewed to assist in "ground truthing" the rainfall derived from the radar products. Thus, the radar data was used to spatially distribute the rain gauge estimated rainfall, which provides a reliable means of deriving the actual rainfall characteristics of an isolated thunderstorm in an area that does not have a rain gauge available.

Figure 2 depicts a screenshot of the radar rainfall data for July 25, 2015 at approximately 7:30 pm.

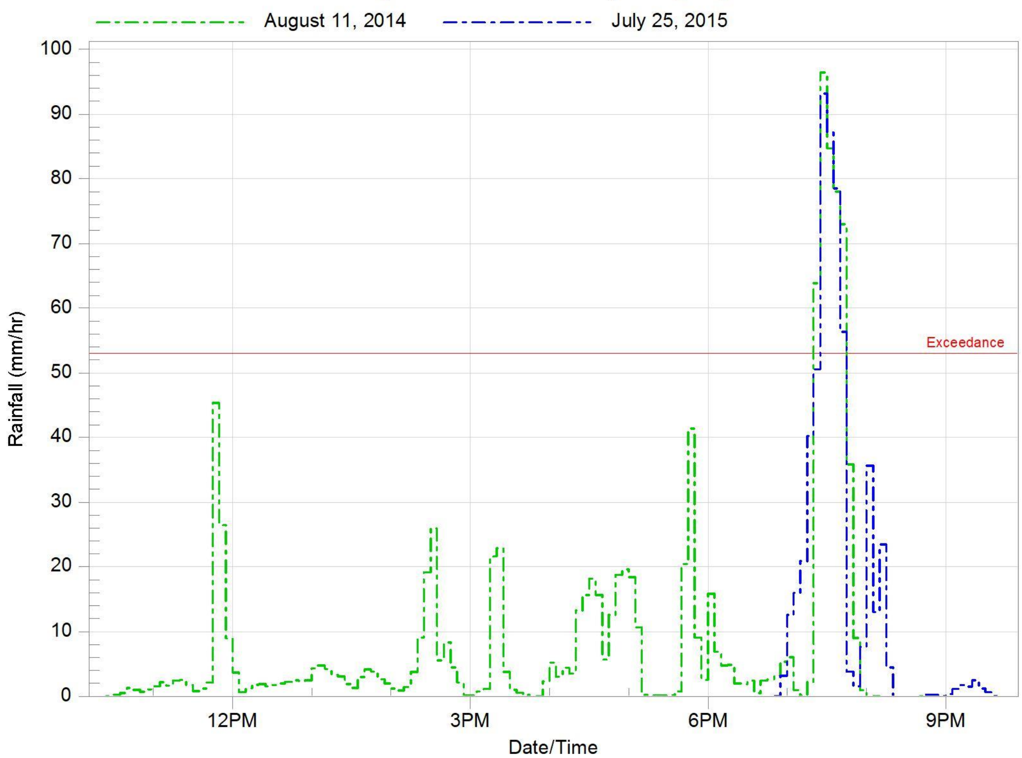
Figure 2 – July 25, 2015 Radar Rainfall



The August 2014 and July 2015 storms can both be classified as approximately 10 year storm events when compared to historical rainfall data.

Both storms had similar high-intensity rainfall periods which significantly exceeded the design rainfall intensity of the Heritage storm sewer system. **Graph 1** depicts the 1:5 Year design peak rainfall intensity and the rainfall hyetographs for the two subject storm events. Rainfall hyetographs graphically represent the varying rainfall intensity over the duration of a storm event. Heritage Estates 1:5 Year design peak rainfall intensity is 53 mm/hr as shown by the red line. Approximate rainfall intensities that were experienced at the study area for August 11, 2014 and July 25, 2015 storm events are shown in green and blue.

Graph 1 – Rainfall Hyetographs

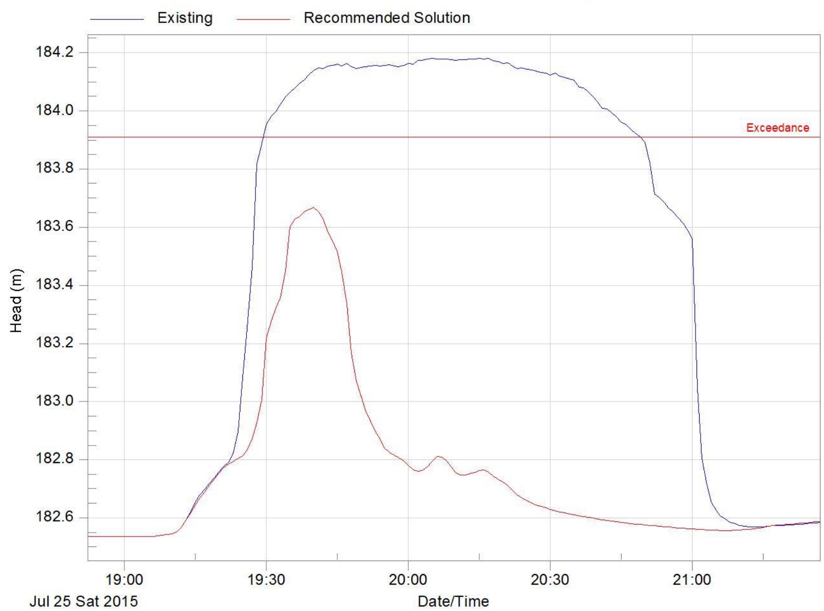


4.3 EXISTING STORM SEWER SYSTEM

The existing storm sewer system experienced significant surcharging and surface ponding during both the August 2014 and July 2015 storm events. It should be noted that storm sewer systems throughout the County of Essex are generally designed to convey a 2 Year or 5 Year return period storm. Storm sewers within the County are not designed to fully convey the flows resulting from the above-mentioned storm events that occurred in 2014 and 2015.

Public feedback during the Public Information Centre #1 emphasized the prolonged duration and depth of surface ponding in the streets immediately south of Heritage Park.

Graph 2 – Water Levels @ 1945 Lepain Cr.



Graph 2 illustrates the water level (head) versus time for the storm manhole adjacent to 1945 Lepain Cr. During the July 25, 2015 storm event. The graph shows the levels for the existing condition in blue and the recommended Solution B in red (see Section 6.2 for further discussion).

The "exceedence" level of 183.91 m represents the ground elevation. The model estimates that surface ponding occurred for approximately 1 ¼ hours and covered the area as depicted in the blue shading on **Figure 3** below. The recommended solution would completely eliminate surface ponding under the same July 25, 2015 event and significantly reduce the level and duration of sewer surcharge, thus significantly reducing stress on the private drainage systems.

Figure 3 – Approximate Modelled Extents of Surface Ponding @ Lepain Cr. during July 25, 2015 Storm

The model analysis revealed that some areas experienced surcharging and surface ponding under the 5 Year Yarnell design storm event. Storm sewer system improvements are recommended in this report to provide a level of service in which all surface ponding is eliminated during the design storm event.

4.4 PRIVATE DRAIN INSPECTIONS

The Town of LaSalle received 73 calls of reported basement flooding following the July 25, 2015 storm event. According to the Town, many residents noted that they had also flooded on August 11, 2014 but did not call. The Town's Public Works Department responded to flooding calls with camera inspection of private drain connections.

Of the 73 calls received;

- 45 homes were found to have deficiencies in their private storm drain pipes
- 3 homes were found to have storm drain pipe deficiencies on the Town's property
- 9 homes had sufficient storm drain pipes but suspected issues with foundation drainage or sump pump operation
- 14 homes did not make appointment for camera inspection
- 2 homes did not have any issues found during inspection

4.5 FLOODING SURVEYS

Flooding surveys were provided to residents to gather details of the homes within the study area. A total of twenty-two (22) completed surveys were received. The survey asked 20 questions to determine details related to the property, rain gutter downspouts, sump pumps, basement flooding, sewer backup protection and foundation drains. The most notable information was related to sump pumps and basement flooding.

The information obtained from the surveys can be summarized as follows:

- 13 of the 22 surveys reported basement flooding. With the exception of 1 home, basement flooding was reported only for August 11, 2014 and/or July 25, 2015 storm events.

- Basement flooding depths ranged from 6mm (¼") to 152mm (6"). For homes that flooded in both events, the 2014 event typically produced the larger depth.

- Flooding occurred in homes with and without backup sump pumps.

- The residents believe that the flooding was a result of too much rain, storm sewer backup, saturated ground conditions, road surface ponding and sump pump failure.

In one instance, power failure was reported to be the cause and in another instance the sanitary sewer backup was believed to be the cause.

- Most basement flooding water came from the sump pit and/or through the floor/wall in basement. There were two accounts of water coming from the floor drain.

