Welcome

Lynde Creek Master Drainage Plan Update
Municipal Class Environmental Assessment

Community Open House No. 2

October 11, 2018
6:00 PM to 8:00 PM
The Purpose of this Open House is to:

- Provide an update on the Lynde Creek Master Drainage Plan Update (MDPU) Municipal Class Environmental Assessment (EA) Master Plan, including feedback from the first Open House
- Present the completed impact assessments (i.e. natural heritage, fluvial geomorphology, hydrologic, hydraulic)
- Present the recommended Whitby Lynde Creek MDPU strategies, including associated watershed management projects
- Gather public input and discuss next steps in the planning process
- Please sign in and take a comment form and a pen. As you move around and view display boards, we encourage you to ask questions and provide feedback
The Lynde Creek Watershed is predominantly located in the Town of Whitby (Durham Region) and also extends into adjacent municipalities to the north and west (Township of Uxbridge, Township of Scugog, City of Pickering, and Town of Ajax).

The total drainage area of Lynde Creek and its tributaries is approximately 130 km² and falls under the jurisdiction of the Central Lake Ontario Conservation Authority (CLOCA).
How Did We Get Here?

1988 Lynde Creek Master Drainage Study:
• The original 1988 Lynde Creek Master Drainage Study was developed to provide guidance to the Town of Whitby and CLOCA for development in the Lynde Creek Watershed.

2012 Lynde Creek Watershed Plan
• The Lynde Creek Watershed Plan was completed by CLOCA in 2012 to guide future growth planning decisions for the entire watershed area.
• The goal of this Watershed Plan is to achieve healthy natural systems within the Lynde Creek Watershed which can positively respond to landscape changes and watershed conditions while sustaining its ecological health and integrity.
• The Plan informs municipal official plan policies. It makes recommendations to ensure the protection, restoration and enhancement of the existing natural resources in the watershed in consideration of the quickly changing social, economic and natural landscape of the area.
• 23 Action Plans were identified to support the above.

Other Key Relevant Studies Since 1988:
• Brooklin Master Drainage Plan (CPW 1992)
• West Whitby Secondary Plan (Phase 3)
• Brooklin Secondary Plan

This Study: 2018 Lynde Creek Master Drainage Plan Study Update
• Undertaken by the Town of Whitby, in partnership with CLOCA. The study will update the original 1988 Master Drainage Plan and consider a number of additional reports that have been prepared since 1988, including the 2012 Lynde Creek Watershed Plan.
• This update will provide guidance to both the Town, CLOCA and other affected municipalities in continued management of the Lynde Creek watershed and stream corridors, in terms of:
  – Watercourse flows and erosion - resources protection and development.
  – The Study will also support watershed management objectives as directed by the 2012 Lynde Creek Watershed Plan (CLOCA).
  – Identify and describe a list of recommended watershed improvement projects that will inform future capital works programs and budgets.
• The MDPU recognises that watershed planning and associated Master Drainage Plans have evolved over the years.
Phase 1: Problem or Opportunity Statement
- Identify problem or opportunity

Phase 2: Alternative Solutions
- Identify alternative solutions to problem or opportunity
- Inventory natural, social and economic environment
- Consult the public, agencies and other stakeholders regarding problem or opportunity, existing and future conditions and high level alternative solutions
- Identify impacts of alternative solutions on the environment, and mitigation measures
- Evaluate alternative solutions and identify recommended solutions including strategies that meet the 2012 Watershed Plan objectives
- Select preferred solutions

Implementation
- Complete drawings and documents
- Proceed to construction and operation
- Monitor for environmental provisions and commitments

What We Have Heard – Open House No. 1 Comments
- Fix identified stream blockage/erosion issues
- Look at opportunities to improve active transportation linkages as part of the proposed CN/Metrolinx Lynde Creek relief culverts
- Need to address localized problems – flooding, erosion, MTO Highway 412 corridor ATV usage (temporary bridges) and bank stability
- Concern about the quality of water entering Lynde Creek.
- Ensure the wildlife and flora and fauna are minimally impacted.

Open House No. 1 (June 5, 2018)

We are here: Open House No. 2 (October 11, 2018)
Problem:
• The Lynde Creek watershed has experienced and will continue to experience pressures from urban and rural uses. These pressures impact on the watershed’s form and function including but not limited to: flood potential, erosion potential and natural heritage/ecosystem health.
• Effective management strategies are needed to protect and restore the Lynde Creek Watershed.

Opportunity
• Completion of a MDPU provides an opportunity to build on watershed management planning work completed to date and develop a long term road map for watershed improvement initiatives that can guide current land use and future growth.
• Completion of the MDPU will identify a suite of watershed improvement projects that can support future funding applications.

Note: the above before and after figures are examples only
• Land Use can be classified in many ways.

• For the purposes of documenting overall changes in land use and the potential for change to impact drainage and the terrestrial and aquatic Natural Heritage systems, we initially categorized land use as **pervious** (more infiltration, less runoff) and **impervious** (less infiltration, more runoff).

• Existing conditions are typically reflected through airphoto interpretation and resulting multiple land use classifications. For Lynde Creek the recent Lynde Creek Watershed Management Plan (CLOCA 2012) was used.

