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| TO: | CHAIR AND MEMBERS CIVIC WORKS COMMITTEE MEETING ON MAY 26, 2014 |
| FROM: | JOHN BRAAM, P.ENG. MANAGING DIRECTOR ENVIRONMENTAL & ENGINEERING SERVICES AND CITY ENGINEER |
| SUBJECT: | MUD CREEK SUBWATERSHED STUDY UPDATE FOR WATER RESOURCES COMPONENTS UNDER CLIMATE CHANGE CONDITIONS |

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| RECOMMENDATION |
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That, on the recommendation of the Managing Director Environmental & Engineering Services and City Engineer, the following actions **BE TAKEN** with respect to the Mud Creek Subwatershed Study Update for Water Resources components under Climate Change conditions:

- (a) the Mud Creek Subwatershed Study (MCSS) Update for Water Resources components under the Climate Change Conditions **BE ACCEPTED**;
- (b) Alternative 1 **BE APPROVED** as the Preferred Alternative for the proposed Subwatershed Mitigation and Implementation Strategies Plan in the MCSS Update, it being noted that this includes the following recommendations:
 - (i) Peak flow controls on lands with future land use change;
 - (ii) 70% TSS removal in accordance with the Ministry of the Environment guidelines;
 - (iii) Improvements to the Mud Creek morphology by sediment removal in the middle reaches, bank treatments in the lower reaches and channel stabilization in the upper reaches;
 - (iv) Implementation of the proposed Regional SWM servicing works and Private Permanent Systems (PPS);
 - (v) Review and development of City policy for property and existing infrastructure within flood risk areas;
 - (vii) Structural inspection of the CNR culvert by CNR to assess the feasibility of structural lining;
 - (viii) Management of stormwater flows north of the CP railway line;
 - (ix) Cleaning of sediment from the culverts and connecting storm sewers;
 - (x) A Municipal Class Environmental Assessment (EA) study undertaken for the proposed applicable remediation and servicing works; and
 - (xi) Updates to monitoring programs
- (c) the consulting fees for Delcan Corporation **BE INCREASED** by \$35,000 to a new upset limit of \$235,622.40 (excluding HST) in accordance with Section 15.2 (g) of the Procurement of Goods and Services Policy due to supplementary assessments of the existing flood reductions and risk assessment for Oxford Street, the attendance and preparation for information/progress meetings with the UTRCA and various City's department/divisions.

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| PREVIOUS REPORTS PERTINENT TO THIS MATTER |
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Planning & Environment Committee, September 10, 2013, Application By: Bluestone Properties Inc. 450 Oxford Street West

Civic Works Committee, January 2012, Appointment of Consulting Engineer for the Mud Creek Subwatershed Study Update

Built and Natural Environment Committee, June 13, 2011, Climate Change Adaptation Strategy Phase 1 Completion

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Environment and Transportation Committee, September 27, 2010, Phase 1 – Climate Change Adaptation Strategy Studies

Environment and Transportation Committee, July 14, 2008, Appointment of the consultants for Phase 1 Climate Change Adaptation Strategy

Board of Control, May 28 2008, 2008 Wastewater and Treatment Emergent Projects (a) - ES2470 Climate Change Strategy

Environment and Transportation Committee, December 10, 2007, Review of Rainfall Intensity Duration Frequency Curves for City of London under Climate Change

Environment and Transportation Committee, September 2007, Appointment of Consulting Engineer for Municipal Class Environmental Assessment Study for Storm/Drainage and Stormwater Management Servicing Works for Mud Creek East Drainage Area

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| BACKGROUND |
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Purpose

This report provides Committee and Council with an assessment of existing and future conditions and seeks approval to finalize the MCSS Update for Water Resources components under Climate Change conditions, as well as recommends Alternative 1 as the Preferred Alternative for the MCSS Update's Mitigation and Implementation Strategies Plan for this system. The study area is shown in Appendix 'B'.

Context

The original MCSS was completed in 1995 by Marshall Macklin Monaghan Limited as part of the Group 1 Subwatershed Study that included Medway and Stanton Creeks along with Mud Creek. Since the original study, substantial development activities have occurred within the MCSS drainage area with the percentage of land development increasing from 40% in 1995 to over 80% in 2010.

The MCSS undertook an inventory of the existing conditions and instituted the subwatershed management strategy to maintain and enhance the water resources, environmental and ecological performance and health of the system under existing and future land uses.