4.6 PUBLIC INFORMATION CENTRE (PIC) NO. 1

The purpose of PIC No.1 was to provide an information/progress update and solicit feedback from the public. The PIC presented results of the Heritage Estates/Oliver Farms storm sewer system evaluation as well as preliminary design concepts for Oliver Farms. The PIC was held on Thursday, February 11, 2016 and was attended by 39 residents.

The PIC No.1 display boards are included in **Appendix A**.

Below is a synopsis of comments received during the PIC as well as from comment sheets.

The August 11, 2014 and July 25, 2015 storm events both overwhelmed the storm sewer system and resulted in temporary surface ponding. There was prolonged surface ponding (over 1 hour), particularly in Heritage Estates area south of the Park where water levels were halfway up the driveway in some locations. Many residents noted that their sump pump could not keep up with the inflow to the sump pit. Others noted that water was entering the basement through the walls.

A few residents noted that water was entering through the floor drain, which is typically connected to the sanitary sewer system. There was also mention of water being pumped into the laundry tub. In some cases, the flooded basement drained via the floor drain, putting added stress on the sanitary sewer system.

Several residents noted that they have not flooded up until the last few years and suggested that the newly constructed Herb Grey Parkway caused their basement flooding.

There was a general consensus that the flooding issue needs to be addressed as soon as possible. Many residents can no longer qualify for insurance coverage related to basement flooding and are looking forward to improvements of the existing storm sewer system.

Some residents approached the PIC with the position that the Town needs to fix the flooding problem. Others noted that they have undertaken some improvements to protect their homes. The PIC boards and discussion outlined the preliminary study findings that the basement flooding is primarily a private drainage system issue and that private drainage requires homeowner maintenance same as roofs, furnaces, windows, etc...

5.0 REVIEW OF ALTERNATIVE SOLUTIONS

The study considered several alternative solutions (options) to address flooding issues which can be categorized as follows;

1. Maintaining/improving private drainage systems
2. Improving conveyance capacity of the storm system – Options 1 to 3
3. Adding storage capacity within the system to temporarily detain runoff from high intensity rainfall events – Options 4a to 4d

5.1 MAINTAINING/IMPROVING PRIVATE DRAINAGE SYSTEMS

Maintaining private drainage systems is critical to ensure that surface water and groundwater surrounding the home is directed away from the home and towards the roadway/storm sewer system.

Private Drainage System Maintenance

Periodic maintenance and repairs to private drainage systems is important to ensure that surface water and groundwater surrounding the home is directed away from the home and towards the roadway/storm sewer system. Some maintenance/repair items include;

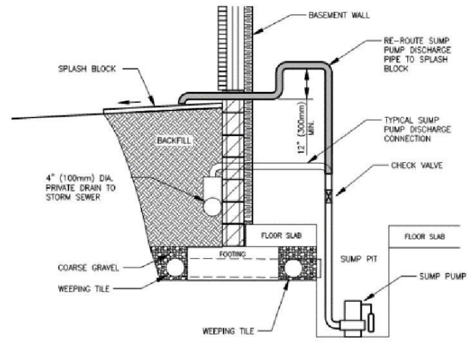
- cracked pipes, cracked basement walls, sump pump system, blockages from tree roots, poor grading around the house, etc.

Sump Pump Systems

The sump pump is the most critical element in dewatering the groundwater surrounding the home and should not be neglected. Investing in a reliable and durable sump pump system is a relatively manageable cost when compared to the cost and nuisance of flooding damage. Adequate power outage protection (i.e. power generator) or a backup pump with alternative power supply is strongly recommended. The backup pump is not meant to handle the day-to-day foundation drainage but rather it should be equipped to handle flows resulting from the high intensity storm event that is likely to coincide with a power outage. For this reason, it is recommended that the backup pump be equal to or better than the main pump.

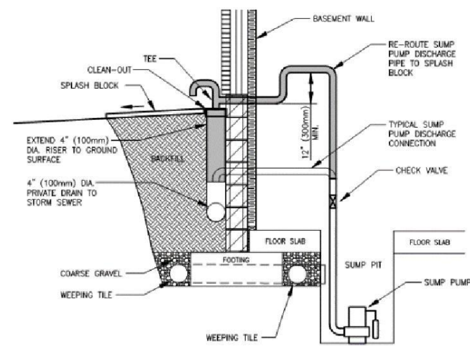
Equally important, the sump pump discharge must be effectively directed away from the home. When a pump discharges into a cracked or clogged private storm drain, water is not effectively directed away from the home. As a result, the pump has to work longer and harder and is prone to failure or the inflow to the sump pit may eventually exceed the pump capacity. A pump discharge to surface ensures that the pump efforts are not lost, provided that the surface discharge is graded away from the home and surrounding backfill zone.

The ideal sump pump system would be similar to sump pump discharge detail 'A' and would have two separate discharge points – one outletting to the private storm drain and one outletting directly to the ground surface – sloping away from the home and towards the road. By installing valves on both discharge pipes, the homeowner could control when the pump discharges to the private storm drain (e.g. winter season, early spring, late fall) and when the pump discharges to the surface (e.g. summer season when high intensity storms are more prominent and pump discharge flow is readily absorbed by the dry ground conditions.)



SUMP PUMP DISCHARGE DETAIL 'A'

Sump pump discharge detail 'B' will provide gravity backflow protection by raising the discharge pipe above the ground level and providing an emergency overflow. It should be noted however that this detail may not provide sufficient drainage if the private storm drain is deficient and pump discharge flows are recirculating to the foundation drainage stone and weeping tile.

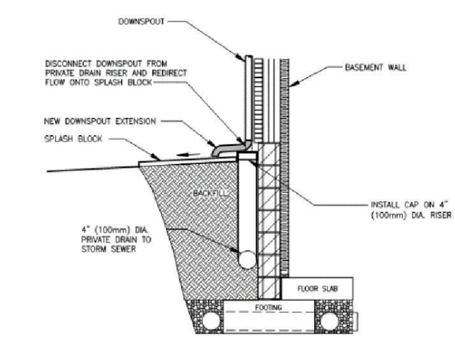


SUMP PUMP DISCHARGE DETAIL 'B'

Downspout Disconnection

When feasible, disconnection of the roof downspouts from the underground sewer system can significantly reduce the direct inflow of water to the private drainage system. However, care must be taken to direct roof water to the street and/or rear yard drainage inlet and not on neighbouring property. Steps to disconnect include:

1. Assessment of the house layout, number of downspouts, and surrounding land.
2. Cutting the downspout pipe(s) and adding an elbow joint to redirect the water to a grassed surface away from the building
3. Use of a concrete or plastic splash-pad to prevent erosion
4. Capping and sealing the old ground connection(s) to be water-tight



EAVESTROUGH DOWNSPOUT DISCONNECTION DETAIL

<u>Challenges:</u>

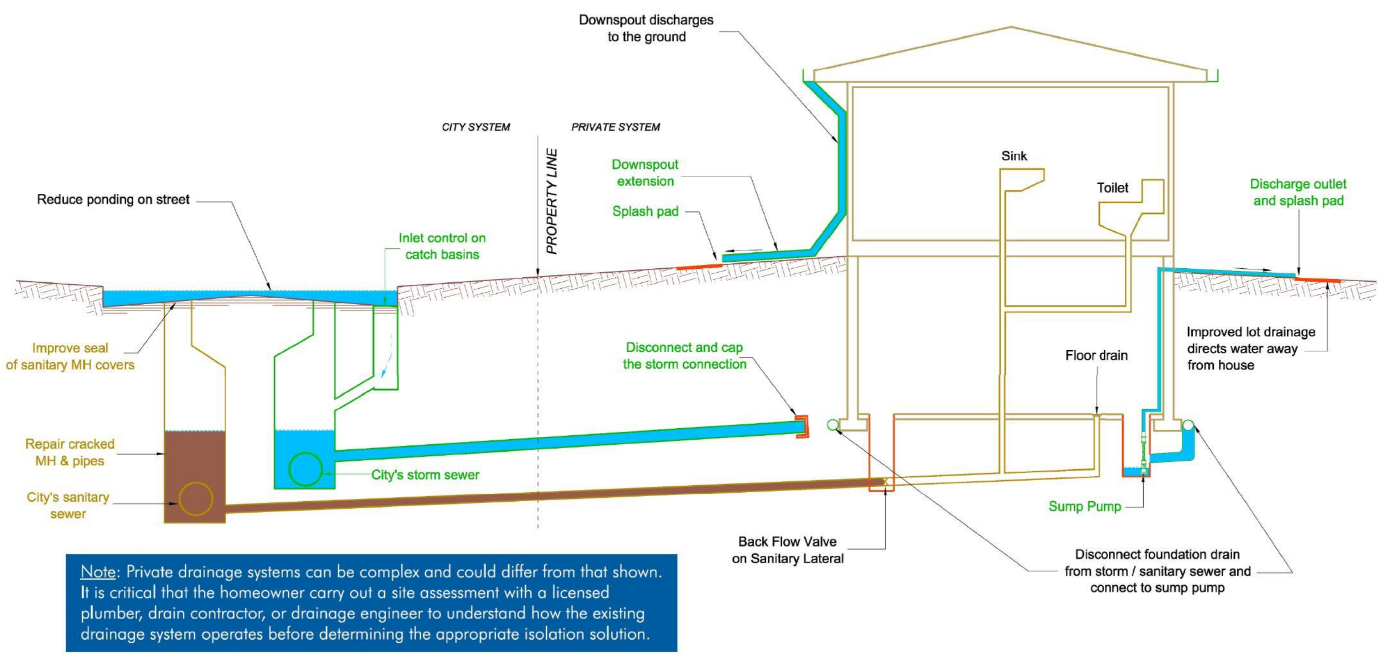
Findings suitable locations to outlet (grass). Do not disconnect at sidewalks or driveways.