• Future conditions are reflected in municipal Official Plans using general classification categories. More detailed land use interpretations are provided in subsequent Secondary Plans and Subdivision Plans. The planning horizon is, typically, to the year 2031.

• For future flow estimates, more detailed Land Use information is required as provided on the next display board.

• In general, there is potential for a greater than 100% increase in impervious-type land use and a re-balancing of pervious-type land use between agriculture and natural heritage system as indicated in the Table, below.

<table>
<thead>
<tr>
<th>Land Use Description</th>
<th>Existing-2012 WMP</th>
<th>Future</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urban Development+ Transportation (Impervious)</td>
<td>11%</td>
<td>26%</td>
</tr>
<tr>
<td>Agricultural (Pervious)</td>
<td>63%</td>
<td>25%</td>
</tr>
<tr>
<td>Natural Heritage + Open Space + Rural Development (Pervious)</td>
<td>26%</td>
<td>49%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>
Land Use

Two Secondary Plans

1. These two Secondary Plans represent the largest future land use change in the Lynde Creek watershed.


Legend
- Proposed Catchment
- CLOCA Land Cover
  - Agriculture (AG)
  - Commercial (C)
  - High-Density Residential (HDR)
  - Rural Residential (RR)
  - Urban Residential (UR)
  - Industrial (I)
  - Institutional (I)
  - Natural Heritage & Open Space (NHOS)
  - Waterbody (W)

Future Land Use
- Agriculture
- Commercial
- Future Urban
- High Density Residential
- Industrial/Business Park
- Institutional
- Low Density Residential
- Medium Density Residential
- Mixed Use
- Natural Heritage/Open Space
- Rural Development
- Transportation
- Urban Development
- Waterbody

Changes in land use imply changes in imperviousness and runoff. This leads to increased streamflow unless increased runoff is mitigated.

Existing Conditions

Future Conditions

West Whitby

Brooklin
Aquatic and Terrestrial Ecosystem Restoration Opportunities

What has changed since 1988?

- Natural Heritage Systems (NHS) Policies (Town and CLOCA)
- Watershed Planning Regulations
- Updated Municipal Official Plans
- Provincial Endangered Species Act
- Additional growth and development
- Department of Fisheries and Oceans (DFO) regulations

How will impacts on the NHS be mitigated?

- A multi-disciplinary approach leverages flood and drainage mitigation strategies to address existing impacts on the NHS
- Recommendations are a result of collaboration between specialists in drainage/hydrology, hydrogeology, fluvial geomorphology, terrestrial ecosystems, and aquatic ecosystems.

Recommendations for the 2018 MDPU:

- Riparian restoration/stabilization throughout the watershed
- Removal of fish barriers in trout/aquatic species at risk (SAR) habitat
- SWM facility retrofits to improve water quality in fish/aquatic SAR habitat
- Recommendations to improve wildlife passage at undersized culverts leading to reduced wildlife mortality
Fluvial Geomorphology

What is Fluvial Geomorphology?
- The study of the form and function of streams and the interaction between streams and their surrounding landscapes
- Used to determine the state of the watercourse (under stress or stable) and how the stream should be managed

What has been completed?
- Review of past studies
- Targeted field reconnaissance
- Confirmation of representative reaches
- Determine risk assessment sites

Rapid Geomorphic Assessment (RGA) – A quick visual assessment tool using an established standard checklist to confirm the presence or absence of indicators for channel stability. The RGA uses visual indicators to determine if the stream is stable or undergoing physical change through aggradation, degradation, channel widening and planimetric form adjustment.

Rapid Geomorphic Assessment (Ministry of the Environment, 2003)

<table>
<thead>
<tr>
<th>Factor Value</th>
<th>Classification</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.29</td>
<td>In Regime or Stable (Least Sensitive)</td>
<td>Channel morphology is within a range of variance for streams of similar hydrographic characteristics – evidence of instability is isolated or associated with normal river meander propagation processes</td>
</tr>
<tr>
<td>0.21-0.40</td>
<td>Transitional or Stressed (Moderately Sensitive)</td>
<td>Channel morphology is within the range of variance for streams of similar hydrographic characteristics but the evidence of instability is frequent</td>
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<tr>
<td>0.41</td>
<td>In Adjustment (Most Sensitive)</td>
<td>Channel morphology is not within the range of variance and evidence of instability is widespread</td>
</tr>
</tbody>
</table>

Rapid Geomorphic Assessment of Targeted Reaches within the Study Area as Compared with the Existing Conditions Report (CLOCA, 2008)

