



CITY OF MARKHAM  
ENGINEERING DEPARTMENT

SUBMISSION OUTLINES  
*for*  
VARIOUS ENGINEERING REPORTS / STUDIES

July, 2023

**A. GENERAL**

The following is a list of various engineering reports that may be required for development applications:

- 1) Master Environmental Servicing Plan (MESP) and Scoped Environmental Master Servicing Plan for Intensification Areas (SEMSPIA)
- 2) Functional Servicing Report (FSR)
- 3) Erosion and Sediment Control (ESC) Report
- 4) Stormwater Management (SWM) Report (including major and minor system design)
- 5) SWM Pond / Facility Design Report
- 6) SWM Pond Operation and Maintenance (O & M) Report
- 7) Environmental Site Assessment (ESA) Phase One and Phase Two Reports and Environmental Clearance and Reliance Letter
- 8) Geotechnical Report
- 9) Hydrogeological / Water Balance Analysis Report
- 10) Noise Study
- 11) Transportation Impact Study
- 12) Internal Functional Traffic Design Study

All reports must be signed, dated and stamped by a Professional Engineer in good standing or a Qualified Person.

All reports shall be prepared in accordance with *Engineering Report Guide* dated November 8, 2019 or as amended from time to time, and prepared by Profession Engineering Ontario.

All reports shall be prepared in compliance with the City's Engineering Standard Drawings and Design Criteria (City Standards), and applicable City policies, specifications, guidelines and by-laws. Where no City Standards Drawings exist, the Ontario Provincial Standards (OPS) for Roads and Public Works, the Transportation Association of Canada (TAC)-Geometric Design Guide for Canadian Roads, and the Ministry of Environment, Conservation and Parks (MECP) Guidelines etc. may be used, subject to their acceptance by the Director of Engineering.

A digital copy of the final report shall be provided in one file in an adobe acrobat format for each submission. All units must be shown in the metric system.

Additional reports, if requested by the City, will need to be submitted in support of the development applications.

**1) Master Environmental Servicing Plan (MESP) and Scoped Environmental Master Servicing Plan for Intensification Areas (SEMSPA)**

The following provides an overview of the City of Markham’s Submission Requirements for Master Environmental Servicing Plans (MESP’s). The MESP is to be prepared in support of Secondary Plans for specific development areas, and is to be completed in conformance with the requirements outlined in the City’s Official Plan. These submission requirements are intended to be generic and summarize the information requirements for an MESP completed anywhere within the City of Markham. Nevertheless, it is recognized that the submission requirements may be tailored to be specific to the available information and / or guidance from higher level studies (such as the Subwatershed Study for the City’s Future Urban Area).

In circumstances where a Subwatershed Study (for instance) precedes a Secondary Plan and MESP process, some of the data/analyses listed herein may not require new work or it may be appropriate to build upon the technical analyses and assessments conducted in the primary or parent studies, subject to scope concurrence with the City and its partners. References in the table below to the need to refine SWS recommendations are intended to apply to circumstances where refinement may be needed if there are substantive differences in land use assumptions between the MESP and the SWS and / or legislative requirements, policies or engineering standards that have arisen since the completion of the SWS (e.g. Species At Risk (SAR), Climate Change, etc.).

These Submission Requirements summarize only the information and content which is required for an MESP. Further details of the scope of work required for MESP’s (i.e. analytical tools and methodology, monitoring, field investigations, mapping and reporting formats and requirements, etc.) are to be defined in the Terms of Reference for each specific MESP. Development proponents are required to consult with the City of Markham and the City’s Study Partners (e.g., TRCA, MNRF, Region of York, adjacent municipalities, as appropriate) to establish and prepare the Terms of Reference for each MESP, prior to initiation.

The submission outlines for **MESP and SEMSPA** includes, but not limited to, the following:

<b>Section</b>	<b>Description</b>
1.0	<p><b>Executive Summary</b></p> <ul style="list-style-type: none"> <li>• Integrated summary of the work completed and conclusions of the individual sections</li> <li>• Identification of inter-relationship between the various sections</li> <li>• Concise summary of the significance and implications of the findings of the MESP</li> <li>• Summary of the overall conclusions reached</li> </ul>
2.0	<p><b>Introduction and Background</b></p> <ul style="list-style-type: none"> <li>• Purpose for the MESP or SEMSPA</li> <li>• Relevant information from Sub-watershed Studies or other relevant studies which addresses the submission requirements of the MESP</li> <li>• Study area location, attributes, descriptions, figures, and boundaries</li> <li>• Setting - existing land-use, natural features, etc.</li> <li>• Study objectives and scope outline</li> <li>• Study team</li> <li>• Maps depicting land ownership and participation in the study</li> <li>• Report structure outline</li> <li>• Background review of existing relevant studies (e.g. transportation studies, approved watershed, sub-watershed, drainage studies, fisheries management plans, best management practices guides, natural heritage systems planning guides, flood and stormwater management studies, etc.)</li> <li>• Summary of pre-consultation with City, External Agencies, and Others, as</li> </ul>

	required
3.0	<p><b>Planning and Environmental Policy Context</b></p> <ul style="list-style-type: none"> <li>• Identify and define applicable federal, provincial, regional, and municipal planning and environmental policies</li> <li>• Reference existing relevant Drainage Studies and Watershed, Sub-watershed and / or Master Drainage studies</li> <li>• Define requirements for compliance with sub-watershed and other applicable studies</li> <li>• Identify Greenway System and natural heritage and hydrologic features identified for protection in the Official Plan</li> </ul>
4.0	<p><b>Characterization of Existing Conditions: Constraints and Opportunities</b></p> <ul style="list-style-type: none"> <li>• <b>Monitoring</b> <ul style="list-style-type: none"> <li>➤ Pre-development monitoring of adequate duration established consultatively with City and applicable external agency staff</li> </ul> </li> <li>• <b>Physiography</b> <ul style="list-style-type: none"> <li>➤ Topography and geology, as well as surficial soils description and location mapping</li> </ul> </li> <li>• <b>Surface Water Resources</b> <ul style="list-style-type: none"> <li>➤ Hydrology and hydraulics assessment including drainage plan boundaries and patterns, hydrologic modeling, floodplain mapping (supported with hydraulic modelling) and identification of flood hazards including downstream risk areas</li> <li>➤ Water budget assessment based upon water balance for surface water within input from groundwater component</li> <li>➤ Identification of headwater drainage features, if any</li> <li>➤ Surface water quality assessment including retrofit and restoration opportunities, and benthics (where appropriate)</li> </ul> </li> <li>• <b>Groundwater Resources</b> <ul style="list-style-type: none"> <li>➤ Hydrogeological investigations including: Existing groundwater levels, flow direction and gradients, Aquifer locations and vulnerability, Groundwater recharge and discharge zones, Base-flow contribution to wetlands and watercourses</li> <li>➤ Major groundwater resources and groundwater users in the area</li> <li>➤ Refine / define targets for overall water balance as necessary</li> </ul> </li> <li>• <b>Water Budget / Water Balance</b> <ul style="list-style-type: none"> <li>➤ Establish water budget for existing conditions including calculation of annual infiltration and establish targets for overall water balance to ensure the sustainability of wetlands, woodlands, etc. and to manage runoff</li> <li>➤ Identify features and provide information including how each feature is fed within their catchment areas (groundwater / surface water), hydroperiod, and expected timing to return to “normal” conditions</li> <li>➤ Prepare stage / storage / discharge information for storage based features using survey and monitoring data</li> <li>➤ Prepare and calibrate hydrologic / hydrogeologic modeling or calculations using monitoring data</li> </ul> </li> <li>• <b>Source Water Protection</b> <ul style="list-style-type: none"> <li>➤ Plan to identify Wetland Protection Area, Groundwater Vulnerability, Significant Groundwater Recharge Areas, Ecologically Significant Groundwater Recharge Areas, and Surface Water Intake Protection Zones, etc.</li> </ul> </li> <li>• <b>Fluvial Geomorphology</b> <ul style="list-style-type: none"> <li>➤ Existing land use fluvial geomorphologic conditions including reach delineation, rapid assessments, detailed field assessment, erosion hazard delineation including downstream risk areas, erosion threshold determination, meander belt width assessments for major tributaries, meander belt width delineation in support of Redside Dace habitat limits</li> </ul> </li> </ul>