Preventing outflow from causing flooding or ice on own or neighbouring property.

Completely Isolated Private Drainage System

When feasible, complete isolation from the Town sewer system typically provides the best protection against basement flooding. To be completely isolated from backup in the Town sewer system, you need:

1. Disconnection of downspouts from Town sewers
2. Backflow valve on the sanitary sewer line
3. Disconnection of foundation drains from Town sewers and severance (capping) of the storm lead (if it exists), including clay plug
4. Installation of sump pump to drain foundation drain to surface



5.2 IMPROVING CONVEYANCE CAPACITY

Improving conveyance capacity will limit the amount and frequency of sewer surcharging and subsequently alleviate stress on private drainage systems. Options 1 to 3 present various conveyance capacity improvement alternatives considered:

- OPTION 1 – OVERALL SYSTEM SEWER REPLACEMENT
- OPTION 2 – PARTIAL SEWER REPLACEMENT WITH RE-ROUTE OF OLIVER FARMS STORM SEWER THROUGH PARK AREA
- OPTION 3 – PARTIAL SEWER REPLACEMENT WITH ADDITION OF RELIEF OUTLET SEWERS

5.3 ADDING STORAGE CAPACITY

Adding storage capacity within the system will temporarily detain runoff from high intensity rainfall events and reduce peak flows to the storm sewer. Options 4a to 4d present various storage capacity improvement alternatives considered:

- OPTION 4a – ADD SMALL WET POND STORAGE AREA + DEPRESSED BASEBALL DIAMOND STORAGE AREA FOR MAJOR EVENTS
- OPTION 4b1 – ADD SMALL WET POND STORAGE + UNDERGROUND SEWER STORAGE
- OPTION 4b2 – ADD SMALL WET POND STORAGE + UNDERGROUND TANK STORAGE
- OPTION 4c – ADD LARGE WET POND STORAGE AND ELIMINATE BASEBALL DIAMOND – PUMPED OUTLET
- OPTION 4d – ADD LARGE WET POND STORAGE AND ELIMINATE BASEBALL DIAMOND – GRAVITY OUTLET

5.4 EVALUATION OF OPTIONS

Each of the various options were evaluated based on the following considerations:

- Natural Environment Impacts
- Socio-Cultural Impacts
- Technical Impacts
- Economic Impacts

5.4.1 Natural Environment Impacts

- Potential Impact on Terrestrial Systems (Vegetation, Trees, Wildlife)
- Potential Impact on Aquatic Systems (Aquatic Life and Vegetation, Surface Water Quality, Receiving Watercourses)

Options 1 to 3

- No benefit to surface water quality.
- Increase in likelihood of flooding and erosion downstream.
- Measures would be required downstream to address impacts.

Option 4a to 4d

- Improved surface water quality via wet pond treatment.
- Slows conveyance of storm water to larger water bodies reducing occurrences of flooding and the likelihood of erosion downstream;
- Purifies storm water by capturing sediment and removing pollutants such as oil and grease before they enter drains and rivers;
- Supports habitat for local wildlife species including birds, butterflies, turtles and frogs;
- Improves species biodiversity and air quality;
- Establishes a local amenity to observe nature including seasonal changes to plants and animals;
- Provides health benefits associated with connecting with nature;

5.4.2 Socio-Cultural Impacts

- Effect on Urban Greenspace (Parks, Open Spaces)
- Disruption to Existing Community During Construction (Traffic, Noise, Access to homes, Muddy streets)
- Disruption to Existing Community Post Construction (Visual Impact, Odour, Safety)

Options 1 to 3

- Improved conveyance would require downstream lands, potentially greenspace, to address added storage requirements.

Option 1

- No effect on Heritage park and minimal impact on greenway.
- Major disruption to the community during construction

Option 2

- Temporary disruption to Heritage park and greenway during construction
- Major disruption to the community during construction

Option 3

- Temporary disruption to Heritage park and greenway during construction
- Limited disruption to community during construction

Option 4a to 4d

- Temporary disruption to Heritage park and greenway during construction
- Limited disruption to community during construction
- Wet pond can be an aesthetic feature and amenity to park.

Option 4a

- 0.75 metre depressed baseball diamond provides storage while maintaining functionality

Option 4b

- Underground storage allows baseball diamond to remain at existing ground

Options 4c & 4d

- Large wet pond eliminates baseball diamond – can be replaced at another park within community

5.4.3 Technical Impacts

- Feasibility of Control Measure (Available Space, Accessibility, Constructability)
- Basement Flooding Prevention Effectiveness
- Ability to Improve Stormwater Runoff Quality
- Impact on Upstream, Downstream and Surrounding Areas

Maintaining/Improving Private Drainage Systems

- Provides the most effective protection against basement flooding

Options 1 to 3

- Improving conveyance capacity alleviates stress on the private drainage systems to help mitigate basement flooding.
- Improved sewer conveyance will result in increased outflow to outlet (Lepain Drain)
- No ability to improve stormwater runoff quality. Measures would be required downstream to address water quality.

Options 1 & 2

- Large amount of sewer replacement increases likelihood of conflicts with existing underground infrastructure
- Very limited accessibility for replacement of large diameter outfall sewer through existing easements

Option 3

- Limited amount of sewer replacement reduces likelihood of conflicts with existing underground infrastructure

Option 4a to 4d

- Adding storage capacity alleviates stress on the private drainage systems to help mitigate basement flooding.
- Limited amount of sewer replacement reduces likelihood of conflicts with existing underground infrastructure
- Storage facilities within Heritage park will result in a decreased outflow to outlet (Lepain Drain)
- Ability to improve stormwater water quality.
- Provides stormwater quality and quantity control for the proposed Oliver Farms improvements.

5.4.4 Economic Impacts

- Capital Cost
- Operating and Maintenance Cost

Options 1 to 3

- No change to current operating and maintenance cost for storm sewer system

Options 4a to 4d

- Increased operating and maintenance costs for storage facility and pump station (excluding Option 4d, gravity outlet).

Table 1 – Probable Cost of Various Options

Options		Oliver Storm System	Greenway Storm System	Heritage Park Storage	Heritage Storm System	TOTAL STORMWATER COST[1]
1	Overall Sewer Replacement	1,953,000	519,400	307,000	8,862,600	**11,642,000**
2	Partial Sewer Replacement w/ re-route of Oliver thru Park	1,953,000	2,756,000	312,000	6,044,000	**11,065,000**
3	Partial Sewer Replacement w/ relief sewers	1,953,000	2,756,000	315,000	1,875,000	**6,899,000**
4a	Small Wet Pond + Depressed Baseball Diamond	1,953,000	2,487,000	1,440,000	1,042,000	**6,922,000**
4b.1	Small Wet Pond + Underground Sewer Storage	1,953,000	2,487,000	5,026,000	1,029,000	**10,495,000**
4b.2	Small Wet Pond + Underground Tank Storage	1,953,000	2,487,000	5,854,000	1,029,000	**11,323,000**
4c	Large Wet Pond – Pumped Outlet	1,953,000	1,997,000	1,441,000	994,000	**6,385,000**
4d	Large Wet Pond – Gravity Outlet	1,953,000	1,997,000	476,000	975,000	**5,401,000**

Note 1: The Total Stormwater Cost includes stormwater system improvements to both Oliver Farms and Heritage Estates.

5.4.5 Discussion

All options provide a similar reduction in overall sewer surcharge and surface ponding which will alleviate stress on the private drainage systems. However, Option 4d provides this reduction with the most easily implementable solution in terms of accessibility, constructability and lowest cost.

Option 4d provides the greatest improvement to surface water quality via wet pond treatment and would provide the current standard of stormwater quality and quantity control required to implement the proposed improvements to the Oliver Farms storm sewer system. In addition, Option 4d provides the least disruption to the study area and would bring many environmental and social benefits.