<table>
<thead>
<tr>
<th>Reach</th>
<th>Aggradation</th>
<th>Degradation</th>
<th>Widening</th>
<th>Planimetric Form Adjustment</th>
<th>Stability Index</th>
<th>Condition</th>
<th>Notes</th>
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<tbody>
<tr>
<td>L-04</td>
<td>0.50</td>
<td>0.17</td>
<td>0.75</td>
<td>0.14</td>
<td>0.39</td>
<td>Transitional</td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>same result as CLOCA, 2008</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>L-13 Within Reach 8 (CLOCA, 2008)</td>
<td>0.38</td>
<td>0.00</td>
<td>0.63</td>
<td>0.14</td>
<td>0.29</td>
<td>Transitional</td>
</tr>
<tr>
<td></td>
<td><em>same result as CLOCA, 2008</em></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td>L-18</td>
<td>0.38</td>
<td>0.14</td>
<td>0.25</td>
<td>0.14</td>
<td>0.23</td>
<td>Transitional</td>
</tr>
<tr>
<td></td>
<td>L-19</td>
<td>0.25</td>
<td>0.00</td>
<td>0.38</td>
<td>0.14</td>
<td>0.19</td>
<td><em>In Regime</em></td>
</tr>
<tr>
<td></td>
<td><em>same result as CLOCA, 2008</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>L-20</td>
<td>0.38</td>
<td>0.14</td>
<td>0.50</td>
<td>0.14</td>
<td>0.29</td>
<td>Transitional</td>
</tr>
<tr>
<td></td>
<td><em>same result as CLOCA, 2008</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td>H-13</td>
<td>0.25</td>
<td>0.60</td>
<td>0.00</td>
<td>0.29</td>
<td>0.13</td>
<td><em>In Regime</em></td>
</tr>
<tr>
<td></td>
<td>H-19</td>
<td>0.13</td>
<td>0.60</td>
<td>0.00</td>
<td>0.14</td>
<td>0.07</td>
<td><em>In Regime</em></td>
</tr>
<tr>
<td></td>
<td>H-20</td>
<td>0.13</td>
<td>0.14</td>
<td>0.25</td>
<td>0.29</td>
<td>0.20</td>
<td>Transitional</td>
</tr>
</tbody>
</table>

Reach L-04: Evidence of Widening
- Falling/leaning trees, large organic material and exposed tree roots

Reach L-20: Evidence of Aggradation
- Siltation in pools
Fluvial Geomorphology

Targeted Geomorphic Reaches

Reaches are classified as a section of a stream or river along which similar hydrologic conditions exist, such as discharge, depth, area and slope. Priority reaches were chosen based on existing conditions, proximity to new development (Official Plan Schedule K, V) and reach mobility.

Existing Geomorphically Undersized Crossings:
- Crossings that do not exceed bankfull width and/or affect the natural process of the channel
- Potential to impact sediment transport processes, channel migration, increased risk to infrastructure
- Potential impact to fish passage

Mitigation:
- Works within existing and new development to replicate the natural flow regime (E.g. Low Impact Development - stormwater retention)
- Channel Crossing should address the potential for in-channel erosion without impacting local channel adjustment processes
- Crossings should extend greater than bankfull width and not impact natural sediment transport processes or channel velocity

Existing Erosion Sites:
- Increases in flow regime associated with land use changes (increased urbanization) can increase erosion potential within receiving watercourses
- Can lead to channel instability, degraded habitat, increased rates of bank erosion and channel migration
- Watercourses are dynamic and naturally move sediment, however issues arise when changes result in an increased duration of erosive events with a resulting increase in the amount of flow that can entrain sediment

Mitigation:
- Implement Low Impact Development and Stormwater Management best practices to replicate more natural flow conditions (see Hydraulics Board)
- Maintain or restore channel connection with the floodplain
- Maintain appropriate bankfull width dimensions throughout the watercourse
- Restore and maintain the riparian corridor with the addition of native plants, shrubs and trees
- Undertake erosion control works on reaches currently experiencing erosion
Targeted Reach Risk Assessment Priority Sites - *Examples*

**Existing Erosion Sites and Riparian Restoration Locations**

**Existing Geomorphically Undersized Culverts**
Hydrologic Assessment

What has been completed?

- Work to date has been unable to validate the hydrologic model. The final decision on appropriate flows, for use in the Lynde Creek MDPU, is pending further discussion and review by CLOCA/Whitby.
- Development of a future land use scenario projected to the planning horizon 2031 – to be used in the hydrologic model to reflect increased runoff due to development.
- Confirmation of appropriate Climate Change scenario.
- Development of hydrologic models for future conditions, existing conditions with stormwater management facilities (SWM) or climate change and a risk management condition that considers the impact on flows from SWM as well as routing major flow upstream of large roads and railway embankments.

1. “No Storage” implies the impacts of SWM Ponds and major roadway/railway embankments have not been considered – these results are typically used for floodplain mapping purposes.
How do existing and future flows compare based on the 2018 MDPU results?

- Future flows have increased by ~10%-20%, over existing, due to land use change; especially in the Heber Down tributary. However, this impact has potential to be mitigated by SWM/LID implementation during land development.
- Climate Change should increase existing flows by ~25%.
- Existing SWM Ponds decrease existing flows by ~1%-2%. This suggests that, generally and in the future, SWM Ponds will not have a significant effect on existing flows in the watershed, although peak flow duration will be increased.
- Major storage points in the system, as a result of roadway and railway embankments, reduce peak flows by an additional ~2% over SWM storage impacts.
- The difference between existing and future flows for the Regional Storm (Hurricane Hazel) is not significant.
Hydraulic Assessment

What has been completed?
- Hydraulic assessment, using HEC-RAS, was undertaken for several of the flow scenarios developed in the hydrology component of this study.

How will the Hydraulic Assessment results be used in the 2018 MDPU?
- The results were used to identify locations in the watershed where road crossing infrastructure works could reduce the impact of the existing and future flow regimes. A total of 76 crossing structures (bridges/culverts) were identified in the HEC-RAS model.