	<ul style="list-style-type: none"> <li>• <b>Aquatic Resources</b> <ul style="list-style-type: none"> <li>➤ Aquatic community description - physical conditions such as channel form, in-stream cover, spawning habitat, refuge habitat, riparian cover, etc.</li> <li>➤ Fisheries community composition and significant / sensitive species including aquatic species or communities that have designations under the Endangered Species Act or the Species At Risk Act</li> </ul> </li> <li>• <b>Hydrologically sensitive features and key hydrologic features</b> <ul style="list-style-type: none"> <li>➤ Natural features' dependencies on surface water and / or groundwater based upon features-based water balance</li> <li>➤ Identification and classification of all wetland features (provincially and locally significant wetlands and unevaluated wetlands)</li> <li>➤ Identification and delineation of valleyland features and buffers</li> </ul> </li> <li>• <b>Terrestrial Resources</b> <ul style="list-style-type: none"> <li>➤ Vegetation community description and floral inventories including                             <ul style="list-style-type: none"> <li>✓ Ecosystem context</li> <li>✓ Community description using MNRF ELC standards</li> <li>✓ Identification of Areas of Natural and Scientific Interest (ANSI)</li> <li>✓ Identification of vegetative communities and significant / sensitive species including species or communities that have designations under the Endangered Species Act or the Species At Risk Act</li> <li>✓ Identification and assessment of woodlands using Woodlands Evaluation Criteria including feature delineation</li> <li>✓ Wildlife description and wildlife inventories</li> <li>✓ Habitat conditions and species. Acceptable methods should be clarified for birds, amphibians / reptiles and mammals. (consultant will provide description of the work for our review before they do the work)</li> <li>✓ Significant wildlife species and habitat conditions</li> <li>✓ Conduct breeding bird and amphibian surveys, as requested by TRCA or MNRF</li> <li>✓ Significant species including local, Regional, Provincial significant species, communities of conservation concern as per TRCA rankings, and species or communities that have designations under the Endangered Species Act or the Species At Risk Act</li> <li>✓ Identification of wildlife linkage passages and connectivity opportunities</li> </ul> </li> <li>➤ Confirmation of the Greenway System                             <ul style="list-style-type: none"> <li>✓ Integrated characterization (Task 4) of how the existing Greenway System is interconnected, including natural heritage and hydrologic features and their functions. This would include:                                     <ul style="list-style-type: none"> <li>▪ Identify natural linkages and ecological corridor functions</li> <li>▪ Identification of vegetation protection zones (i.e. buffers)</li> <li>▪ Identification of complementary land uses and potential enhancement lands</li> </ul> </li> </ul> </li> </ul> </li> </ul>
5.0	<p><b>Potential Development Impacts and Proposed Mitigation / Enhancements</b></p> <p>An impact assessment shall be conducted after the characterization of the Environment and once a Conceptual Plan has been developed.</p> <p>The impact assessment must include the application of the Mitigation Hierarchy. The Mitigation Hierarchy must be documented to prioritize the determination of avoidance, minimization and mitigation to alleviate environmental harm and the removal of natural heritage and hydrologic features. Requests for consideration of natural heritage compensation are always treated as a last resort outcome.</p> <p>The MESP will include:</p> <ul style="list-style-type: none"> <li>• Assessment of impacts on surface and groundwater resources             <ul style="list-style-type: none"> <li>➤ Development footprint and site grading</li> </ul> </li> </ul>

	<ul style="list-style-type: none"> <li>➤ Assessment of the impacts of the development on the surface water and groundwater systems and any mitigation measures required prior to construction</li> <li>➤ Define impacts of buried services and roads</li> <li>• List mitigation and enhancement techniques to achieve sub-watershed study recommendations (as available)</li> <li>• Recommend list of acceptable LID techniques to maintain water budget, based upon long list of general mitigation techniques previously advanced (see Section 5); final LID and Best Management Practices (BMPs) to be established at the detailed design stage. Provide target information values for landowners.</li> <li>• Apply and advance the recommendations from the Sub-watershed Study (as available) related to headwater drainage features completed as part of the sub-watershed studies or related studies as available. The MESP shall recommend management scenarios for each feature based on established protocols and management scenarios in the sub-watershed studies (as available)</li> <li>• Characterization of groundwater quality where potential exists for development to alter conditions (e.g., individual septic systems) Assess impacts on aquatic and aquatic habitats and recommend suitable mitigation, enhancement, and compensation measures where applicable including consultation summary with MNRF to address implications on aquatic SAR (e.g. Redside Dace) Assess impacts on vegetation and vegetative communities and recommend suitable mitigation measures, enhancements and compensation where applicable</li> <li>• Assess impacts on woodlands and recommend suitable mitigation measures, enhancements and compensation where applicable</li> <li>• Assess impacts on wildlife and wildlife habitat and recommend suitable mitigation, enhancement, and compensation measures where applicable</li> <li>• Apply and advance the recommendations from the Sub-watershed Study (as available) related to Greenway System corridors / linkages</li> <li>• Apply and advance the recommendations from the sub-watershed study (as available) related to channel protection, buffers and / or setback delineation in accordance with criteria established in the current Official Plan and related Official Plan Amendments (OPAs)</li> <li>• Identify enhancement and compensation requirements based on recommendations from higher level studies</li> <li>• Effects on connectivity, and fragmentation and isolation of habitat</li> <li>• Complete a feature specific water budget analyses and identify mitigation, enhancement and compensation measures as applicable</li> <li>• Assess impacts to, and identify protection, enhancement and compensation approaches as applicable for the management of species at risk based on the federal Species At Risk Act (SARA) and / or the Provincial Endangered Species Act (ESA)</li> <li>• Description of how the recommended watercourse and stormwater management strategy and Greenway System address requirements of higher level studies</li> <li>• Integrated assessment of impacts to interconnection between the existing Greenway System with groundwater, surface water, wetlands, woodlands, and other natural heritage features</li> </ul>
6.0	<p><b>Limits of Development</b></p> <ul style="list-style-type: none"> <li>• Conduct Constraints Analysis based on, but not limited to: Soil mapping, slope stability analysis, erosion hazard analysis, fluvial geomorphology, watercourse characterization with meander belt, erosion threshold analysis, post-development floodplain analysis (identify local flooding constraints), ecological constraints, significant valley lands and woodlands mapping, fish habitat assessment, Species at Risk assessment, preliminary grading analysis, and natural heritage concerns, constraints and / or opportunities mapping</li> </ul>
7.0	<p><b>Proposed Development Plan and Municipal Servicing</b></p>