On July 25, 2011, City Council approved the completion of the City of London Climate Change Adaptation Strategy Phase 1. The Council resolution stated that *“Planning, Environmental and Engineering Services **BE DIRECTED** to proceed with the next set (Phase 2) of the Climate Change Adaptation Strategy studies as follows:*

- (i) update the Water Resources Components of the existing Subwatershed Studies such as the Dingman Creek, Stoney Creek, Mud Creek, Medway Creek and Pottersburg Creek using the Climate Change Upper Bound (CC_UB) scenarios in order to develop climate change Adaptation Policies; assess the impacts of these scenarios on the City's infrastructure in order to recommend mitigation strategies*
- (ii) develop the Water Resources Components and slope stability evaluation for a Central Thames Subwatershed Study using the 100-year Climate Change Upper Bound (CC_UB) scenario for climate change Adaptation Policies development and decision making of the impacts;*
- (iii) develop a Green Infrastructure Plan to incorporate an environmental/ ecological approach to water resources management;*
- (iv) finalize the Climate Change Long Term Adaptation Strategy; and*
- (v) use of 21% Intensity Duration Frequency (IDF) for modeling purposes.”*

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The MCSS Update includes, but is not limited to the:

- 1) Review and update to the water resources (hydraulic, hydrologic, erosion) inventory and analyses;
- 2) Confirmation of the preliminary ecological conditions in the subwatershed in relation to the water resources system;
- 3) Determination of the risk impact of flooding from extreme storm events on critical City infrastructure; and
- 4) Development of a Recommended Subwatershed Mitigation and Implementation Strategies Plan for this system.

While the study was conducted to be consistent with the Municipal Class Environmental Assessment (EA) process by following the first phase and a portion of the second phase such that the Subwatershed Mitigation and Implementation Strategies Plan preferred option was developed and recommended, it does meet the requirements of the EA process for the Master Plan. A separate EA study for the recommended Subwatershed Mitigation and Implementation Strategies Plan for Mud Creek Subwatershed system including an EIS will be undertaken to implement the proposed applicable remediation and servicing works that require EA approval.

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| DISCUSSION |
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The MCSS instituted and evaluated various alternative/option strategies which included recommended management actions, protection and enhancement strategies and development criteria. The evaluation and assessment of the alternatives resulted in the development of a recommended plan. Several baseline conditions and technical reports were prepared to document the existing conditions in 1995 including Geology and Hydrogeology, Hydrology, Hydraulics, Erosion and Geomorphology, Water Quality, Aquatic Biology and Terrestrial Biology. Using the existing conditions information, the study formulated a series of Alternative Strategies for evaluation which included possible management actions, protection and enhancement strategies and establishment of development criteria. The evaluation and assessment of the alternatives resulted in the development of a recommended Implementation Strategy plan.

The constraints identified in the 1995 Subwatershed Study generally remain valid today; however, some opportunities and constraints have become more pressing due to the increased development in the study area. The original 1995 MCSS set out a series of goals and objectives for the subwatershed plan to achieve. These objectives have been reviewed, confirmed and updated to incorporate present day conditions.

In addition, the current study examines the water resources components of this subwatershed for future land uses and under climate change conditions. This MCSS Update included a review of all transpired and existing Official Plan land designations, Zoning, completed and ongoing Master Plans/Community Plans and Secondary Plans. Also, the study incorporates the present planning policies and provides an update on the understanding of environmental functions and features as well as assesses the effects of the recommended Implementation/Remediation Subwatershed strategy.

Based on the substantial changes identified in the land use characteristics of this subwatershed, a new hydrological model was developed. The estimated flows under the existing and ultimate conditions compared to the 1995 Subwatershed Study have increased. In accordance with the Council direction the updated water resources models include rainfall based on the Climate Change Upper Bound (CC_UB) Intensity Duration Frequency (IDF) curves used to simulate changing climate conditions.

Evaluation of Alternatives

In the MCSS Update, four alternative subwatershed mitigation and implementation strategies were developed using common components and a screening process to identify additional components for each alternative.

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The risk of flooding was evaluated for each alternative. The Flood Risk Assessment methodology used is consistent with the approach developed for the City of London Vulnerability of Infrastructure to Climate Change study (VICC) approved by City Council in July, 2011. Risk is defined as the intersection of a hazard, in this case flooding, with vulnerability.

The common components that are integrated into each alternative include;

- Stormwater management controls for approved developments in developing urban areas including onsite quantity control and conveyance systems to existing SWM Facilities
- Private Permanent Systems (PPS) for quantity control on lands with future land use changes from the existing condition
- PPS for quality control on lands with future land use changes from the existing condition except for draft approved lands with a pre-determined Stormwater Management Strategy
- SWM Facility on the draft approved lands
- Channel cleaning, bank treatments and repairs/stabilization of creek channel
- Structural lining of the CN culvert
- Clean out of culvert and storm sewers at Oxford St. and Proudfoot Lane
- Flood Management North of the CP Rail Line
- Implementation of Best Management Practices (BMP) in future land developments to reduce runoff
- Maintenance/enhancement of the terrestrial and aquatic features consistent with applicable Acts, the current Official Plan and future Environmental Impact Studies

The common components are proposed to address changing climate conditions as climate change pertains to increased flood risk.