The infrastructure works include:
- Upgrades (culvert/bridge) to reduce water level (wl) during flooding events, thus, reducing roadway flooding and potential structure loss.
  - Roadways were assigned types (local, collector, arterial) and characteristics (rural, urban)
  - Design Flows were based on Road Classification and required Return Period of the design flow (MTO)
  - MTO criteria were used to establish criteria for freeboard (wl to top road), clearance (wl to soffit) and overtopping depth for the 100-yr event (wl to top road) depending on design flow
- Eleven (11) structures were identified as a high priority for replacement and are identified on the adjacent map
  - Upgrades to culverts/bridges that are overtopped with a depth of flooding greater than 0.3m for the 100yr event and do not meet clearance or freeboard standards for their design flow.
  - Upgrades to culverts/bridges to reduce flood water level in Flood Vulnerable Areas (FVA).
  - There are seven (7) FVA’s (refer to next board)
    - The highest priority FVA is upstream of Highway 401 with 189 dwellings at risk: a $6.2M relief culvert project is being considered for the downstream CN/GO rail crossings. This will remove the dwellings from the 100-yr floodplain.
Hydraulic Assessment

Flood Damage Centres (FDC) 1.


<table>
<thead>
<tr>
<th>Location</th>
<th>Number of Structures</th>
</tr>
</thead>
<tbody>
<tr>
<td>LYN_3</td>
<td>4</td>
</tr>
<tr>
<td>LYN_5</td>
<td>189</td>
</tr>
<tr>
<td>LYN_8</td>
<td>8</td>
</tr>
<tr>
<td>LYN_9</td>
<td>2</td>
</tr>
<tr>
<td>LYN_11</td>
<td>1</td>
</tr>
<tr>
<td>LYN_12</td>
<td>5</td>
</tr>
<tr>
<td>LYN_16</td>
<td>16</td>
</tr>
</tbody>
</table>

[Map and images of flood damage centres showing various locations and structures.]
Stormwater Management

Existing and Proposed SWM Facilities

Legend
- Municipal Boundary
- Lynde Creek Watershed
- Freeway
- Expressway / Highway
- Major Road
- Railway
- Pipeline
- Watershed
- Waterbody

Lynde Creek Watershed

Stormwater Management Facilities

<table>
<thead>
<tr>
<th>Stormwater Management Facilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>June 2018</td>
</tr>
</tbody>
</table>

Source: AECOM, CLOCA, LID, Town of Whitby

Figure 1
Stormwater Management

SWM Low Impact Development (LID) Measures and Best Management Practices (BMP)

SWM Pond Retrofits

- All new development will adhere to LID and BMP Guidelines that will mitigate the impacts of increased runoff and reduced water quality. Maintaining a Water Balance will play a significant role.
- Water quality affects fish habitat, especially the potential negative warming effects of SWM pond discharge. It is proposed that thermal effects mitigation be considered for existing SWM Ponds by retrofitting as follows:
  - reversed slope, bottom draw, rather than top draw, outlet for water quality
  - addition of cooling trenches at water quality outlets.
- The adjacent map identifies reaches that have significant fish habitat with species at risk (SAR) and the location of existing SWM Ponds with priorities for retrofit provided (based on contributing drainage area). Most SWM ponds should be considered for retrofit since the Lynde Creek outlet and many contributing reaches have been identified as areas of SAR critical habitat.

Examples of Retrofit Possibilities
Significant Groundwater Recharge Areas - Surficial Geology Review

• Visited eleven (11) locations distributed throughout watershed in May 2018.

• Targeted areas identified as Significant Groundwater Recharge Areas in background documentation (CTC, 2015) and/or where coarse-grained sediments have been mapped (OGS, 2011).

• Completed spot sampling of surficial soils at seven (7) of the visited locations.

• Samples obtained generally were consistent with background information; consisting predominantly of sand to gravel-sized sediments.

• Identified two (2) active aggregate (sand extraction) operations in watershed.
Groundwater Discharge Areas

- Visited sixteen (16) locations distributed throughout watershed in May 2018
- Targeted public land (roadway) watercourse crossings in areas identified as Groundwater Discharge Areas in background documentation (CLOCA, 2018)
- Completed a site walk at each location for the purpose of identifying any visual indicators of potential groundwater discharge, such as:
  - Presence of groundwater dependent plant species
  - Presence of bank seepage
  - Permeable stream substrate and/or soft saturated floodplain sediments
  - Presence of iron-staining and/or natural sheen
- Potential groundwater discharge indicators identified in eight (8) locations (refer to blue triangles △)
What has changed since 1988?

A good understanding of the hydrologic cycle, including recharge and infiltration rates, has been developed in the Lynde Creek Watershed Existing Conditions Study (CLOCA 2008).

What has been completed?

- For development areas (Brooklin and West Whitby Secondary Plans) water budgets have yet to be established by Sub-Area Studies, as required.
- Water budget targets or groundwater infiltration rates (mm/yr), for the five (5) subwatersheds, have been identified based on the Lynde Creek Existing Conditions Study (CLOCA 2008):
  - Lynde Main – 130
  - Heber Down – 154
  - Kinsale – 125
  - Ashburn – 209
  - Myrtle - 210
- General infiltration targets will be established within the two Secondary Plan areas using Class A methods.
- Twenty (20) Years of monthly precipitation and temperature data, from the Oshawa WPCP, will serve as input to the model.
- Runoff and Infiltration rates are will be finalized for the Secondary Plan Areas.
- A proposed methodology for more detailed water budget studies (Class B through Class D) for the identification of target infiltration rates, at a Secondary Plan Sub-Area level of detail, will be discussed and recommendations made.
The Problem: The existing CNR/Metrolinx Rail Corridor Lynde Creek culverts have hydraulic capacity limitations that contribute to upstream flooding and negatively impact on how the watershed functions.