	<ul style="list-style-type: none"><li>• <b>Water supply servicing</b><ul style="list-style-type: none"><li>➤ Existing infrastructure</li><li>➤ Availability of external services</li><li>➤ Expected population and demand</li><li>➤ Future population (Ultimate Scenario) within in the catchment area in accordance with current Official Plan (OP)</li><li>➤ Identification of proposed / permitted connection points to existing water supply systems</li><li>➤ Pressure districts</li><li>➤ Design criteria (average, daily, hourly, fire water demand, pressure, and pipe roughness)</li><li>➤ Proposed infrastructure and servicing plan</li><li>➤ Water distribution modelling and pressures during maximum day, peak hour, minimum hour and maximum day plus fire conditions</li><li>➤ Servicing constraints (Regional, Municipal and Internal), expansion, and upgrade requirements to support the proposed development</li></ul></li><li>• <b>Wastewater / Sanitary Servicing</b><ul style="list-style-type: none"><li>➤ Existing infrastructure</li><li>➤ Identification of proposed / permitted connection points to existing wastewater servicing systems</li><li>➤ Existing service areas and flows</li><li>➤ Design criteria (generation rates and infiltration contribution) for growth</li><li>➤ Proposed infrastructure and servicing plan</li><li>➤ Expected population and wastewater generation</li><li>➤ Future Population (Ultimate Scenario) within the catchment area in accordance with the current OP</li><li>➤ Expected sanitary flow from the proposed and future developments within the area</li><li>➤ Prepare and implement monitoring plan at key locations as required</li><li>➤ Wastewater servicing model inclusive of existing and proposed service areas</li><li>➤ Servicing constraints (Regional and Municipal scale), expansion, and upgrade requirements to support the proposed development</li></ul></li><li>• <b>Stormwater Management (SWM) and Servicing</b><ul style="list-style-type: none"><li>➤ Pre and post development drainage boundaries, including major and minor drainage systems</li><li>➤ Evaluate the existing storm sewer and stormwater management system; identify the constraint and opportunities, and recommend upgrades to the existing system as necessary to accommodate the future developments in the study area and possibly lands external to the study area</li><li>➤ SWM design criteria (quantity control, quality control, water balance, erosion control)</li><li>➤ SWM plan to include Best Management Practices (BMPs) and a combination of control options (site level, conveyance, and end-of-pipe), preliminary design of SWM facilities and conceptual storm servicing plan.</li><li>➤ Hydrologic modeling (pre and post development)</li><li>➤ Post development water budget - determine infiltration targets</li><li>➤ Propose Low Impact Development (LID) measures</li><li>➤ Consultation summary with MNR / MECP to address implication on SARS (e.g. Redside Dace)</li><li>➤ Hydraulic analysis - major infrastructure (floodplain, culverts, and crossings, etc.)</li></ul></li><li>• <b>Floodplain modelling and mapping</b><ul style="list-style-type: none"><li>➤ Existing conditions floodplain model and mapping needs to be updated to identify flooding issues (for both river and tableland flooding)</li><li>➤ Proposed conditions floodplain model and mapping should be updated to reflect on future developments (for both river and tableland flooding) to</li></ul></li></ul>
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	<p>highlight any flooding impacts</p> <ul style="list-style-type: none"> <li>➤ To accommodate future developments, explore options to alleviate flooding, which could include, but not limited to:             <ul style="list-style-type: none"> <li>▪ upgrade the existing drainage system capacity;</li> <li>▪ relocate and re-design the drainage system;</li> <li>▪ cut-fill analysis; or</li> <li>▪ a combination of the above</li> </ul> </li> <li>➤ All remedial options should be evaluated based on cost, environmental, social, technical, etc., in consultation with the TRCA, and any applicable approval agencies. The preferred remedial options should be selected</li> </ul> <ul style="list-style-type: none"> <li>• <b>Preliminary Grading</b> <ul style="list-style-type: none"> <li>➤ Existing grading including existing topography and general grading / sloping direction(s) of site, location of high and low areas</li> <li>➤ Grading criteria including consideration of positive drainage of sewers and overland flows by gravity to receiving systems, ensurance of acceptable grading of site and roads</li> <li>➤ Proposed grading including proposed preliminary grading concept plan, location of high and low areas, grading constraints in relation to existing and proposed servicing infrastructure and environmental / ecological features, requirements for cut / fill and retaining wall(s), consideration of existing and future grades of surrounding areas)</li> <li>➤ High level recommendations and principles to be applied for site management and phasing, related to minimizing erosion and sediment discharge to receiving watercourses during construction, consistent with City Engineering Standards</li> </ul> </li> <li>• <b>Conceptual natural channel design (if required) for relocated watercourse including</b> <ul style="list-style-type: none"> <li>➤ Base mapping</li> <li>➤ Design criteria (hydrology, hydraulics, channel dimensions, terrestrial and aquatic habitat)</li> <li>➤ Geomorphic field assessment</li> <li>➤ Design constraints</li> <li>➤ Corridor requirements (flood conveyance, erosion hazard limits, aquatic habitat, terrestrial habitat)</li> <li>➤ Fish habitat impacts and mitigation, enhancement or if appropriate, compensation opportunities</li> <li>➤ Design concepts (plan view, profile, typical sections, etc.)</li> <li>➤ Barrier removal opportunities</li> <li>➤ Consultation summary with MNRF where Redside Dace (and / or other species at risk) habitats may be affected</li> </ul> </li> <li>• <b>Road crossing, cycling and pedestrian bridge crossing, and trail system conceptual designs</b> <ul style="list-style-type: none"> <li>➤ Based on recommendations from relevant studies (where available), complete conceptual design of road crossings, cycling and pedestrian bridge crossing, and trail system including consideration of requirements related to hydraulics, fluvial geomorphology and wildlife passage</li> </ul> </li> </ul>
8.0	<p><b>Transportation</b></p> <p>The MESP at minimum will include:</p> <ul style="list-style-type: none"> <li>• <b>Introduction</b> <ul style="list-style-type: none"> <li>➤ Study assumptions</li> <li>➤ Rationale and location of crossings as related to the Greenway System</li> <li>➤ Intersection operation methodology</li> </ul> </li> <li>• <b>Existing Conditions</b> <ul style="list-style-type: none"> <li>➤ Site and area description</li> <li>➤ Study area road network (including transit, bike and pedestrian)</li> </ul> </li> </ul>



	<ul style="list-style-type: none"> <li>➤ Transit service</li> <li>➤ Existing traffic volumes</li> <li>➤ Existing traffic intersection operations</li> <li>• <b>Future background traffic conditions</b> <ul style="list-style-type: none"> <li>➤ Planned network improvements</li> <li>➤ Traffic growth</li> <li>➤ Other area developments</li> <li>➤ Background traffic volumes</li> <li>➤ Background traffic intersection operations</li> </ul> </li> <li>• <b>Proposed development</b> <ul style="list-style-type: none"> <li>➤ Development statistics</li> <li>➤ Vehicular trip generation</li> <li>➤ Non-auto trip generation</li> <li>➤ Trip distribution and assignment</li> </ul> </li> <li>• <b>Total traffic conditions</b> <ul style="list-style-type: none"> <li>➤ Total traffic volumes</li> <li>➤ Total traffic intersection operations</li> <li>➤ Transportation demand management</li> <li>➤ Recommended transportation network                             <ul style="list-style-type: none"> <li>▪ Road classification</li> <li>▪ Non-auto facilities (Including transit, bike and pedestrian)</li> <li>▪ Future transit service</li> <li>▪ Right of way</li> <li>▪ Cross sections</li> </ul> </li> </ul> </li> </ul>
9.0	<p><b>Phasing</b></p> <p>The MESP will include:</p> <ul style="list-style-type: none"> <li>• Construction phasing and staging</li> <li>• Mobility connectivity - internal and external</li> <li>• Requirements for interim municipal servicing and environmental management, and associated recommendations</li> </ul>
10.0	<p><b>General and Public Consultation</b></p> <p>The MESP will:</p> <ul style="list-style-type: none"> <li>• Outline how all consultation requirements have been met for the Planning Act and the Municipal Class EA for the first two phases in the Planning and Design Process of the Class EA for all major road, water and wastewater projects at a minimum, where applicable</li> <li>• Include appropriate consultation within the context of the Planning Process</li> </ul>
11.0	<p><b>Monitoring</b></p> <p>Monitoring requirements must be included in the MESP in accordance with findings of the MESP and any relevant environmental studies or other higher level documentations where applicable. This may include:</p> <ul style="list-style-type: none"> <li>• Terrestrial and aquatic system</li> <li>• Valleylands and Creek system</li> <li>• Surface and Groundwater systems</li> <li>• Water balance / water budget for all feature based natural systems</li> <li>• During construction and post-construction monitoring activities</li> <li>• Other monitoring requirements (e.g. MNRF, Region)</li> </ul>
12.0	<b>Future Study Requirements (Draft plan stage, detailed design stage, etc.)</b>
13.0	<b>Conclusion and Recommendations</b>