The northern portion of Heritage Park (i.e. the picnic area, playground, basketball court and the open space surrounding these existing park features) would not be affected by the addition of the proposed stormwater pond. The pedestrian connection into the park from Heritage Drive would remain in place. The walking pathway connection to Montgomery Drive would be realigned within Heritage Park to preserve the connection to park features and use by dog walkers. The pond would replace an existing under-utilized baseball diamond and soccer pitch. James Jenner Park would continue to act as the neighbourhood baseball facility and Sandwich West Park would remain the local soccer pitch.

The existing Lepain pond located immediately south of Holy Cross Elementary school was not designed to address current stormwater management standards and would require significant retrofit measures to address stormwater requirements resulting from the proposed storm sewer improvements of Options 1 to 3. The retrofit measures would require additional lands beyond the existing pond footprint which would result in the following:

- Expansion of the existing pond onto adjacent land owners, which would result in multiple land owners and trigger a requirement for a Schedule "B" Environmental Assessment (i.e. additional study, public consultation and delay of improvements to the existing storm system).
- Loss of developable lands
- Loss of Sandwich West Park (primary park) lands

Depending on the extent of pond expansion required, the pond could also require a pump station. Through the review of the alternatives, Option 4d is the preferred option even without consideration to the potential land costs and pump station costs associated with retrofitting of the existing Lepain Pond. Thus, these costs were not considered further, yet it should be acknowledged that these costs could potentially result in a substantial increase to the cost of Options 1 to 3.

In summary, stormwater storage in Heritage Park is ideally located to:

- provide relief to the existing storm system in Heritage Estates
- provide a stormwater management facility for Oliver Farms improvements
- reduce the outflow to the Lepain Drain

5.5 PUBLIC INFORMATION CENTRE (PIC) NO. 2

The purpose of PIC No. 2 was to present various solutions considered and solicit feedback from the public on the preferred solution – Option 4d. The PIC was held on Wednesday, March 30, 2016 and was attended by 41 residents.

The PIC display boards are included in **Appendix B**.

Below is a synopsis of comments received during the PIC as well as from comment sheets.

The preferred solution was well received at the PIC. Most residents at the PIC acknowledged that maintenance/improvements to their private drainage systems will mitigate future flooding and agreed that the addition of a wet pond in Heritage Park is the best solution available. Many residents noted that the soccer pitch and baseball diamond are rarely used and would not be missed.

One resident expressed his preference for Option 3 at the PIC and suggested improvements be made to the existing downstream pond in lieu of a new pond in Heritage Park. Said resident noted several concerns with the implementation of preferred Option 4d. Similar concerns were raised by two residents on Lepain Crescent via comments submitted to the Town on May 4, 2016. The collective concerns of the three residents are summarized as follows:

- Concerns with loss of recreational use of the park and socializing opportunities
- Concerns with the proliferation of mosquitos, attraction of geese and fish species
- Concerns with safety as a swimming area and ice skating surface
- Concerns with algae growth and odours

All comments and concerns were carefully considered and addressed in PIC No.3 display boards included in **Appendix C**.

5.6 NEED FOR ADDITIONAL PUBLIC CONSULTATION

The total number of formal comments received by residents was unfortunately, very limited. While PIC No.2 attendees generally concurred with proposed wet pond solution, formal comments confirming this were lacking. Moreover, there was concern that many residents, particularly those who did not flood, were more likely to have ignored the study and would be unaware that a pond was being proposed in the park.

It was agreed by the project team that a third PIC would be beneficial to obtain more feedback and give residents another opportunity to comment on the proposed wet pond. The PIC would also serve to present expanded options, provide details and conceptual design of the wet pond approach and associated benefits and measures that would be implemented to address the concerns expressed in PIC No.2 comments.

The notice for a third PIC was issued on November 9th, 2016 and was strategically prepared with the intent of capturing the residents attention. It included a high level schematic of a large wet pond in the park and highlighted bold text to clearly express that a wet pond was being proposed. The notice served its purpose well as numerous phone calls and emails to the Town followed. The notice also prompted a formal petition which is further discussed in the next section of this report.

5.7 FORMAL PETITION TO PRESERVE PARK

A commendable effort was undertaken by a group of local residents to visit every home in Heritage Estates (664 homes) and ask residents if they would be prepared to sign a petition with the message "**Preserve Heritage Park for Future Generation. No Storm Water Pond in Heritage Park**". The petition provided signatures from 562 residents (440 homes), representing 66% of all homes and 90% of all responding residents, with the remaining 10% of responding residents refusing to sign the petition. The petition signatures appear to have ranged from November 27, 2016 to December 7, 2016 (i.e. both before and after PIC No. 3 held on December 1, 2016).

The petition was presented to Town Council on December 13, 2016 along with a 3 page cover letter which urged the Mayor and Councillors of the Town of LaSalle, "**No storm water pond in Heritage Park".** The petition and letter have been included in **Appendix D**. The letter states that this message has no potential ambiguity in interpreting what the residents are saying. While we agree that the message is clear regarding a wet pond, we believe that it is in fact unclear as to whether or not the residents would oppose a dry pond and more specifically a shallow depressed recreational area acting as an infrequent and temporary storage area to detain floodwaters during extreme rainfall events. Comments received from PIC No.3 provided some insights on the stormwater pond concerns.

5.8 PUBLIC INFORMATION CENTRE (PIC) NO. 3

The purpose of PIC No. 3 was to allow residents the final opportunity to provide feedback on the proposed wet pond in Heritage Park and proposed storm system improvements in Oliver Farms. The PIC presented conceptual plans of the proposed pond solution as well as expanded options in lieu of the wet pond, which are discussed in Section 5.9. The PIC was held on Thursday, December 1, 2016 and was attended by 75 residents. The PIC display boards are included in **Appendix C**.

Below is a synopsis of comments received during the PIC as well as from comment sheets received from 44 residents.

The general consensus was that the **residents habitually use and are unwilling to lose the open space that the park currently provides. Many residents also were strongly against the wet pond due to wet pond related concerns** (lack of maintenance, breeding of mosquitos/disease, habitat for insects and vermin, safety hazards of open water and thin ice, geese fecal matter and/or attacks, poor aesthetics - odor and appearance). While the PIC display boards presented and discussed design approaches and mitigating measures to address these wet pond concerns, the residents generally maintained their disapproving position on wet ponds.

Interestingly, when comparing the signed petition with the comments received during or following the third PIC, we found significant correlations. We found that 34 of the 44 residents who submitted comments also signed the petition and that at least 18 and as much as 26 of the 34 signing the petition were not opposed to a storm pond. These residents either;

a. agreed with preferred option 4d2 – small wet pond with underground storage (8 residents)
b. explicitly noted that they preferred the dry pond options (9 residents)
c. explicitly noted their disapproval of a wet pond stating wet pond related concerns – may support a dry pond (8 residents) or
d. appear to have changed their opinion and now prefer the large wet pond (1 resident).

The above correlations advocate that the majority of residents are not opposed to a storm pond in Heritage Park, **provided that** the two main concerns – loss of open space and wet pond related concerns – are addressed.

5.9 EXPANDED OPTIONS FOR STORAGE CAPACITY

To mitigate the loss of the park's green space and provide economically viable options in lieu of a wet pond, expanded options considered adding storage capacity via the use of polypropylene and polyethylene elliptical arch shaped chambers (StormTech) as an economical alternative to provide underground storage. Options 4d2 to 4g provide expanded options using StormTech chambers for underground storage in the park as well using the chambers in lieu of a standard storm sewer design (circular concrete pipe designed for 1:5 Year storm conveyance).

- Option 4d – ADD LARGE WET POND IN HERITAGE PARK – STANDARD STORM SEWER DESIGN IN OLIVER FARMS AND GREENWAY
- Option 4d2 – ADD SMALL WET POND IN HERITAGE PARK – UNDERGROUND STORAGE CHAMBERS IN OLIVER FARMS
- Option 4e – ADD FULL UNDERGROUND STORAGE IN HERITAGE PARK & GREENWAY – STANDARD STORM SEWER DESIGN IN OLIVER FARMS
- Option 4e2 – ADD FULL UNDERGROUND STORAGE IN HERITAGE PARK & GREENWAY – UNDERGROUND STORAGE CHAMBERS IN OLIVER FARMS
- Option 4f – ADD UNDERGROUND STORAGE WITH DRY POND IN HERITAGE PARK – STANDARD STORM SEWER DESIGN IN OLIVER FARMS

- Option 4f2 – ADD UNDERGROUND STORAGE WITH DRY POND IN HERITAGE PARK – UNDERGROUND STORAGE CHAMBERS IN OLIVER FARMS
- Option 4g – DO NOTHING IN HERITAGE PARK – UNDERGROUND STORAGE CHAMBERS IN OLIVER FARMS

Note that Option 4d is the same as was presented in PIC No. 2 but the display board title was revised to match the context of the expanded options and addition of storage chambers alternatives.