While there have been no major damages to existing property or structures to date, the Town, in partnership with structure owners, has identified the need to update its floodplain mapping and investigate alternatives for addressing conveyance limitations and providing flood protection for a 1 In 100 year storm.

The relief culverts will remove all dwellings (105) from the 100-Year floodplain but will not affect the Regulatory Flood level.
The study considered various environmental and technical issues and reviewed four alternative scenarios:

1. Do nothing – consider the impacts of not making hydraulic improvements to the crossing
2. Install flood relief culverts beside the existing CN and GO structures
3. Replace the existing CN and GO structures
4. Non-structural improvements – consider downstream channel modifications or berms to control the flood plain.

The preferred alternative was determined to be Alternative 2: Installing flood relief culverts beside the existing CN and GO structures crossing Lynde Creek. The rationale is as follows:

- Alternative 2 is expected to incur the least construction-related impacts and has been in accepted in principle by CN.
- High potential to reduce upstream flooding - the reduction of flood levels would reduce the 100-year flood level such that the 60 properties between Highway 401 and Dundas Street are not within the flood plain.
- Avoids impact to existing CN rail structure – disruptions mitigated.
- Low potential to affect drainage patterns and increase erosion/sedimentation.
- No changes to fish habitat or fish passage.
- Least amount of disturbance to aquatic habitat in Lynde Creek (in-water works largely avoided).
- Least potential for disturbance to Eastern Pondmussel habitat (if confirmed in Lynde Creek work area).
- Consistent with provincial and local policies that permit development in key natural heritage areas for the purpose of flood or erosion control.

Municipal Class EA Schedule C requirements are being satisfied under the Lynde Creek Master Drainage Plan Update.
Lynde Creek MDPU Recommendations

Master Drainage Plan – Key Components

Natural Heritage
- Fish barrier removal
- Riparian restoration
- SWMP/LID–New development
- SWMP retrofit
- Wildlife Corridors – roadway crossings
- SWM Guidelines – LID/BMP
- Future Studies
- Monitoring

Flooding
- Roadway/Railway Crossing Upgrades
- Floodplain Mapping
- SWMP/LID–New development
- SWM Guidelines – LID/BMP
- Future Studies
- Monitoring

Geomorphology/Erosion
- Erosion Protection
- Natural Channel Restoration
- SWMP/LID–New development
- SWM Guidelines – LID/BMP
- Roadway Crossings
- Future Studies
- Monitoring
**Recommended Lynde Creek MDPU Projects**