**2) Functional Servicing Report (FSR)**

FSR provides a review of functional serviceability for a proposed development and verifies that water, sanitary, and storm sewer networks are adequate for servicing the development. It describes the location and nature of the existing municipal water, sanitary, and storm infrastructure that may be available to provide servicing for the proposed development. It outlines, in detail, the proposed servicing requirements for the development and indicates, where possible, the capacity of the existing mains to support the development.

FSR is prepared in support of development / re-zoning and intensification projects in order to streamline the review process. For large developments with significant environmental considerations, it requires an MESP followed by FSRs for development applications. In some instances, it may be appropriate to complete only an FSR and / or servicing brief for small scale developments.

The submission outlines for **FSR** includes, but not limited to, the following:

Section	Description
1.0	<p><b>Introduction</b></p> <ul style="list-style-type: none"> <li>• Objectives</li> <li>• Description and location of the property (with map)</li> <li>• Detailed description of the proposed development</li> <li>• Phasing of the proposed development</li> <li>• Background studies / references</li> <li>• Include Design Criteria Checklist (Section K), as an Appendix and provide justification if any of the Design Criteria can not be met with proposed resolution</li> </ul>
2.0	<p><b>Water Supply Servicing</b></p> <ul style="list-style-type: none"> <li>• Existing servicing including existing watermain sizes and locations (with map), pressures district(s), possible connections, and current capabilities</li> <li>• Design criteria including water demand criteria, estimated population, pressure criteria, conformity of water demand, and pressure to any higher order accepted study or existing infrastructure</li> <li>• Proposed servicing including proposed servicing / water distribution concept plan, proposed connections to existing watermains, estimated consumption, servicing constraints or impact of proposed development on existing infrastructure, expansion, and upgrade requirements, if any, to support the proposed development, consideration of external areas</li> <li>• Watermain Analysis               <ul style="list-style-type: none"> <li>➢ A summary of all assumptions made in the hydraulic model</li> <li>➢ Determine if the water demand exceeds the supply for the project, and how the project will affect the surrounding developments</li> <li>➢ Determine the water demand for the proposed project, size of the proposed watermain, maximum day demand, fire flow including fire demand calculations and peak hour demand, commercial and institutional demands</li> <li>➢ Confirm with the City staff any problematic issues or deficiencies in meeting flow requirements</li> <li>➢ Obtain current model data from the City staff and submit the complete water model to the City in an acceptable format (confirm with the City staff, in advance)</li> </ul> </li> </ul>
3.0	<p><b>Sanitary Servicing</b></p> <ul style="list-style-type: none"> <li>• Existing sanitary sewer sizes and locations (with map), sanitary drainage plan and areas, possible connections, and current capacities</li> <li>• Design criteria including generation rate(s), estimated population, Harmon peaking factor, infiltration contribution, conformity of discharge rate(s) to any higher order accepted study or design criteria</li> <li>• Include rationale for any assumptions made</li> </ul>

	<ul style="list-style-type: none"> <li>Proposed servicing including proposed servicing concept plan, proposed connections to existing sewers, estimated sanitary flows, comparison with current capacities, servicing constraints or impact of proposed development on existing infrastructure, expansion and upgrade requirements, if required, to support the proposed development, consideration of external areas</li> <li>Detailed sanitary design sheets to show a minimum of one leg of the existing sewer downstream</li> </ul>
4.0	<p><b>Stormwater Management and Storm Servicing</b></p> <ul style="list-style-type: none"> <li>The SWM scope of work will depend on the type, size, and complexity of application (e.g. OP / ZA / SPC / PLAN or TEC). Preliminary SWM information (high-level) is typically required for OP / ZA / PLAN applications. For TEC applications, detail SWM information is required. Provide SWM information (with applicable details, as necessary) in accordance with the scope of work and format requirements in the 'SWM Report' section of this document</li> <li>Applicant can provide the above SWM information in the FSR or as a separate SWM report</li> </ul>
5.0	<p><b>Preliminary Grading</b></p> <ul style="list-style-type: none"> <li>Existing grading including existing topography and general grading / sloping direction(s) of site, and location of high and low areas</li> <li>Grading criteria including consideration of positive drainage of sewers and overland flows by gravity to receiving systems, ensurance of acceptable grading of site and roads</li> <li>Proposed grading including proposed preliminary grading concept plan, location of high and low areas, grading constraints in relation to existing and proposed servicing infrastructure, and environmental / ecological features, requirements for cut / fill and retaining wall(s), consideration of existing and future grades of surrounding areas</li> <li>Recommendation for pavement structure, with reference to the submitted Geotechnical Report</li> </ul>
6.0	<p><b>Erosion and Sediment Control (ESC) Report</b></p> <ul style="list-style-type: none"> <li>The ESC report's scope of work will depend on the type, size, and complexity of application (SPC, TEC, and SALT). Provide ESC report (with applicable details, as necessary) in accordance with the scope of work and format requirements in the 'ESC Report' section of this document</li> <li>Applicant can provide the above ESC report in the FSR or as a separate ESC report</li> </ul>
7.0	<p><b>Water Supply Supporting Documents</b></p> <ul style="list-style-type: none"> <li>Detailed calculations for all domestic demand scenarios (i.e. Average Day, Maximum Day, Maximum Hour, Minimum Hour, Maximum Day + Fire) as listed in the City's <i>Design Criteria</i> section C2</li> <li>A summary of all assumptions made for the calculations</li> <li>Detailed Required Fire Flows Calculations, if needed, as outlined in the current edition of "<i>Water Supply for Public Fire Protection, A Guide to Recommended Practice</i>" by the Fire Underwriters Survey</li> <li>Detailed Field Fire Flow Testing Results as outlined in the current edition of "<i>M17 Fire Hydrants: Installation, Field Testing and Maintenance</i>" by the American Water Works Association or "<i>NFPA291 Recommended Practice for Water Flow Testing and Marking of Hydrants</i>" by the National Fire Protection Association.</li> <li>Detailed Monitoring Results, if needed</li> <li>Detailed InfoWater model results including: <ul style="list-style-type: none"> <li>detailed pipe ID drawing</li> <li>node ID drawing</li> <li>model input and output tables under all demand scenarios as listed in the City's <i>Design Criteria</i> section C2 (i.e. Average Day, Maximum Day, Maximum Hour, and Minimum Hour, Maximum Day + Fire)</li> </ul> </li> </ul>

	<ul style="list-style-type: none"> <li>Digital water model in InfoWater format</li> </ul>
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**3) Erosion and Sediment Control (ESC) Report**

The submission outlines for **ESC Report** includes, but not limited to, the following:

Section	Description
1.0	<p><b>Erosion and Sediment Control Plans</b></p> <p>In addition to the City of Markham Design Criteria (Section L), Standard Drawings for erosion and sediment control, the ESC plans shall follow the most recent version of the TRCA’s Erosion &amp; Sediment Control Guidelines for Urban Construction dated 2019. The ESC report and drawings shall be signed and stamped by a P.Eng. The ESC report shall include, but not limited to, the following:</p> <ul style="list-style-type: none"> <li>• Details of erosion protection at: <ul style="list-style-type: none"> <li>➢ Inlet / outlet structure</li> <li>➢ Site entrance</li> <li>➢ Catchbasins</li> <li>➢ Overland flow sections including berms and spillways</li> <li>➢ Mud and dust control</li> </ul> </li> <li>• Introduction / purpose of ESC report</li> <li>• Location plan</li> <li>• Existing site conditions and receiving watercourse / drainage system</li> <li>• Proposed alteration plan, including cut-fill area</li> <li>• Plan view of entire subdivision / site showing details of the erosion and sediment control measures</li> <li>• Detail design of Erosion &amp; Sediment control Measures (e.g. sediment control pond, sediment trap) and drawings <ul style="list-style-type: none"> <li>➢ Controls require prior to / during topsoil stripping</li> <li>➢ Controls require during municipal servicing works</li> <li>➢ Controls require during building construction and after construction</li> </ul> </li> <li>• Stockpile details</li> <li>• Outfall locations</li> <li>• Cross section of the sediment basin (if applicable)</li> <li>• Monitoring plan</li> <li>• Contingency plan</li> <li>• Construction sequencing</li> <li>• Inspection and Maintenance requirements</li> <li>• Record keeping</li> <li>• Emergency contacts</li> <li>• If any component of works for site alteration encroaches into adjacent property, a Permission Letter from the adjacent landowner must be obtained and included in the report.</li> </ul>

**4) Stormwater Management (SWM) Report**

A SWM report is prepared in order to meet conditions set at the Draft Plan, Site Plan, or MESP stage. The SWM report must provide the required design and supporting calculations for all areas of the proposed stormwater management system. The SWM report shall contain detailed design of stormwater controls and environmental restoration works, delineation / confirmation of constraint boundaries, sediment / erosion control plans, hydraulic and hydrologic analyses, and preservation and restoration / remediation plans.

For small developments (e.g. single lot, small commercial site), the SWM report can be customized in a SWM Brief, at a much smaller scale as compared to a SWM report. The SWM brief will summarize how the proposed design shall meet the stormwater management targets for water quality, quantity, erosion, water balance (infiltration) and the protection of natural features for the proposed development / project as required.

The submission outlines for **SWM Report** includes, but not limited to, the following:

Section	Description	Page No.
1.0	<p><b>Introduction</b></p> <ul style="list-style-type: none"> <li>• Objectives</li> <li>• Description and location of site</li> <li>• Description of proposed development</li> <li>• Referenced background studies / reports; watershed, sub-watershed, MESP, FSR, SWM reports and identify any deviations from the latest City's guidelines and the MECP's Stormwater Management</li> </ul>	
2.0	<p><b>Existing/Pre-development Stormwater Drainage</b></p> <ul style="list-style-type: none"> <li>• A map of existing contours and pre-development catchment areas, including runoff coefficients and external contributing areas</li> <li>• Existing storm drainage plan and areas including existing sewers and overland flow drainage systems and direction(s), current capacities, and possible connections</li> <li>• Existing SWM facilities and location, including Low Impact Development (LID) measures</li> <li>• Detail calculations and input parameters to the hydrologic and hydraulic models</li> <li>• Electronic data files of input and output for pre-development conditions</li> <li>• Complete computer output / input printouts and summaries</li> <li>• Identification of floodplain limits of all watercourses</li> <li>• Identification of existing watercourse crossings</li> </ul>	
3.0	<p><b>SWM Design Criteria</b></p> <ul style="list-style-type: none"> <li>• Summary of the applicable SWM criteria to be met</li> <li>• Stormwater quantity control criteria including allowable / pre-development discharge rate</li> <li>• Stormwater quality control criteria</li> <li>• Erosion control criteria</li> <li>• Water balance and Low Impact Development criteria</li> </ul>	
4.0	<p><b>Proposed Post-development SWM</b></p> <ul style="list-style-type: none"> <li>• Proposed Storm Drainage Plan showing the post-development drainage areas and runoff coefficients, existing / proposed SWM facilities / LID location(s) and external areas</li> <li>• Proposed Storm Servicing Plan showing the proposed minor / sewer and major / overland flow routes systems and directions, and existing / proposed SWM facilities / LID location(s)</li> <li>• Proposed Grading Plan showing the existing and proposed grades of</li> </ul>	

	<p>the proposed development</p> <ul style="list-style-type: none"> <li>• Proposed water quantity control including discharge rates and on-site storage (Provide a summary table comparing the Pre and Post development scenarios)</li> <li>• Proposed water quality control</li> <li>• Detailed design of proposed SWM facilities (e.g. Wet pond, underground SWM facility, OGS, LIDs) and design drawings shall be provided. If the SWM facilities are privately-owned, provide the details here in this SWM report. On the other hand, if the proposed SWM facility, such as a wet pond, dry pond, OGS, LIDs or underground SWM facility, is to be ultimately assumed and owned by the City (City-owned), then a separate SWM Pond / Facility Design Report should also be submitted with the design details. Refer to the SWM Pond / Facility Design report section for format and requirements. <i>(*Design guidance for underground SWM facility is being developed by the City. As such, proposed underground SWM facility will be reviewed on a case-by-case basis until engineering design guidance becomes available. Specific relevant information for underground SWM facility will be required for review)</i></li> <li>• Detailed design of LID measures, their location and design drawings</li> <li>• Outline of the maintenance and monitoring program for the proposed SWM facilities</li> <li>• Detail design calculations and input parameters for hydrologic and hydraulic models</li> <li>• Proposed catchbasin inlet control devices and orifice pipe controls</li> <li>• Proposed minor system capacities and proposed connections</li> <li>• Proposed major system capacities, full capture locations, and flow depth</li> <li>• Verification that major overland flow routes do not impact properties and that road gutter flows are within City parameters</li> <li>• Electronic data files of input and output for post-development conditions</li> <li>• Complete computer input / output printouts and summaries</li> <li>• Summary of how all City and Watershed SWM criteria has been satisfied</li> <li>• Expansion and upgrades requirements, if required, to support the proposed development</li> <li>• Erosion and sediment control measures to be implemented including design plans</li> </ul>	
5.0	<p><b>Hydraulic Gradeline (HGL) Analysis</b> <i>(HGL analysis shall also be included in the engineering drawings)</i></p> <ul style="list-style-type: none"> <li>• 100-Year hydraulic grade lines to be calculated for all pipes</li> <li>• Basement elevations to be evaluated for surcharge / flooding potential</li> <li>• Show street names associated with each pipe segment</li> <li>• Show pipe upstream and downstream inverts, sizes, length, slopes, and manning n values</li> <li>• Show pipe flows and flow velocities</li> <li>• Show pipe friction losses, manhole losses and velocity head</li> <li>• Show pipe surcharge conditions, and upstream and downstream HGL</li> <li>• Show the freeboard between the upstream HGL and the basement elevation</li> </ul>	
6.0	<p><b>Channel Design or Alteration (if required)</b></p> <ul style="list-style-type: none"> <li>• Location</li> <li>• Sizing calculations (flow, velocity, etc.)</li> <li>• Vertical and lateral erosion rates</li> </ul>	

	<ul style="list-style-type: none"><li>• Detailed design plans (plan / profile)</li><li>• Fluvial geomorphology components (low flow / backfill / floodplain width, inverts and slope, tractive force / erosion analysis, etc.)</li></ul>	
7.0	<b>Summary &amp; Conclusions</b>	

**5) SWM Pond / Facility Design Report**

A standalone report for each SWM pond / facility shall be prepared in accordance with the City's Stormwater Management Guideline and other applicable agencies' requirement.