5.10 EVALUATION OF EXPANDED OPTIONS

Each of the expanded options were evaluated based on the following considerations:

- Natural Environment Impacts
- Socio-Cultural Impacts
- Technical Impacts
- Economic Impacts

5.10.1 Natural Environment Impacts

- Potential Impact on Terrestrial Systems (Vegetation, Trees, Wildlife)
- Potential Impact on Aquatic Systems (Aquatic Life and Vegetation, Surface Water Quality, Receiving Watercourses)

Options 4d to 4g

- Improved surface water quality via wet pond/underground storage chamber treatment/infiltration.
- Slows conveyance of storm water to larger water bodies reducing occurrences of flooding and the likelihood of erosion downstream;
- Purifies storm water by capturing sediment and removing pollutants such as oil and grease before they enter drains and rivers;

Options 4d & 4d2

- Supports habitat for local wildlife species including birds, butterflies, turtles and frogs;
- Improves species biodiversity and air quality;
- Establishes a local amenity to observe nature including seasonal changes to plants and animals;
- Provides health benefits associated with connecting with nature;

5.10.2 Socio-Cultural Impacts

- **Effect on Urban Greenspace (Parks, Open Spaces) – Most Important to Residents**
- Disruption to Existing Community During Construction (Traffic, Noise, Access to homes, Muddy streets)

- Disruption to Existing Community Post Construction (Visual Impact, Odour, Safety)

Options 4d to 4f

- Temporary disruption to Heritage park and greenway during construction
- Limited disruption to community during construction

Option 4d2, 4e2 & 4f2

- Storage in Oliver Farms reduces impact on park.

Option 4e & 4e2

- Full underground storage will maintain the current condition of Heritage Park. (Note that park would be temporarily disrupted during construction and installation of the underground storage chambers).

Option 4f & 4f2

- Dry pond & underground storage maintains soccer pitch and baseball diamond within a shallow depressed area.

Option 4g

- No disruption to Heritage park and greenway.
- No disruption to Heritage park community during construction.

5.10.3 Technical Impacts

- Feasibility of Control Measure (Available Space, Accessibility, Constructability)
- Basement Flooding Prevention Effectiveness
- Ability to Improve Stormwater Runoff Quality
- Impact on Upstream, Downstream and Surrounding Areas

Option 4d to 4f

- Adding storage capacity alleviates stress on the private drainage systems to help mitigate basement flooding.
- Limited amount of sewer replacement reduces likelihood of conflicts with existing underground infrastructure
- Storage facilities within Heritage park will result in a decreased outflow to outlet (Lepain Drain)
- Ability to improve stormwater water quality via storage chamber treatment and infiltration

Options 4d, 4e, 4f & 4g

- Storage facility in Heritage Park provides stormwater quality and quantity control for the proposed Oliver Farms improvements.

Options 4d2, 4e2 & 4f2

- Underground storage chambers within Oliver Farms provides stormwater quality and quantity source control for the proposed Oliver Farms improvements. Addressing stormwater as close to the source as possible is recommended by the Ministry of

Environment and Climate Change. The proposed chambers will promote infiltration and stormwater volume reduction – which has a positive impact to reduce the frequency, magnitude and duration of outflow to the receiving LePain Drain.

Option 4g

- Chambers in Oliver Farms will attenuate peak flows to Heritage Estates storm sewer system and provide some level of relief to the northern half of Heritage Estates. The southern half of Heritage Estates (south of the park) would receive minimal benefit.
- Heritage Estates will continue to experience sewer surcharge and surface ponding during high intensity events, including the 5 Year Design Storm.

5.10.4 Economic Impacts

- Capital Cost
- Operating and Maintenance Cost

Options 4d to 4g

- Increased operating and maintenance costs for storage facilities.

Table 2 – Probable Cost of Expanded Options

Options		Oliver Storm System	Greenway Storm System	Heritage Park Storage	Heritage Storm System	TOTAL STORMWATER COST[1]
4d	Large Wet Pond – Std Storm Sewer in Oliver	1,953,000	1,997,000	476,000	975,000	**5,401,000**
4d2	Small Wet Pond – Chambers in Oliver	3,600,000	1,224,000	252,000	975,000	**6,051,000**
4e	Full Underground Storage – Std Storm Sewer in Oliver	1,953,000	3,240,000	5,940,000	975,000	**12,108,000**
4e2	Full Underground Storage – Chambers in Oliver	3,600,000	3,240,000	2,664,000	975,000	**10,479,000**
4f	Underground Storage w/ Dry Pond – Std Storm Sewer in Oliver	1,953,000	3,240,000	2,226,000	975,000	**8,394,000**
4f2	Underground Storage w/ Dry Pond – Chambers in Oliver	3,600,000	1,944,000	246,000	975,000	**6,765,000**
4g	Do Nothing in Heritage Park – Chambers in Oliver	3,600,000	396,000	-	-	**3,996,000**

Note 1: The Total Stormwater Cost includes stormwater system improvements to both Oliver Farms and Heritage Estates.

5.10.5 Discussion

The expanded options are all similar in regards to technical and natural environment impacts. Where the expanded options differ is in their socio-cultural and economic impacts.

Entering PIC No.2, the preferred option was presented as option 4d, the cheapest option, with a total stormwater cost of **$5,401,000** for both Oliver and Heritage stormwater system improvements.

Entering PIC No.3, the preferred option was presented as option 4d2, **recognizing the importance that the residents place on the open space of the park** and thus minimizing the area used for stormwater management. The added cost of **$650,000** (from a total stormwater cost of **$5,401,000** to **$6,051,000**), would be the economic trade-off to minimize socio-cultural impact of losing open green space.

Following PIC No.3, it was evident that **the majority of residents do not want to lose any green space and strongly oppose a wet pond type of stormwater management**. Thus, the balance between economic and socio-cultural and impacts has shifted further with the final recommendation of option 4f2, at an added cost of **$1,364,000** (from a total stormwater cost of **$5,401,000** to **$6,765,000**). We believe this to be a reasonable solution that addresses residents concerns.

The term "dry pond" is not meant to imply that water will pond in the facility every time it rains. On the contrary, the general term "dry pond" that is being recommended can be more specifically defined as a floodplain storage area. The recommended shallow (~ 1.0 metre depth) depression will serve to provide storage for excess runoff under extreme events that exceed the storm sewer capacity. Option 4f2 also includes the addition of underground storage to provide relief to the storm sewer system under more frequent events.

For perspective on the frequency of ponding in the dry pond, it is estimated that the proposed dry pond would not have ponded during the July 25, 2015 and would have ponded up to 0.2 metres depth and for a total ponded duration of approximately 2 ¼ hours under the August 11, 2014 event. In summary, the dry pond will maintain all of the current open space that the park provides and it will be dry under most rainfall conditions.

At the opposite end of the economic/socio-cultural balance would be option 4e2, which would increase the stormwater cost by **$5,078,000** (from a total stormwater cost of **$5,401,000** to **$10,479,000**). This option is simply not practical, and the significant cost increase far outweigh the benefit of keeping the stormwater underground as a few residents would prefer it**. From a socio-cultural impact perspective, option 4f2 and 4e2 both preserve the park's current function and open space**, with the exception that option 4f2 incorporates a large shallow depressed area to improve the Heritage Estates storm system's ability to handle extreme storm events.

The reality of stormwater design is that extreme events – even larger than those experienced in August 11, 2014 and July 25, 2015 – are likely to occur over time and should be planned for in stormwater design. However, it is not practical to design infrastructure to fully convey and/or fully store these events underground. Extreme events are handled via proper surface routing and planned storage via pond and/or floodplain areas that keep water away from homes.

5.11 REVIEW AGENCY CONSULTATION

The study was originally designated as a Schedule A+ (pre-approved) project under the Municipal Class EA process, with two (2) planned Public Information Centres. The project evolved into a Schedule B (approved subject to Screening) with the preferred solution identified as a **new stormwater facility proposed in Heritage Park**.