The four alternatives considered were:

- Alternative 1 – No Additional Storage for Climate Change;
- Alternative 2 – Land raising;
- Alternative 3 – Additional storage and new lower and enlarged CN culvert; and
- Alternative 4 – Land Raising, additional storage and new lower and enlarged CN culvert.

Each alternative includes the above noted common components; additional components associated with each Alternative are detailed below.

Alternative 1 includes only the common components, there is no proposed additional storage for Climate Change or any other additional features associated with this alternative.

Alternative 2 includes all common components as well as raising/filling private land to mitigate the effects of flooding on private lands under the Climate Change condition. The raising of private lands is considered as a private cost. The land filling/raising may mitigate flooding conditions to minimize impact to private infrastructure. The alternative includes mitigation of flooding conditions for the private properties at 415 Oxford Street, 607 Proudfoot Lane and 450 Oxford Street. However raising the private lands will result in a loss of flood storage, is against UTRCA Policy and OP Policy, and may have an incremental impact on municipal transportation infrastructure and limit options for improvement of this infrastructure in the future.

Alternative 3 includes all common components in addition to additional storage in Mud Creek by widening and deepening the middle reaches, and a new lower and enlarged CN culvert. There would be significant environmental disruption with this option, however it will provide for better aquatic habitat due to geomorphological improvements associated with sediment reduction.

Alternative 4 includes all common components in addition to additional storage in Mud Creek by widening and deepening the middle reaches, a new lower and enlarged CN culvert and private land raising. Alternative 4 is effectively a combination of Alternatives 2 and 3.

The four alternatives were evaluated using Planning, Technical, Social/Cultural/Natural Environment and Economic criteria. See Appendix D for a comparison of alternatives under the specified criteria.

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The risk analysis enables conclusions and recommendations to be made regarding the reliability of the infrastructure (municipal and private) network within the City to adapt to changing climate conditions. In this study the results will assist in evaluating the alternatives in terms of promoting adaptation of the infrastructure network to the anticipated changing climate conditions.

It should be noted that at the September 10, 2013 meeting of the Planning and Environment Committee, the following recommendations were approved regarding the application by Bluestone Properties Inc. for the property at 450 Oxford Street West:

Upon the completion of the Mud Creek Subwatershed Study Update and the provision of revised floodlines by the Upper Thames River Conservation Authority to the City, the Civic Administration BE DIRECTED to bring forward any required amendments to the Official Plan and the Z.-1 Zoning By-Law to implement the revised floodlines as approved by the Upper Thames River Conservation Authority, it being noted that an Open Space designation and an Open Space (OS4) zone variation could be applied to a portion of these lands.

The approval of the Mud Creek Subwatershed Study does not provide for the provision of revised Regulatory Flood Line mapping. It is the UTRCA's responsibility to approve revised Regulatory Flood Plain modelling and mapping. The Conservation Authority is working towards the development of this information and is utilizing updated technical information provided by the City through the development of the MCSS as a basis for this undertaking.

The MCSS Update explicitly examined the evaluation of the four viable alternatives and originally Alternative 2 was scored to be the highest overall rank based on rating of the criteria. The results of the risk analysis assessment identified Alternative 2 as having the lowest risk for existing infrastructure, the lowest consequence value and fewest buildings affected.

The City of London's Planning department does not support Alternative 2 due to the impacts of land raising/filling on the private parcels on terrestrial/ecological conditions. The loss of some natural features is a major concern. The EA study for the Mud Creek for proposed remediation works, including land filling work, would require an integrated EIS to meet Official Plan Policy and the test of Provincial Policy.

Due to the issues with Alternative 2, the evaluation determined that filling to mitigate flooding conditions at 415 Oxford Street, 607 Proudfoot Lane and 450 Oxford Street is not consistent with regulatory requirements, OP policy, and the filling may have an incremental impact on municipal transportation infrastructure and limit options for improvement of this infrastructure in the future. **Alternative 1 is considered by the City of London as the Preferred Alternative** as; none of the issues associated with Alternative 2 are present in Alternative 1, it is identified by the MCSS as the second best alternative, and it is the least costly alternative.