<table>
<thead>
<tr>
<th>Project ID #</th>
<th>Project Name</th>
<th>Project Type</th>
<th>Project Description</th>
<th>Linkage to 2012 Lynde Creek Watershed Plan Action Plans</th>
<th>Applicable Stream Reach ID #</th>
<th>Estimated Schedule</th>
<th>Cost Estimate</th>
<th>Comments</th>
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</thead>
<tbody>
<tr>
<td>1.</td>
<td>Riparian Restoration and Bank Stabilization</td>
<td>Vegetation Planting/Management/Bank Stabilization</td>
<td>Plant native trees, shrubs, live stakes/native seed 30 m on either side of watercourse. ~110 m length of riparian area.</td>
<td>Helps achieve Action Plan #1, #2, #5, #16</td>
<td>North of Bayview Court 663797 4870511 to 663847 4870595</td>
<td>TBD</td>
<td>&lt;100k</td>
<td>1st order stream. Complete a botanical inventory of existing watercourse and identify established populations of invasive species.</td>
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<tr>
<td>2.</td>
<td>Riparian Restoration and Bank Stabilization</td>
<td>Vegetation Planting/Management/Bank Stabilization</td>
<td>Plant native trees, shrubs, live stakes/native seed 30 m on either side of watercourse. ~120 m length of riparian area.</td>
<td>Helps achieve Action Plan #1, #2, #5</td>
<td>South of Columbus Road, East of Camber Court 663423 4870374 to 663485 4870549</td>
<td>TBD</td>
<td>&lt;100k</td>
<td>1st order stream. Assess for bank stabilization opportunity.</td>
</tr>
<tr>
<td>3.</td>
<td>Riparian Restoration and Bank Stabilization</td>
<td>Vegetation Planting/Management/Bank Stabilization</td>
<td>Plant native trees, shrubs, live stakes/native seed 30 m on either side of watercourse.</td>
<td>Helps achieve Action Plan #1, #2, #5</td>
<td>South of Columbus Road, west of Ashburn Road 661967 4869703 to 661778 4870024</td>
<td>TBD</td>
<td>&lt;100k</td>
<td>1st order stream. Agricultural field, likely private land within Brooklin Secondary Plan area. Aquatic species at risk present.</td>
</tr>
<tr>
<td>4.</td>
<td>Riparian Restoration and Bank Stabilization</td>
<td>Vegetation Planting/Management/Bank Stabilization</td>
<td>Plant native trees, shrubs, live stakes/native seed 30 m on either side of watercourse.</td>
<td>Helps achieve Action Plan #1, #2 and #5</td>
<td>South of Columbus Road, west of Ashburn Road 661975 4869753 to 662126 4869874</td>
<td>TBD</td>
<td>&lt;100k</td>
<td>2nd order stream. Agricultural field, likely private land</td>
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<td>Riparian Restoration and Bank Stabilization</td>
<td>Vegetation Planting/Management/Bank Stabilization</td>
<td>Plant native trees, shrubs, live stakes/native seed 30 m on either side of watercourse.</td>
<td>Helps achieve Action Plan #1, #2 and #5</td>
<td>West of Ann Arbor Court 663520 4869431 to 663459 4859534</td>
<td>TBD</td>
<td>&lt;100k</td>
<td>Assess for bank stabilization opportunity. Potentially multiple restoration areas within location.</td>
</tr>
<tr>
<td>6.</td>
<td>Riparian Restoration and Bank Stabilization</td>
<td>Vegetation Planting/Management/Bank Stabilization</td>
<td>Plant native trees, shrubs, live stakes/native seed 30 m on either side of watercourse.</td>
<td>Helps achieve Action Plan #1, #2 and #5</td>
<td>West of Lockridge Street 663549 4862552 to 663556 4862747</td>
<td>TBD</td>
<td>&lt;100k</td>
<td>3rd order stream.</td>
</tr>
<tr>
<td>7.</td>
<td>Riparian Restoration and Thermal Regulation</td>
<td>Riparian cover to maintain thermal requirements- Brook Trout</td>
<td>Plant native trees, shrubs, live stakes/native seed 30 m on either side of watercourse.</td>
<td>Helps achieve Action Plan #1, #2 and #5</td>
<td>Main Lynde Creek immediately north of Columbus Road.</td>
<td>TBD</td>
<td>&lt;100k</td>
<td>4th order stream.</td>
</tr>
<tr>
<td>8.</td>
<td>Riparian Restoration and Thermal Regulation</td>
<td>Riparian cover to maintain thermal requirements for aquatic species at risk</td>
<td>Plant native trees, shrubs, live stakes/native seed 30 m on either side of watercourse.</td>
<td>Helps achieve Action Plan #1, #2 and #5</td>
<td>Main Lynde Creek immediately north of the Highway 407.</td>
<td>TBD</td>
<td>&lt;100k</td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>Riparian Restoration and Thermal Regulation</td>
<td>Riparian cover to maintain thermal requirements for aquatic species at risk</td>
<td>Plant native trees, shrubs, live stakes/native seed 30 m on either side of watercourse.</td>
<td>Helps achieve Action Plan #1, #2 and #5</td>
<td>South of Highway 407, west of Anderson Street.</td>
<td>TBD</td>
<td>&lt;100k</td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>Riparian Restoration and Thermal Regulation.</td>
<td>Riparian cover to maintain thermal requirements for Brook Trout Manage potential in-stream barriers due to pedestrian bridges through golf course.</td>
<td>Plant native trees, shrubs, live stakes/native seed 30 m on either side of watercourse.</td>
<td>Helps achieve Action Plan #1, #2 and #5, potentially #17</td>
<td>South of Myrtle Road west, west of Ashburn Road 660142 48702779</td>
<td>TBD</td>
<td>&lt;100k</td>
<td>Brook Trout potential in the headwaters. Ensure no barriers due to pedestrian bridges at golf course.</td>
</tr>
<tr>
<td>11.</td>
<td>Riparian Restoration and Thermal Regulation.</td>
<td>Riparian cover to maintain thermal requirements- Brook Trout</td>
<td>Plant native trees, shrubs, live stakes/native seed 30 m on either side of watercourse.</td>
<td>Helps achieve Action Plan #1, #2 and #5</td>
<td>North of Myrtle Road west, east of Lake Ridge Road 658789 4874069 to 658040 4874302</td>
<td>TBD</td>
<td>&lt;100k</td>
<td>Brook Trout capture site downstream. Assess for bank stabilization opportunity.</td>
</tr>
</tbody>
</table>
## Lynde Creek MDPU Recommendations