As part of the Screening process, the project was identified as works directly affecting Recreational Areas and a "Notice of Comments Invited" was sent to the following review agencies:

- Ministry of Tourism, Culture and Sport (MTCS)
- Local Ministry of Natural Resources and Forestry (MNRF)
- Essex Region Conservation Authority (ERCA)
- Ministry of Environment and Climate Change (MOECC)
- County of Essex Planning Department

Of the review agencies listed above, only the MTCS had comments to offer, which were provided in a letter dated June 2, 2017 (appended in **Appendix H**). In summary, the comments recommended that two evaluations be conducted to determine;

a. Archaeological Potential

A Stage 1 archaeological assessment (AA) of the study area was undertaken with a study report prepared and provided in **Appendix H**. A synopsis of the report is as follows:

The study determined that portions of the study area retain archaeological potential for the presence of archaeological resources. Thus, portions of the study area which retain archaeological potential and any area of archaeological potential that will be subject to construction disturbance must be subject to a Stage 2 archaeological assessment prior to construction. Further, it has also been determined that portions of the study area do not retain archaeological potential and no further archaeological assessment is recommended for those areas (refer to Figure 8 of the AA report).

b. Potential for Built Heritage and Cultural Heritage Landscapes

A completed checklist and supporting memo of the evaluation are provided in **Appendix H**. A synopsis of the evaluation is as follows:

Based on consultation with the appropriate regulatory bodies and completion of desktop research, it was determined that cultural heritage value or interest is not identified within the study area, except that the study area is located within the Canard River Watershed and the buried streams within the study area are tributaries of the Detroit River, a Canadian Heritage River. However, it is noted that while the area is within the Canard River Watershed, the streams were buried or redirected as a result of the Heritage Estates subdivision, and thus have been altered and are not part of a visible landscape component within the study area. As a result, impacts from the project are not anticipated on this resource.

5.12 PROBABLE COST SUMMARY

5.12.1 General

An opinion of probable cost was prepared as an attempt to project what someone else will be willing to contract for in the future to do construction work which has not yet been defined and which is subject to changes in scope, design, and market conditions. **Tables 1** and **2** shown above provide a summary the probable cost of the proposed Oliver Farms and Heritage Estates stormwater system improvements.

5.12.2 Level of Accuracy

Opinions of probable cost are typically provided throughout various stages of a project's life cycle. There are a number of classifications for estimates that identify typical minimum and maximum probable costs or levels of accuracy. These classifications vary widely by industry but all are based on the fact that the level of accuracy is directly proportional to the level of detail available at each stage of the project.

The level of accuracy increases as the project moves through the various stages from planning to preliminary design to final design. A wide range of accuracy would be expected at the planning stage of a project development because a number of details would be unknown. As the project moves closer to completion of final design, the estimate would become more accurate due to the increased level of detail available and the reduced number of unknowns.

Table 3 includes a summary of typical estimate classifications used throughout a project's development including a description of the project stage and range of accuracy.

Table 3 – Classification of Cost Estimates

Class	Description	Level of Accuracy	Stage of Project Lifecycle
1	Conceptual Estimate	+50% to -30%	Screening of alternatives.
2	Study Estimate	+30% to -15%	Treatment system master plans.
3	Preliminary Estimate	+25% to -10%	Pre-design report.
4	Detailed Estimate	+15% to -5%	Completed plans and specifications.
5	Tender Estimate	+10% to -3%	This is the actual tender price and it can vary depending on the amount of contingency allowance consumed.

The opinions of probable cost in this study are estimated at the study stage (Class 2) and the corresponding level of accuracy could range from –15% to +30% from the opinion presented in the report.

5.12.3 Factors Considered in Developing an Opinion of Probable Cost

In addition to the level of accuracy discussed, the opinion of probable cost was prepared taking into consideration the following factors.

- All estimates are based on 2016 dollars.
- It is assumed that the Contractor will have unrestricted access to the site and will complete the work during normal working hours from 7:00 am to 7:00 pm Monday to Friday. There is no allowance for premium time included.
- Equipment costs are based on vendor supplied price quotations and historical pricing of similar equipment.
- Bulk material and equipment rental costs used are typical for the Windsor area.
- The estimate does not include the cost of application or permit fees.
- HST is excluded.
- Allowances for engineering and contingencies (15% and 25% respectively) are included in the estimate.
- No allowance is included for escalation beyond the date of this report.
- No allowance is included for potential land costs and/or pump station costs to accommodate stormwater storage facilities.
- It is not known whether contaminated soil conditions would be encountered in the areas proposed for the sewers. The potential impact cannot reasonably be determined at this point and no allowance is included in the estimate for this possible eventuality.
- Costs for the sewer replacements include trench restoration only with milling/resurfacing of half the roadway.

6.0 RECOMMENDATIONS

The most effective way to reduce the risk of flooding involves a two-part solution that aims to:

Solution A. Maintain/Improve private drainage systems to ensure adequate drainage of surface, roof and groundwater around the home, supplemented with;

Solution B. Improvements to the Town's stormwater system to reduce the duration and frequency of sewer surcharging during intense rainfall events – thereby alleviating stress on the private drainage systems.

6.1 SOLUTION A

It is important to **emphasize that Solution A is most critical in reducing the risk of flooding and protecting the home. This solution can be implemented immediately**. It is strongly recommended that the homeowner take an active role in implementing home improvements to reduce the risk of basement flooding. Not all recommendations of Solution A need to be implemented, however more is better.

Each homeowner will need to consider their level of risk tolerance and assess the level of improvements that are necessary to <u>ensure that surface water and groundwater surrounding the home is directed away from the home and towards the roadway/storm sewer system</u>.

Private drainage systems can be complex and could differ from that presented in the Public Information Centres. It is critical that the homeowner carry out a site assessment with a licensed plumber, drain contractor, or drainage engineer to understand how the existing drainage system operates before determining the appropriate improvements.

Section 5.1 of this report provides a detailed discussion and recommendations on the various ways to maintain/improve the private drainage systems which form Solution A. Below is a brief summary of these recommendations;

- **Private Drainage System Maintenance**

  Periodic maintenance and repairs to private drainage systems is important to ensure that surface water and groundwater surrounding the home is directed away from the home and towards the roadway/storm sewer system.

- **Sump Pump Systems**

  The sump pump is the most critical element in dewatering the groundwater surrounding the home and should not be neglected. Adequate power outage protection (i.e. power generator) or a backup pump with alternative power supply is strongly recommended. It is also recommended that the backup pump be equal to or better than the main pump.

Equally important, the sump pump discharge must be effectively directed away from the home. When a pump discharges into a cracked or clogged private storm drain, water is not effectively directed away from the home.

- **Downspout Disconnection**

When feasible, disconnection of the roof downspouts from the underground sewer system can significantly reduce the direct inflow of water to the private drainage system. However, care must be taken to direct roof water to the street and/or rear yard drainage inlet and not on neighbouring property. Do not disconnect downspouts at sidewalks or driveways.

- **Completely Isolated Private Drainage System**

When feasible, complete isolation from the Town sewer system typically provides the best protection against basement flooding. Complete isolation eliminates drainage issues resulting from deficient private drains and protects the home of backflow from the Town's sewer systems.

Solution A is the first line of defense. And it can be implemented immediately. Solution B will enhance protection but will not provide long-term protection on its own.

6.2 SOLUTION B

Option 4f2 – Add Underground Storage with Dry Pond in Heritage Park

The recommended **Option 4f2** consists of underground storage with a dry pond (depressed floodplain area) in Heritage Park for surface storage during extreme events. This option will maintain the park's green space as illustrated on the previous page. The illustration below depicts a typical dry pond cross section. The proposed dry pond is to have a maximum depth of 1.2 metres (4 feet).

TYPICAL DRY POND CROSS SECTION

Option 4f2 is the recommended Solution B which can be implemented in two independent phases (i.e. Phase 2 can be implemented before Phase 1):

Phase 1 – Oliver Farms Improvements

- Replace approximately 2,360 metres of existing Oliver Farms storm sewers with one row of MC4500 StormTech underground chambers (approximately 10,000 cubic metres of storage).
- Replace approximately 260 metres of existing storm sewer in greenway from Montgomery Drive to the south end of walkway off Carriage Lane with one row of MC4500 StormTech underground chambers (approximately 1,100 cubic metres of storage).
- Install a 900 mm dia. flow control orifice with backflow prevention connecting StormTech chambers to 1200 mm dia. storm sewer in walkway from Carriage Lane.

Phase 2 – Heritage Estates Improvements

- Install approximately 260 metre length of one row of MC4500 StormTech chambers within greenway from Kenwick Way overflow sewer to Heritage Park lands.