If an underground SWM facility is proposed instead of a SWM pond, the Underground SWM Facility Design Report format shall be determined with the City on a case-by-case basis. Design guidance for underground SWM facility is being developed by the City. As such, proposed underground SWM facility will be reviewed on a case-by-case basis until engineering design guidance becomes available. Specific relevant information for underground SWM facility will be required for review.

The submission outlines for **SWM Pond / Facility Design Report** includes, but not limited to, the following:

<b>Section</b>	<b>Description</b>	<b>Page No.</b>
1.0	<b>Introduction</b> <ul style="list-style-type: none"> <li>• Objectives</li> <li>• Description and location of site</li> <li>• Description of proposed development</li> <li>• Referenced background studies / reports; watershed, sub-watershed, MESP, FSR, SWM reports and identify any deviations from the latest City's guidelines the MECP's Stormwater Management</li> </ul>	
2.0	<b>SWM Design Criteria</b> <ul style="list-style-type: none"> <li>• Quantity control</li> <li>• Quality control</li> <li>• Erosion control</li> <li>• Water balance</li> </ul>	
3.0	<b>Drainage Plan and Hydrologic Modelling</b> <ul style="list-style-type: none"> <li>• Existing conditions drainage plan and modelling</li> <li>• Proposed conditions drainage plan and modelling</li> <li>• Rainfall data used</li> <li>• Sub-Catchments parameters</li> <li>• Model schematics</li> </ul>	
4.0	<b>SWM Pond Design and Operating Characteristics* (if applicable)</b> Proposed SWM Scheme <ul style="list-style-type: none"> <li>• Volume requirements                             <ul style="list-style-type: none"> <li>➢ Quality control volume</li> <li>➢ Erosion control volume</li> <li>➢ Quantity control volume</li> </ul> </li> <li>• SWM Facility Layout and Grading                             <ul style="list-style-type: none"> <li>➢ Permanent pool volume &amp; elevation and thermal mitigation measures provided</li> <li>➢ Extended detention storage &amp; elevation provided</li> <li>➢ Sediment Forebay</li> <li>➢ Active storage</li> <li>➢ Stage-storage-discharge relationships</li> </ul> </li> <li>• Inlet configuration                             <ul style="list-style-type: none"> <li>➢ Minor flow</li> <li>➢ Major flow-overland flow route</li> </ul> </li> <li>• Outlet configuration                             <ul style="list-style-type: none"> <li>➢ Low flow control (extended detention)</li> <li>➢ Higher flow control</li> <li>➢ Emergency spillway</li> </ul> </li> </ul>	



	<ul style="list-style-type: none"> <li>• Maintenance access road</li> <li>• Geotechnical and Hydrogeological Considerations <ul style="list-style-type: none"> <li>➤ Soil types and groundwater level</li> <li>➤ Side slopes and berm stability analysis</li> <li>➤ Clay liner</li> <li>➤ Dewatering-short term &amp; long term</li> </ul> </li> <li>• Erosion Protection Measures <ul style="list-style-type: none"> <li>➤ Storm inlet</li> <li>➤ Overland flow route</li> <li>➤ Storm outlet and outfall channel</li> <li>➤ Emergency spillway</li> </ul> </li> </ul>	
5.0	<p><b>Underground SWM Facility Design Details (if applicable)</b></p> <ul style="list-style-type: none"> <li>• If an underground SWM facility is proposed instead of a SWM pond, the Underground SWM Facility Design Report format shall be determined with the City on a case-by-case basis</li> <li>• Design guidance for underground SWM facility is being developed by the City. As such, proposed underground SWM facility will be reviewed on a case-by-case basis until engineering design guidance becomes available. Specific relevant information for underground SWM facility will be required for review (and may be subject to peer-review)</li> </ul>	
6.0	<p><b>OGS and Low Impact Development (LID) Measures Design Details (if applicable)</b></p> <ul style="list-style-type: none"> <li>• This section is only for Municipally-owned SWM measures (for ECA purposes). For privately owned OGS &amp; LIDs, their details should be documented in the SWM report.</li> </ul>	
7.0	<b>Erosion and Sediment Control Details</b>	
8.0	<p><b>Planting and Restoration</b></p> <ul style="list-style-type: none"> <li>• This section to be reviewed the Urban Design department</li> </ul>	
9.0	<p><b>Operation and Maintenance (O&amp;M)</b></p> <ul style="list-style-type: none"> <li>• A separate O&amp;M manual shall be provided for each SWM facility</li> <li>• See the requirement for an O&amp;M in Section 7 of this document</li> </ul>	
10.0	<b>Conclusion</b>	

**6) SWM Pond Operation and Maintenance (O & M) Report**

An Operation and Maintenance (O & M) Report shall be prepared in accordance with the City of Markham Stormwater Management Guidelines (October 2016) and Inspection and Maintenance Guide for Stormwater Management Ponds and Constructed Wetlands (TRCA, 2016). In addition, the O & M report shall include all tables presented in this section.

If an underground SWM facility is proposed instead of a SWM pond, the Underground SWM Facility O&M Report format shall be determined with the City on a case-by-case basis. Design guidance for underground SWM facility is being developed by the City.

The submission outlines for **SWM Pond O & M Report** includes, but not limited to, the following:

Section	Description	Page No.
1.0	• Maintenance methods and procedures i.e. procedure for drawing down SWM pond forebay during sediment removal	
2.0	• Sediment removal techniques	
3.0	• Annual loading rates and estimates of sediment accumulation rate	
4.0	• Estimate of maintenance / cleaning frequency	
5.0	• Inspection procedures and frequency	

**SWM Pond Sediment Frequency Removal Data**

Input	Value	Unit
Drainage Area		ha
Imperviousness		%
Level 1 Enhanced Storage Required (80% TSS Design Efficiency)		m <sup>3</sup> / ha
Level 2 Normal Storage Required (70% TSS Design Efficiency)		m <sup>3</sup> / ha
Provided Permanent Pool Storage Per Design / ECA		m <sup>3</sup>
Provided Permanent Pool Storage Per As-built (By City)		m <sup>3</sup>
Estimated Annual Loading Rate (Per MECP 2003)		Kg / ha / Year
Annual Sediment Loading		m <sup>3</sup>
Provided Forebay Depth		m
Output		
Permanent Pool Volume for 5% TSS Efficiency Loss		m <sup>3</sup> / ha
Provided Pool Storage Minus Pool Volume at 5% Efficiency Loss		m <sup>3</sup>
Sediment Drying Area Footprint (assume 1m depth)		m <sup>2</sup>
Sediment Volume Provided by Drying Area		m <sup>3</sup>
Annual Sediment Loadings Captured (Removal at Design TSS Efficiency)		m <sup>3</sup>
Maintenance Frequency to Reach 5% Efficiency Loss		Years
Average Sediment Surface Elevation at 5% Efficiency Loss		m

**7) Environmental Site Assessment (ESA) Phase One and Phase Two Reports and Environmental Clearance and Reliance Letter**

The requirements for an ESA are identified in the *City's Environmental Policy and Procedures for Conveyance of Land to the City Pursuant to the Planning Act ("the Policy")*. These requirements must be followed if there is any land to be conveyed to the City under the Planning Act. The lands to be conveyed to the City shall be defined as any land or easement to be conveyed to the City, in accordance with *the Policy*.

The Phase One ESA and Phase Two ESA have to be completed in accordance with Ontario Regulation 153/04 – Records of Site Condition, as may be amended from time to time ("*O. Reg. 153 / 04, as amended*"), under *Part XV.1 of the Environmental Protection Act*

The Phase One ESA and Phase Two ESA are to be used as part of a Record of Site Condition (RSC) process.