<table>
<thead>
<tr>
<th>Project ID #</th>
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<tbody>
<tr>
<td><strong>B. Fish Barriers</strong></td>
<td></td>
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<tr>
<td>1.</td>
<td>BARLYN08</td>
<td>In-stream barrier removal. Allow for fish passage and connectivity of headwater communities where Brook Trout are potentially present</td>
<td>Remove perched CSP culvert (0.5 m x 0.5 m) and potentially replace with concrete structure or larger CSP properly embedded into substrate. Helps achieve Action Plan #1, #5 and #17</td>
<td>Bryant Side Road, north of Townline Road 661139 4878640</td>
<td>TBD</td>
<td>&gt;250k</td>
<td></td>
<td>Priority barrier - highest score (In-stream barrier action plan). Incorporation of wildlife crossing for reptiles, amphibians and mammals.</td>
</tr>
<tr>
<td>2.</td>
<td>BARLYN07</td>
<td>In-stream barrier removal. Allow for fish passage and connectivity of headwater communities where Brook Trout are potentially present</td>
<td>Remove concrete dam and restore passage for non-jumping fish species Helps achieve Action Plan #1, #5 and #17</td>
<td>Way Street, south of Carnwith Drive West</td>
<td>TBD</td>
<td>&gt;250k</td>
<td></td>
<td>Priority barrier – 2nd highest score (In-stream barrier action plan).</td>
</tr>
<tr>
<td>3.</td>
<td>BARLYN09 and BARLYN10</td>
<td>In-stream barrier removal. Allow for fish passage and connectivity of headwater communities where aquatic species at risk are potentially present</td>
<td>unknown Helps achieve Action Plan #1 and #17</td>
<td>South of Ashburn, West of Ashburn Road 661167 4872502</td>
<td>TBD</td>
<td>&gt;250k</td>
<td></td>
<td>Two barriers in this immediate area. BARLYN10 is a priority barrier – 3rd highest score (In-Stream Barrier Action Plan). Would improve habitat for aquatic species at risk.</td>
</tr>
<tr>
<td>4.</td>
<td>BARLYN01</td>
<td>In-stream barrier removal. Allow for fish passage and connectivity of headwater communities to and from Chalk Lake</td>
<td>unknown Helps achieve Action Plan #1 and #17</td>
<td>South of Chalk Lake Road, North of Townline Road 657669 4875964</td>
<td>TBD</td>
<td>&gt;250k</td>
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<tr>
<td>5.</td>
<td>BARLYN02</td>
<td>In-stream barrier removal. Allow for fish passage and connectivity of headwater communities to and from Chalk Lake</td>
<td>unknown Helps achieve Action Plan #1 and #17</td>
<td>South of Chalk Lake Road, North of Townline Road 657653 4876056</td>
<td>TBD</td>
<td>&gt;250k</td>
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<tr>
<td><strong>C. Wildlife Crossing Structures</strong></td>
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<tr>
<td>1.</td>
<td>Wildlife Crossing</td>
<td>Incorporation of Wildlife Crossing Structures into Culvert Upsizing Opportunities.</td>
<td>Allows for reptile, amphibian and mammal movement and land connectivity, while reducing road mortality, within GLOCA’s Wildlife Habitat Network Helps achieve Action Plan #5 Culverts identified for upsizing opportunities.</td>
<td></td>
<td>TBD</td>
<td>TBD</td>
<td></td>
<td>Design considerations for culvert size, substrate type, openness ratio, length, metal mesh ledges, riparian planting and funneling techniques to encourage wildlife to use culverts to cross roads.</td>
</tr>
<tr>
<td><strong>D. Stormwater Management Pond Retrofits</strong></td>
<td></td>
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<tr>
<td>2.</td>
<td>Brooklin Meadows Subdivision PD56-01</td>
<td>Thermal Impact Mitigation Bottom Draw/Cooling Trench</td>
<td>--</td>
<td>--</td>
<td>TBD</td>
<td>$200K</td>
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**Lynde Creek MDPU Recommendations**