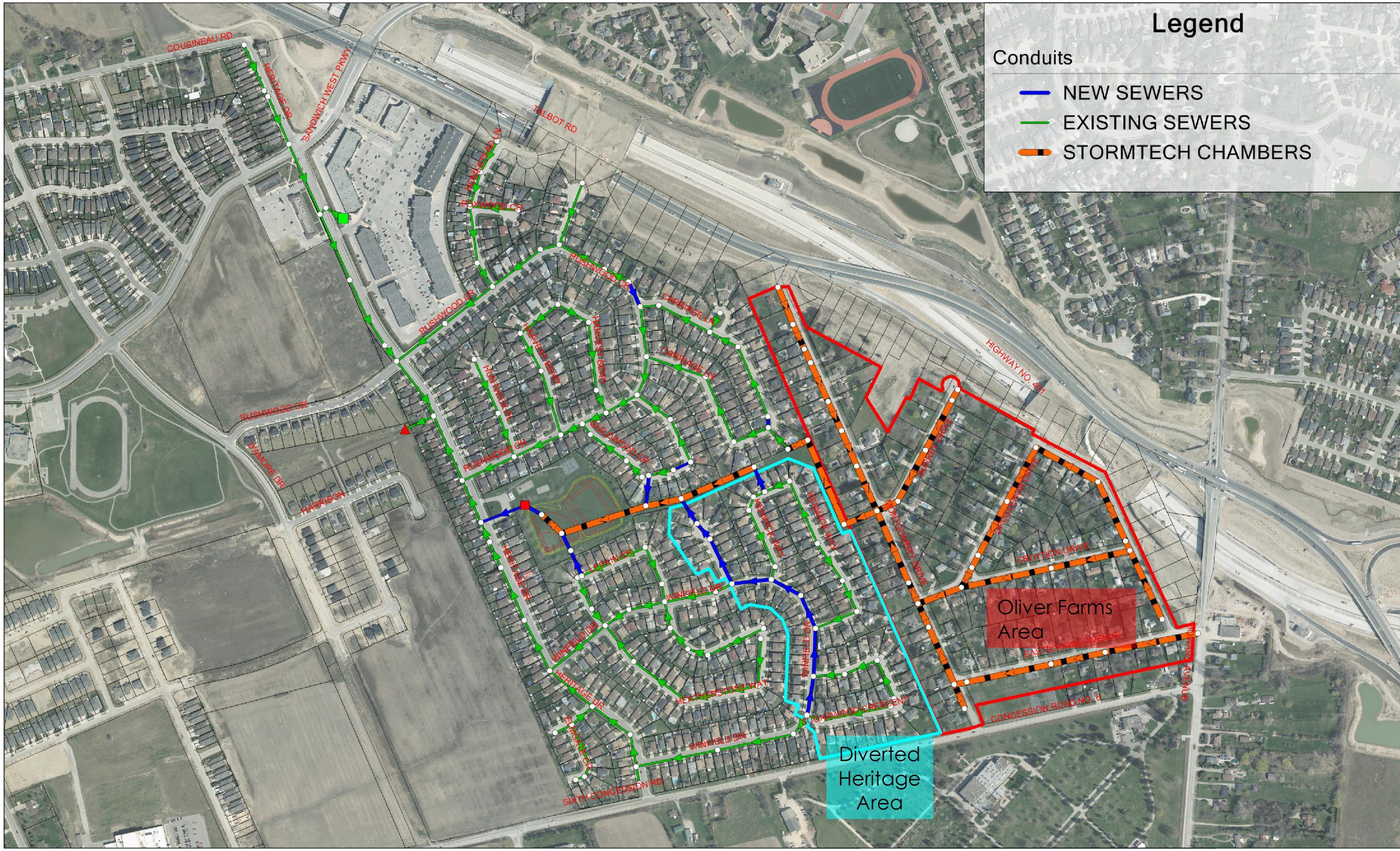
- Install approximately 3,200 cubic metres of StormTech underground chambers under Heritage Park with configuration to be determined at detailed design.
- Construct shallow dry pond (shallow depressed area) up to maximum 1.2 metre (4 foot) depth in Heritage Park to provide 11,000 cubic metres of surface storage at a maximum water surface elevation of 184.0m.
- Install surface catch basins in depressed areas for surface runoff drainage as well as interconnections between underground and surface storage. Ensure sufficient routing capacity in interconnections for underground storage to rise up and fill surface storage during extreme events.
- Install 525 mm dia. storm sewer outlet from Heritage Park underground storage chambers to Heritage Drive storm sewer.
- Install 900 mm dia. storm sewer along Winfield Dr. and Coachwood Pl. to divert 10.74 hectares to the greenway storm sewer /pond.
- Install overflow relief sewers to connect existing storm sewers to the greenway storm sewer/pond through walkways at Lepain Cr. (600 mm dia.), Kenwick Way (600 mm dia.) and Guildwood Cr. (450 mm dia.), complete with flap gates.
- Construct interconnection sewers on Rushwood Cr. (375 mm dia.), Carriage Lane (375 mm dia.) and Guildwood Cr. (300 mm dia.).
- Disconnect existing 750mm dia. sewer in manhole at Winfield Dr. and Coachwood Pl. such that all flows are diverted northerly via new storm sewer along Coachwood.
- Disconnect existing 600mm dia. storm sewer in manhole at Sugarwood Cr. and Winfield Dr. such that all flows are diverted northerly via new storm sewer along Winfield.

Refer to **Figure 4** on the next page for a storm sewer plan of Option 4f2.

Solution B will help to mitigate risk of flooding by alleviating stress on the private drainage system caused by sewer surcharging and prolonged surface ponding. It will improve level of service of the storm sewer system such that the 5 Year design storm event will not result in any surface ponding. In other words, Solution B will result in less frequent and shorter durations of surface ponding.

<u>However, Solution B is ultimately only a supporting measure that does not, in itself, provide long-term protection against basement flooding and should not be relied upon without implementation of Solution A.</u>

Figure 4 – Option 4f2 Storm Sewer Replacement Plan



6.3 FUNDING

It is important to note that any and all options presented have not been included in any current capital plan approved by Council. In developing a financial strategy to implement any solution the Town will require assistance/funding from senior levels of government, may need to issue debt to fund the ultimate solution, or otherwise re-prioritize existing projects. Given these financial circumstances and realities the construction of any solution may be beyond the 5 year horizon unless significant senior government funding is obtained, other projects are re-prioritized, and/or debt issued.

With the issuance of debt will come the corresponding required debt repayment. The annual amount of the debt repayment could be funded by an increase in taxes (which will effect all properties Town wide), or the implementation of a local improvement assessment (which will effect only the directly benefitting properties), and/or some combination of both.

Table 4 – Cost Allocations for Recommended Solution B (Option 4f2)

	Oliver Farms Neighbourhood	Heritage Estates Neighbourhood	TOTAL
Total Number of Homes	119	664	783
Total Approximate Residential Assessment	20,300,000	123,400,000	143,700,000
Total Approximate Commercial Assessment	---	25,000,000	25,000,000
Total Stormwater Cost	**3,996,000**[1]	**2,769,000**	**6,765,000**

Note 1: Proposed Oliver Farms Improvements also include watermain replacement, road reconstruction and street lighting replacement for a total cost of $9,079,000. See section 7.0 for details.

Town Council has not determined method in which the project(s) will be financed nor the timelines for commencement as both factors may be subject to funding from senior levels of government. The ultimate method of financing will be the subject further public consultation.

6.4 OTHER RECOMMENDATIONS

1. The LePain Drain water surface elevation should not exceed 182.06m at the Heritage Estates storm outlet for all storm events up to and including a 100 Year storm.
2. The Town should consider installing manhole inserts to prevent stormwater from entering the sanitary manhole through the lift holes and around the manhole cover.
3. Additional geotechnical investigations should be performed in the detailed design phase, as recommended in **Appendix F**.
4. The Town should consider holding public meetings and/or workshops during the detailed design phase of the stormwater management pond design. This would allow residents to interact with the design team to create a feature that is tailored to the community.

5. Portions of the study area which retain archaeological potential and any area of archaeological potential that will be subject to construction disturbance must be subject to a Stage 2 archaeological assessment (AA) prior to construction. Further, it has also been determined that portions of the study area do not retain archaeological potential and no further archaeological assessment is recommended for those areas (refer to Figure 8 of the AA report in **Appendix H**).

7.0 OLIVER FARMS PRELIMINARY DESIGN

7.1 BACKGROUND

The Town has identified the Oliver Farms development as an area in need infrastructure improvements, including road reconstruction urban road cross-section, new sidewalks, watermain replacement, storm sewer replacement and evaluation of existing street lighting to meet current Town Standards.

A description of the Oliver Farms development was presented in Section 2.1 of this report.

7.2 STORM SEWER REPLACEMENT

When the Heritage Estates area was developed in the 1980s, it effectively covered a section of the Lepain Drain, which served as the outlet to Oliver Farms. The Oliver Farms storm drainage was then re-routed through the Heritage Estates storm sewer system, before outletting to the Lepain Drain immediately downstream (west) of the Heritage Estates development. The Heritage Estates storm sewer design allocated capacity for Oliver Farms area based on a 5 Year Yarnell curve design storm and a corresponding design peak flow of 0.94 cms. However, the Oliver Farms storm drainage system was originally designed to a lower standard and has never been upgraded. Thus, the sub-standard drainage in Oliver Farms currently throttles the flow being conveyed to the Heritage storm system and can only convey approximately 0.55 cms to the Heritage system based on the 5 Year Yarnell curve storm event.