The RSC requirements must follow the requirements of the *Part XV.1 of the Environmental Protection Act* and *O. Reg. 153/04, as amended*.

A Phase one ESA is a desktop exercise that includes a review of background documents, a site visit, and interviews with relevant parties to determine if soil and / or groundwater may have been contaminated by the site or adjacent sites land uses.

A Phase One Environmental Site Assessment requires the Qualified Person ("*QP*") to:

- identify any potentially contaminating activity in the phase one study area, including the phase one property
- identify areas of potential environmental concern on the phase one property
- determine if a phase two environmental site assessment is needed (for some types of property uses and circumstances, a phase two environmental site assessment is mandatory)

The *QP* shall be defined as the person who meets the qualifications prescribed by the *Environmental Protection Act* and *O. Reg. 153 / 04, as amended*.

- A Phase Two ESA is an intrusive investigation (e.g. boreholes / monitoring wells, test pits, etc.) and assessment of a property's, surface and subsurface media (e.g. soil and / or groundwater sampling) in the areas of potential environmental concern, as identified in the Phase One ESA. It may also include soil and / or groundwater remediation. This information is necessary to file a RSC and perform a Risk Assessment ("*RA*").

A RSC is a formal submission on *Ontario's Environmental Registry*, together with all supporting documentation, acknowledged by the Ministry of the Environment, Conservation and Parks ("*MECP*") as certified by a *QP*, indicating the environmental conditions of the site, and its suitability for the proposed use.

A RSC summarizes the environmental (soil and / or groundwater) conditions of the property based on ESA reports. The RSC confirms the property meets either generic or property-specific standards (developed through a RA process).

An Environmental Clearance and Reliance Letter from a *QP* to the City for all lands or interests in lands to be conveyed to the City to the satisfaction of the City of Markham is required, as well. The Environmental Clearance and Reliance Letter will be completed in accordance with the City's standard (see attached) and will be signed by the *QP* and a person authorized to bind the Owner's company. The City will not accept any modifications to the standard Environmental Clearance and Reliance Letter, except as and where indicated in the template.

**8) Geotechnical Report**

The submission outlines for **Geotechnical Report** (for Buildings, Roads, and SWM Pond construction) includes, but not limited to, the following: (Also refer Design Criteria (Section I))

<b>Section</b>	<b>Description</b>	<b>Page No.</b>
1.0	<b>Introduction. Include Key Map</b>	
2.0	<b>Site and project description</b> <ul style="list-style-type: none"> <li>• A description of the Site location</li> <li>• Description of the material that makes up the area</li> <li>• Existing condition of the site, and what is being proposed for the site</li> </ul>	
3.0	<b>Field Work</b> <ul style="list-style-type: none"> <li>• A description of the Field Work that was completed (i.e.: number of boreholes and monitoring wells, and their locations and depth</li> <li>• Include a statement that the field work was supervised and the findings were recorded by a Geotechnical Technician</li> <li>• Include a statement indicated the system with which the geodetic elevations was obtained</li> </ul>	
4.0	<b>Subsurface Conditions</b> <ul style="list-style-type: none"> <li>• Refer to attached subsurface profile figures</li> <li>• Make reference to a Borehole Location Plan and the borehole logs</li> <li>• A description of each of the encountered subsurface conditions</li> </ul>	
5.0	<b>Groundwater Conditions</b> <ul style="list-style-type: none"> <li>• Check boreholes for the presence of groundwater and the occurrence of cave-in level</li> <li>• Include a Summary Table for the groundwater levels observed at each borehole / monitoring well</li> </ul>	
6.0	<b>Discussion and Recommendations</b> <ul style="list-style-type: none"> <li>• Include a section on the recommendation for pavement structure, if applicable</li> <li>• Discuss stripping, sub-excavation and grading of the site for the proposed works</li> <li>• Recommendation for fill material, backfilling, engineered fill, bedding, basement, foundations, and footings</li> <li>• Calculations of lateral earth pressures acting on foundation and basement walls</li> <li>• Reference to hydrogeological study for the site (if any)</li> </ul>	
7.0	<b>Conclusions and General Comments</b>	
8.0	<b>Appendix for figures, drawings, calculations, borehole location plan, borehole logs</b>	

**9) Hydrogeological / Water Balance Analysis Report**

The submission outlines for **Hydrogeological / Water Balance Analysis Report** includes, but not limited to, the following:

<b>Section</b>	<b>Description</b>	<b>Page No.</b>
1.0	<p><b>Introduction</b></p> <ul style="list-style-type: none"> <li>• Address and General site location of the subject property</li> <li>• Brief description of the proposed development and overview of the study area</li> <li>• Purpose of the study</li> </ul>	
2.0	<p><b>Proposal Description and Context</b></p> <ul style="list-style-type: none"> <li>• A description of the proposal, development stats (such as number of units, site area) type of development proposed, height, parking areas, access points, location of amenity areas, proposed phasing</li> <li>• A description of the existing on-site conditions as well as surrounding areas, roads, natural areas, buildings, parking areas</li> <li>• Concept Plan for the development including building location, parking, access, amenity areas, grading and natural features and any natural hazards</li> </ul>	
3.0	<p><b>Existing Conditions</b></p> <ul style="list-style-type: none"> <li>• Description of topography and drainage patterns, regional (watershed or larger) physiography map of the study area showing the site</li> <li>• Description of surficial and bedrock material, Summary of on-site borehole information, characterization of soil stratigraphy,</li> <li>• Description of test pits / boreholes and monitoring wells / piezometers on site including date of construction/abandonment</li> <li>• Provision of private well Survey within 500 m of the site</li> <li>• Hydrogeology / Hydrostratigraphy: Aquifer properties, groundwater levels, groundwater flow direction and hydraulic conductivity</li> <li>• Description of surface water features and functions</li> <li>• Description of surface and groundwater quality</li> <li>• Identify source water protection: wellhead protection areas, transport pathways, significant drinking water threats, existing conditions / issues</li> <li>• Identify ecologically significant groundwater recharge areas</li> </ul>	
4.0	<p><b>Potential Short / Long-term Impact Assessment</b></p> <ul style="list-style-type: none"> <li>• Description of the changes to groundwater levels, flow direction</li> <li>• Description of reduction to infiltration / recharge / discharge rates and volumes on varying time scales</li> <li>• Description of the changes to groundwater discharge (Base-flow)</li> <li>• Description of the changes to groundwater quality: Private water supply servicing and discharge water as a result of dewatering activities</li> <li>• Identify impacts to nearby receiving surface waters (wetlands, watercourses or other significant features) and environmental features</li> <li>• Temporary (during construction) and permanent (post-construction) dewatering, if required</li> </ul>	
5.0	<p><b>Water Balance Analysis</b></p> <ul style="list-style-type: none"> <li>• Obtain precipitation values from a reliable source such as</li> </ul>	

	<p>Environment Canada Meteorological Services for the area (utilize closest station with adequate data)</p> <ul style="list-style-type: none"> <li>• Estimate of local values for major water balance components (evapotranspiration, surplus, runoff, and infiltration) for pre-development, post-development and post-development with mitigation conditions</li> <li>• Calculations of impervious areas that reflect actual conditions based on the proposed site plan or a reasonable range of impervious areas used in those cases where only a conceptual development plan is provided</li> <li>• Runoff coefficients consistent with generally accepted numbers</li> <li>• The water balance is required to take into account the changes to grading / topography and land cover</li> <li>• Grain size analysis for both the fill material and on-site soils to confirm fill material is similar to existing soil conditions (maybe recommended).</li> <li>• Appropriate catchments should be used within the analysis (i.e. delineate catchments based on drainage, grades, vegetation, soils and show how infiltration and runoff will change within these zones for both pre- and post-development).</li> <li>• All calculations should be provided in a table format which clearly demonstrates that inputs (precipitation, additional runoff, water from municipal wells, etc.) are equal to outputs (i.e. infiltration, runoff, water use)</li> </ul>	
6.0	<p><b>Mitigation Measures</b></p> <ul style="list-style-type: none"> <li>• Maintenance of Infiltration / Recharge</li> <li>• Maintenance of Groundwater Quality</li> <li>• Monitoring Program</li> <li>• Contingency Plans (ensure consistency)</li> <li>• The extent of the negative impact</li> <li>• Details of the existing or pre-construction state of all the infrastructure, City sewage works and natural environment within the affected zone</li> </ul>	
7.0	<p><b>Conclusions &amp; Recommendations</b></p>	

**10) Noise Study**

The submission outlines for a Noise Study is included in Section 'O' (Attachment 'F') of Design Criteria.