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<tr>
<td>E. Crossing Upgrades</td>
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<tr>
<td>1</td>
<td>Myrtle T3</td>
<td>Culvert/Bridge upgrading - 25yr design flow</td>
<td>Bryant Side Road – Rural Arterial – 1.7msx1.1mr</td>
<td>--</td>
<td>R1 - XS 113#1</td>
<td>TBD</td>
<td>&gt;$250K</td>
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<td>2</td>
<td>Lynde</td>
<td>Culvert/Bridge upgrading – 100yr design flow</td>
<td>Jeffrey St - Urban Arterial – 30.5msx2.8mr</td>
<td>--</td>
<td>R3 - XS 323</td>
<td>TBD</td>
<td>&gt;$1M</td>
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<td>3</td>
<td>Lynde</td>
<td>Culvert/Bridge upgrading – 100yr design flow</td>
<td>CN/GO Rail line - Freeway – 15msx2.5mr</td>
<td>--</td>
<td>R2 – XS 3243</td>
<td>TBD</td>
<td>&gt;$6M</td>
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<td>4</td>
<td>Kinsale</td>
<td>Culvert/Bridge upgrading – 25yr design flow</td>
<td>Halls Road – Rural Arterial – 2.4md</td>
<td>--</td>
<td>XS 5833#1</td>
<td>TBD</td>
<td>&gt;$250K</td>
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<tr>
<td>5</td>
<td>Kinsale</td>
<td>Culvert/Bridge upgrading – 25yr design flow</td>
<td>Eastbourne Beach Road – Rural Arterial –1.2md</td>
<td>--</td>
<td>XS 279#1</td>
<td>TBD</td>
<td>&gt;$100K</td>
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<td>6</td>
<td>Heber T4</td>
<td>Culvert/Bridge upgrading – 25yr design flow</td>
<td>Sideline 2 Road – Rural Arterial –1.2md</td>
<td>--</td>
<td>XS 3533#1</td>
<td>TBD</td>
<td>&gt;$100K</td>
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<td>7</td>
<td>Ashburn T1</td>
<td>Culvert/Bridge upgrading – 25yr design flow</td>
<td>Myrtle Road – Rural Arterial – 1.9md</td>
<td>--</td>
<td>XS 1913#1</td>
<td>TBD</td>
<td>&gt;$100K</td>
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<tr>
<td>8</td>
<td>Ashburn</td>
<td>Culvert/Bridge upgrading – 25yr design flow</td>
<td>Townline Road – Rural Arterial – 1.6md</td>
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<td>XS 9657#1</td>
<td>TBD</td>
<td>&gt;$100K</td>
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<td>9</td>
<td>Ashburn</td>
<td>Culvert/Bridge upgrading – 25yr design flow</td>
<td>Myrtle Road – Rural Arterial – 1.3md</td>
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<td>XS 6839#1</td>
<td>TBD</td>
<td>&gt;$100K</td>
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<td>Ashburn</td>
<td>Culvert/Bridge upgrading – 25yr design flow</td>
<td>Ashburn Road – Rural Arterial – 5msx3.5mr</td>
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<td>XS 2549#1</td>
<td>TBD</td>
<td>&gt;$1M</td>
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<td>11</td>
<td>Ashburn</td>
<td>Culvert/Bridge upgrading – 50yr design flow</td>
<td>Cedarbrook Trail – Rural Arterial – 10msx1.6mr</td>
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<td>XS 8</td>
<td>TBD</td>
<td>&gt;$1M</td>
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<tr>
<td>C. Studies</td>
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<tr>
<td>1</td>
<td>Hydrologic Model Calibration</td>
<td>Using WSC streamflow gauges, supplemented by CLOCA streamflow gauges, calibrate and validate the hydrologic model used for streamflow estimation. There would be a large hydrogeological component since infiltration/recharge in the HVRA areas could be a major factor in appropriate modelling.</td>
<td>--</td>
<td>all</td>
<td>2020</td>
<td>$50K</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td>D. Guidelines</td>
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<tr>
<td>1</td>
<td>LID/BMP Guidelines</td>
<td>CLOCA/Whitby to upgrade/expand current development guidelines to include LID and BMP elements; with a focus on Water Balance and Infiltration methods</td>
<td>--</td>
<td>all</td>
<td>2020</td>
<td>$50,000</td>
<td>--</td>
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<tr>
<td>2</td>
<td>Riparian and Natural Channel Restoration Guidelines</td>
<td>Compile, from existing guidelines, acceptable approaches/methods for channel restoration and identify, within the Lynde Creek Watershed, a detailed inventory of sites that need to be addressed</td>
<td>--</td>
<td>all</td>
<td>2020</td>
<td>$50,000</td>
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</tr>
<tr>
<td>1</td>
<td>Streamflow</td>
<td>For Calibration</td>
<td>Develop and operate three (3) streamflow gauges in the Ashburnham and Myrtle Tribs to assist in identifying hydrologic mechanisms for calibration purposes.</td>
<td>Helps achieve Action Plan #8</td>
<td>TBD</td>
<td>2019</td>
<td>$50K+O/M</td>
<td>--</td>
</tr>
<tr>
<td>2</td>
<td>Streamflow</td>
<td>For Heber Down Trib</td>
<td>Develop and implement two (2) streamflow gauges on the Heber Down Trib to identify changes in flow regime.</td>
<td>Helps achieve Action Plan #8</td>
<td>TBD</td>
<td>2019-2020</td>
<td>$30K+O/M</td>
<td>--</td>
</tr>
<tr>
<td>3</td>
<td>Rainfall</td>
<td>For Calibration</td>
<td>Develop and implement a rainfall monitoring program for the upper portion of the watershed (Ashburnham, and Myrtle Tribs). Assume a minimum of four (4) gauges.</td>
<td>Helps achieve Action Plan #8</td>
<td>TBD</td>
<td>2019</td>
<td>$60K+O/M</td>
<td>--</td>
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<tr>
<td>4</td>
<td>Water quality</td>
<td>For impact assessment</td>
<td>Develop and implement a continuous water quality monitoring program for typical indicators (TSS, DO, P, COND). Two (2) sites – one on Heber Down Trib and one near Lynde Creek outlet.</td>
<td>Helps achieve Action Plan #8</td>
<td>TBD</td>
<td>2020</td>
<td>$75K+O/M</td>
<td>--</td>
</tr>
</tbody>
</table>
Next Steps

Fall 2018

• See Project Website for a copy of the display materials: www.whitby.ca/currentstudies
• Receive comments by October 26, 2018
• Study Team to review and consider comments regarding the recommended Whitby Lynde Creek MDPU strategies, including associated watershed management projects

Winter 2018

• Prepare Lynde Creek Relief Culverts Municipal Class EA Master Plan Project File
• Submit Lynde Creek MDPU to agencies for review and comment
• Finalize MDPU, issue Notice of Completion and file Municipal Class EA Master Plan Project File for 30-day public review period
We appreciate the time you have taken to learn more about the Lynde Creek MDPU.

We value your input and encourage you to stay connected. To learn more, visit the project website: [www.whitby.ca/en/townhall/currentstudies](http://www.whitby.ca/en/townhall/currentstudies).

Join our mailing list – leave us an email or mailing address.

Contact the Study Team Representatives listed below with any additional comments or questions.

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**Important Reminder:** Please drop off your comment sheet in the designated box or provide them to one of the Study Team members listed above by October 26, 2018 to be considered as we move forward to finalize this plan.