Storm sewer replacement in the Oliver Farms area would significantly improve the drainage and would consequently increase the peak flow rate being conveyed to the Heritage Estates storm system if the existing storm sewer layout was maintained. Given the existing flooding concerns in the Heritage Estates area it is not recommended to increase flows to this storm system. Many options presented in this study proposed to disconnect the Oliver Farms outlet sewer from the Carriage Lane sewer and redirect the Oliver Farms outlet through the greenway and Heritage Park area where it would be detained via a new stormwater management pond. The recommended option proposes to improve drainage without increasing peak flows to the Heritage Estates storm system.

The recommended option 4f2 includes the installation of StormTech underground storage chambers in lieu of standard storm sewers in Oliver Farms to address stormwater quality and quantity control requirements within the Oliver Farms development. The chambers will replace the 2,360 metres of storm sewer and provide approximately 10,000 cubic metres of storage. The chambers will provide water quality treatment via suspended solids settling and infiltration. The probable cost for the new underground chambers is **$3,600,000**.

With option 4f2, it is beneficial from both a hydraulic and constructing staging perspective to maintain the current outlet connection to Carriage Lane. The existing Oliver Farms storm sewer outlet through the greenway is to be replaced with approximately 260 metres of MC4500 StormTech chambers (one row) from Montgomery Drive to walkway from Carriage Lane. A new 900 mm dia. flow control orifice with backflow prevention shall be installed at the connection between the StormTech chambers and the 1200 mm dia. storm sewer in walkway from Carriage Lane. The probable cost for the new outlet from Montgomery Drive to Heritage Drive is **$396,000**.

7.3 STORMWATER MANAGEMENT

The Oliver Farms improvements will need to meet current stormwater management standards for both stormwater quality as well as quantity control. This means that the stormwater must be detained to allow for settling of suspended solids and must also be detained to attenuate flows being released to the downstream receiving waterbody (Lepain Drain). The Oliver Farms area has limited options to address stormwater management since it is as a fully developed area. The only land available within the Oliver Farms area would be at the James Jenner Park, which is not a practical option given the location of the outlet (i.e. greenway @ Montgomery/Surrey intersection) as well as the gradient of the area, which slopes towards the greenway.

The Heritage Park lands would provide a practical option for stormwater management of Oliver Farms. However, this option was found to be unacceptable to the residents of Heritage Estates. Expanded options reconsidered how stormwater management could be addressed within the Oliver Farms lands.

The recommended option 4f2 provides underground storage chambers as a replacement to the existing storm sewer system as well as a stormwater management solution. As mentioned in section 7.2, the probable cost for the new StormTech underground chambers is **$3,600,000**.

7.4 ROAD RECONSTRUCTION

The proposed roadways will generally follow the same alignment as the existing roads. The new road, including curb and gutter, will be 8.5m wide from face of curb to face of curb. The road reconstruction will incorporate 1.5m wide sidewalks on both sides of the road. See **Appendix E** for an overall road layout and typical cross-sections. The probable cost for the new roadway, including curb and gutter, sidewalks, catch basins and restoration is **$3,538,000**.

7.5 WATERMAIN REPLACEMENT

The existing 150mm dia. watermain is to be replaced with new 200mm dia. watermain, including new fire hydrants, valves and service connections up to the property line. **See Appendix E** for an overall watermain layout plan. The probable cost for the new watermain work is **$1,478,000**. Refer to section 5.11 for details regarding probable cost.

7.6 STREET LIGHTING

The Oliver Farms area currently has limited illumination levels provided by pole-mounted, 150W high pressure sodium fixtures on 2.4m (8') mounting brackets. The fixtures are mounted on existing poles, owned by Bell and/or Essex Power. As part of the Oliver Farms improvements, lighting upgrades are also recommended.

The Town of LaSalle has a concurrent light evaluation study and lighting implementation plan under way. The selected luminaire is the LRL NXT fixture; however, the luminaire model and driver settings have not been specified at the time of this report. A general lighting analysis was performed for Oliver Farms based on the NXT fixture using the AGI lighting software. All roadway and street light analysis performed is quantified and qualified against the latest revision of RP-8, the Standard for Roadway and Street Lighting.

Based on a site visit and the preliminary analysis undertaken that included various iterations which considered different fixture sizes, fixture driver settings and mounting the fixtures on existing Hydro poles with 2.4m (8') mounting brackets at 7.62m (25') above grade, the following was noted and summarized:

1. The existing quantity and spacing of the existing hydro poles (either Essex Power and/or Bell owned) is adequate to provide the required street illumination and lumination levels. With the use of the appropriate fixture and driver settings, the streets within Oliver Farms will have the ability to attain adequate light levels without implementing additional poles. Many of the poles within Oliver farms have also been recently replaced with new wood poles.

2. Further evaluation of the selected fixture location and fixture settings will be required at the detailed design stage to compare the Town of LaSalle's existing street light installation for Oliver Farms with the requirements of RP-8, the Standard for Roadway lighting. The additional assessment of the existing street light installation will be used to determine if any additional changes will be required to meet recommended light levels.

3. The intersection illumination levels within the Oliver Farms subdivision are slightly low in certain locations, i.e., Croydon Drive and Grosvenor Drive, if no additional poles are implemented. The intersections within Oliver Farms will require further evaluation at the detailed design phase to assess existing illumination levels and desired illumination levels. Additional poles in various locations may be required or the settings of the light fixtures may be required to be changed.

4. All existing overhead power will be re-used to power the new light fixtures. All new light fixtures will inherently have a lower operational wattage, however, as there are very few fixtures currently installed in Oliver Farms, the power infrastructure will be required to be assessed during the detailed design phase to account for the additional light fixtures required to attain adequate light levels.

5. At the detailed design phase, it must be confirmed with the Town of LaSalle, Essex Power and Bell Canada, if any of the existing hydro poles located within Oliver Farms cannot be used if it is determined that additional measures must be implemented.

The probable cost to replace 64 existing fixtures with new LRL NXT fixtures is **$67,000**.

7.7 PROBABLE COST SUMMARY

Refer to Section 5.5 for a detailed description of the probable costs presented in this report. **Table 5** below provides a summary of the probable cost of the proposed Oliver Farms improvements.

Table 5 – Probable Cost of Oliver Farms Improvements

Description	Probable Cost
Storm Sewer Replacement/ Stormwater Management	3,996,000
Watermain	1,478,000
Roadway	3,538,000
Street Lighting	67,000
TOTAL COST	**9,079,000**

7.8 UTILITY COORDINATION

Stantec's subconsultant Verhaegen, Stubberfield, Hartley, Brewer, Bezaire (VSHBB) Inc., obtained record information to locate existing utilities as shown on Drawings C-101 to C-110 in **Appendix E**. Field locates performed by the Town were also surveyed by VSHBB and included in the Drawings. Email correspondence was sent out to Essex Power, Union Gas, Bell Canada and Cogeco. See **Appendix G** for correspondence records.

7.9 APPROVALS

The Oliver Farms improvements will require Environmental Compliance Approval (ECA) from the Ministry of the Environment and Climate Change with regards to the new watermain, new storm sewers and new stormwater management facility.

The Lepain Drain is an Essex Region Conservation Authority (ERCA) regulated watercourse and as such the proposed storm sewer improvements and stormwater management facility will require ERCA approval.

7.10 TOPOGRAPHIC SURVEY

Stantec has engaged Verhaegen, Stubberfield, Hartley, Brewer, Bezaire (VSHBB) Inc., Ontario Land Surveyors as a subconsultant with the task of completing a topographic and legal plan of the Oliver Farms area. The survey has collected information from building face to building face, including all surface utility features as located by the Town. The survey is also to collect existing storm sewer sizes and inverts. Refer to **Appendix E** Drawings C-101 to C-110 for base plans showing survey information as well as existing and proposed utilities.

7.11 GEOTECHNICAL INVESTIGATION

Stantec has engaged Golder Associates Ltd. as a subconsultant with the task of completing a geotechnical report. Golder has completed subsurface explorations and testing in many locations throughout the Heritage Estates and Oliver Farms areas, including more than 28 boreholes and test pits reported in 1988 for design and construction of local services. Golder also completed extensive subsurface investigations and engineering evaluations of the geotechnical conditions associated with the adjacent Rt. Hon. Herb Gray Parkway and have subsurface data that extends to bedrock in the area. Golder also completed investigations and design support for multiple municipal drains in the areas and this data will also be utilized.

Golder has utilized the existing geotechnical data to prepare a geotechnical report that provides the following information and recommendations:

- Preliminary and/or detailed pavement design recommendations
- Geotechnical recommendations for preliminary and final design of:
- Excavation support and control for construction of underground services (where these will be less than 4 m deep);
- Groundwater control for services excavations;
- Pipe bedding recommendations;
- Backfill material and placement recommendations;
- Geotechnical recommendations related to storm water detention facilities;
- Recommended subsurface investigations, if and as necessary, to document conditions in specific areas (to be identified during preliminary and detailed design) for contract tendering.

A copy of the report is included in **Appendix F**.