**11) Transportation Impact Study (TIS)**

The submission outlines for **TIS** includes, but not limited to, the following:

<b>Section</b>	<b>Description</b>	<b>Page No.</b>
1.0	<b>Executive Summary</b>	
2.0	<b>Introduction</b> <ul style="list-style-type: none"> <li>• Project Description</li> <li>• Application Type</li> <li>• All Relevant Information &amp; Statistics about the Subject Site</li> </ul>	
3.0	<b>Scope of Work and Study Assumptions</b> <ul style="list-style-type: none"> <li>• Study Area</li> <li>• Study Horizon(s)</li> <li>• Analysis Periods</li> <li>• Level of Service Analysis Methodology</li> </ul>	
4.0	<b>Existing Conditions</b> <ul style="list-style-type: none"> <li>• Site and Area Description</li> <li>• Existing Transportation Network (Road, Active Transportation, Transit)</li> <li>• Existing Traffic Data / Volumes</li> <li>• Existing Level of Service Analysis (Auto, Pedestrian, Bicycle and Transit mode performances)</li> </ul>	
5.0	<b>Future Background Conditions</b> <ul style="list-style-type: none"> <li>• Planned Transportation Improvements</li> <li>• Background Traffic Forecast                             <ul style="list-style-type: none"> <li>➢ Traffic Growth</li> <li>➢ Other Area Developments</li> </ul> </li> <li>• Background Traffic Level of Service Analysis (Auto, Pedestrian, Bicycle, and Transit mode performances)</li> </ul>	
6.0	<b>Proposed Development</b> <ul style="list-style-type: none"> <li>• Site Plan</li> <li>• Proposed Transportation Improvements (road network, active transportation network, site accesses, traffic control, parking, etc.)</li> <li>• Vehicular Trip Generation</li> <li>• Non-Auto Trip Generation</li> <li>• Trip Distribution and Assignment</li> </ul>	
7.0	<b>Future Total Traffic Conditions</b> <ul style="list-style-type: none"> <li>• Future Total Traffic Forecast</li> <li>• Future Total Traffic Level of Service Analysis (Auto, Pedestrian, Bicycle and Transit mode performances)</li> <li>• Recommended Improvements</li> </ul>	
8.0	<b>Site Circulation Review</b>	
9.0	<b>Transportation Demand Management</b> <ul style="list-style-type: none"> <li>• Proposed soft and hard TDM strategies (including responsibility and cost estimate)</li> <li>• TDM Plan</li> </ul>	
10.0	<b>Parking Assessment</b> <ul style="list-style-type: none"> <li>• By-law Requirement</li> <li>• Proposed Parking Supply</li> <li>• Parking Justification Study (if required)</li> </ul>	
11.0	<b>Conclusions &amp; Recommendations</b>	



**12) Internal Functional Traffic Design Study (IFTDS)**

The submission outlines for **IFTDS** includes, but not limited to, the following:

<b>Section</b>	<b>Description</b>	<b>Page No.</b>
1.0	<b>Introduction</b> <ul style="list-style-type: none"> <li>• Site Description</li> <li>• Reference Reports</li> </ul>	
2.0	<b>Development Context</b> <ul style="list-style-type: none"> <li>• Site Location</li> <li>• Proposed Land Uses and Phasing</li> </ul>	
3.0	<b>Total Traffic Conditions</b> <ul style="list-style-type: none"> <li>• Future Traffic Volumes</li> <li>• Total Traffic Intersection operations</li> </ul>	
4.0	<b>Road Classification, Right-of-Way, and Cross-Sections</b> <ul style="list-style-type: none"> <li>• Non-Auto Facilities                             <ul style="list-style-type: none"> <li>➤ Sidewalks</li> <li>➤ Cycling Facilities</li> </ul> </li> <li>• On-Street Parking</li> <li>• Proposed Road Network and Cross-Sections                             <ul style="list-style-type: none"> <li>➤ Arterial Roads</li> <li>➤ Major and Minor Collector Roads</li> <li>➤ Local Roads</li> <li>➤ Laneways</li> </ul> </li> </ul>	
5.0	<b>Vertical Curves, Horizontal Curves, and Sight Distances</b> <ul style="list-style-type: none"> <li>• Vertical Curves</li> <li>• Horizontal Curves</li> <li>• Sight Distances</li> </ul>	
6.0	<b>Intersection Design Requirements</b> <ul style="list-style-type: none"> <li>• Intersection Lane Configuration</li> <li>• Turning Lanes                             <ul style="list-style-type: none"> <li>➤ Storage and Taper Lengths</li> <li>➤ Cycling and Pedestrian Treatments</li> </ul> </li> <li>• Intersection Spacing</li> <li>• Intersection Angle</li> <li>• Design Vehicles                             <ul style="list-style-type: none"> <li>➤ Snowplow Vehicles</li> <li>➤ Garbage Trucks</li> <li>➤ Emergency Vehicles</li> <li>➤ Bus</li> <li>➤ Heavy Vehicles</li> </ul> </li> <li>• Traffic Controls / Roundabout Design</li> <li>• Corner Rounding / Daylight Triangle</li> <li>• Curb Radii</li> <li>• Elbow Design</li> </ul>	
7.0	<b>Transit Service</b> <ul style="list-style-type: none"> <li>• Existing Transit Routes</li> <li>• Future Transit Service / Potential Routes</li> <li>• Bus Stop Locations</li> </ul>	

8.0	<b>Transportation Functional Design Plan</b>	
9.0	<b>Pavement Markings and Signage Plan</b>	
<b>Model Parameters</b>	<p>All models submitted to the City of Markham for review must include a summary table at the front of the modeling section presenting all relevant assumptions, input and output files in addition to the following:</p> <ul style="list-style-type: none"> <li>• A schematic flow diagram of the model must be included. The schematic and information must be consistent with other minor and major system diagrams / drawings provided in the report.</li> <li>• Table summarizing pre and post development catchment input parameters (i.e. catchment number, area, percent impervious and CN value, etc.)</li> <li>• Table summarizing stage, storage and discharge characteristics of the facility.</li> <li>• Table summarizing pre and post development peak flows and storage volumes based on output from hydrologic modeling or comparison to volumes and target peak flows identified in any MESP</li> <li>• Table to summarize and compare required permanent pool and extended detention storage requirements to volumes provided in the facility</li> <li>• Table summarizing calculation for the major (100-Year) and minor (5-Year) flow systems. The format of the storm sewer sheets must conform to the City's standard sheets provided in Section 'E'.</li> <li>• Table to compare calculated 100-Year hydraulic grade line elevations (plus specified freeboard) within storm sewer system to estimated underside of basement floor slab elevations</li> </ul>	