Alternative 1 will achieve the following outcomes to address changing climate conditions:

- (i) Peak flow controls on lands with future land use change
- (ii) 70% TSS removal as per MOE guidelines;
- (iii) Improvements to the Mud Creek morphology by sediment removal in the middle reaches, bank treatments in the lower reaches and channel stabilization in the upper reaches;
- (iv) Implementation of the proposed Regional SWM servicing works and Private Permanent Systems (PPS);
- (v) Review and development of City policy for property and existing infrastructure within flood risk areas;
- (vi) Structural inspection of the CNR culvert to assess the feasibility of structural lining;
- (vii) Management of the stormwater flows north of the CP railway line;
- (viii) Cleaning of sediment from the culverts and connecting storm sewers;
- (ix) Undertake the Municipal Class Environmental Assessment Study for the proposed remediation and servicing works; and
- (x) Updates to monitoring programs.

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Public Consultation

As part of the MCSS study, two public meetings were conducted. These meetings were well attended by the public and affected property owners.

In addition, the City conducted 2 information meetings with the Ministry of the Environment (MOE), that expressed no objections and in principal full support for this study, approximately over 20 project coordination meetings with the UTRCA and 5 information meetings with various City’s Departments and Divisions. All applicable agencies have been engaged in this study update including discussions with CN Rail (CNR).

The CNR culvert is a key infrastructure component with the Mud Creek system. The study team contacted CNR and the following details were confirmed:

- CNR has no current plans to do any work at the culvert location in the near future, which greatly impacted the evaluation of Alternatives 3 and 4.
- All culverts are inspected on a cycle with the last inspection on February 6, 2008 and the next inspection was scheduled for mid to late 2013.

Based on this information, the Study Team concluded that the CNR’s culvert should be inspected by CNR’s Engineer on a regular basis and this study has included a consideration of the options to prolong the life expectancy of CNR’s culvert. The MCSS Update provides an option for a structural stabilization of the culvert that can strengthen the voids in the granular bedding and backfill and line the culvert with a lower roughness material that will maintain or increase its capacity. This information will be shared with CNR. All costs associated with the inspections, maintenance, and the potential stabilization works must be borne by CNR as it is their asset and responsibility to maintain and/or upgrade.

Consulting Assignment Cost

The stakeholder consultation required an unusually large number of meetings that the consultant was required to attend. More than 25 meetings were conducted with stakeholders, mainly with the UTRCA. The number of meetings conducted exceeds what is considered as normal for a project of this scale.

Additional funding is requested to be allocated for this study to cover Delcan’s consulting fees for supplementary preliminary design of servicing options to assess the existing flood reductions for level of service for Oxford Street and the requirement to attend progress meetings with the UTRCA and various City’s Department and divisions beyond what was identified in their original work plan.

As a result, it is recommended to increase the consulting fees for Delcan by \$35,000 to a new upset limit of \$235,622.40 (excluding HST) in accordance with Section 15. 2 (g) of the Procurement of Goods and Services Policy to deal with the consultant cost overrun.

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| CONCLUSION |
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Recommendation

Alternative 1 is recommended as the Preferred Alternative for the proposed Subwatershed Mitigation and Implementation Strategies Plan of the MCSS Update as it is consistent with regulatory requirements, OP Policy and does not have an incremental impact on municipal transportation infrastructure.

The implementation of the recommended works under Alternative 1 will be subject to written approval and UTRCA permits for the proposed remediation and servicing works in accordance with Section 28 of the Conservation Authorities Act.

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While Alternative 1 does not include a recommendation for “land raising” to mitigate flooding conditions at 450 Oxford Street, 415 Oxford Street and 607 Proudfoot Lane, the UTRCA has indicated (Appendix B) that the regulatory process under Section 28 of the Conservation Authorities Act provides an opportunity for a proponent to make application for development or site alteration within the regulated area. Such an application would need to be reviewed on its specific merits and the review would consider the available technical information and the approved policy of the UTRCA for administering the permit process. Updated Regulatory Flood Plain mapping is a critical information requirement for the consideration of any filling proposals that may be pursued by the City or private proponents. The UTRCA is updating the Regulatory Flood Plain information for the Mud Creek Subwatershed and once this updated information is available, the UTRCA will be able to evaluate proposals, such as the filling that was contemplated in Alternative 2.

Acknowledgements

This report was prepared with the assistance of Mitchell Highway, Stormwater Management EIT of the Stormwater Management Unit.

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| PREPARED BY: | REVIEWED AND CONCURRED BY: |
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| RECOMMENDED BY: | |
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| JOHN BRAAM, P. ENG. MANAGING DIRECTOR, ENVIRONMENTAL & ENGINEERING SERVICES & CITY ENGINEER | |

May 12, 2014

- Attach: Appendix “A” – Source of Financing
- Appendix “B” – Location Map
- Appendix “C” – UTRCA Letter
- Appendix “D” – Comparison of Alternatives