

Volume 3: Drawing and Report Requirements

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1 Purpose

This Volume provides the City's expectations for drawings and reports and ensures a level of consistency across submissions to the City.

2 Submission Requirements

All electronic drawing files in PDF or DWG format shall be submitted directly to the representative in Engineering Services Division of the IPPW Department.

All hardcopy drawing submissions may be delivered or mailed to the following address:

City Of Waterloo Integrated Planning and Public Works
100 Regina Street South
PO Box 337, Station Waterloo
Waterloo, Ontario N2J 4A8

3 Drawing Standards

3.1 Quality

All prints of drawings and information shall be neat, legible, and consistent with professional standards.

- All drawings must be printed on bond or greater quality
- All large format hard copies shall be folded to 8.5" x 11"
- Electronic copies of all drawings should be submitted in full-scale PDF format

3.2 Dimensions

- Drawings shall generally measure 610 mm x 914 mm (24 inches x 36 inches) with borders set at a minimum of 13 mm (0.5 inches) at top, right and bottom, 30mm (1.5") at left. Other paper sizes may be considered for use at the discretion of the City of Waterloo.

3.3 Scale

Standard scales to be used are 1:100, 1:250, 1:500 and their factors of 10. Refer to Table V3-1 below for recommended drawing scales:

TABLE V3-1: APPROPRIATE DRAWING SCALES

Drawing	Site Plan	Subdivision
Overall Servicing Plans	1:1000	1:1000
Plan/Profile for New Construction	1:500 Horizontal 1:50 Vertical	1:500 Horizontal 1:50 Vertical
Plan/Profile for Reconstruction	1:250 Horizontal 1:50 Vertical	1:200 Horizontal 1:50 Vertical

Lot Grading Plan	1:500	1:500
Erosion Control Works Plan	1:500 or 1:1000	1:500 or 1:1000
Stormwater Management Facility Plan	1:500	1:500
Landscape Plan	1:250	1:250 or 1:500
Vegetation Management Plan	1: 250 or 1:500 (to match grading plan)	1:500 or 1:1000 (to match grading plan)

3.4 CAD Drawing Standards

All plans must be submitted using 'real world' coordinates based on a 6 Universal Transverse Mercator Projection, North American Datum 1983 (NAD 83).

The City of Waterloo Engineering Services department has City CTB and DWT files available for use on City of Waterloo projects, upon request.

Contact Engineering Infrastructure for the design template for road reconstruction projects

4 Drawing Requirements

4.1 Requirements for All Drawings

- Title Block
- North Arrow
- Construction North, if required
- Preferred orientation of plans is such that the north arrow generally points to the top of drawing or to the right
- Legend
- Graphic bar scale
- Existing and proposed easements
- Property boundaries
- Street names labelled clearly
- Location of all utilities
- Surveyed and indicated Right of Way
- Geodetic Benchmark with location and elevation
- Topographic survey information including date, name and contact information of surveyor
- Existing and proposed lot lines, numbers and blocks (use dashed line for preliminary and solid lines for final lot lines) and external property boundaries including survey information
- All existing buildings on adjacent properties
- Municipal address for each property adjacent to work area
- Depict centre line chainages increasing from left to right whenever possible
- Regional / Regulatory flood line on all plans, if applicable

4.1.1 Subdivision

- All proposed above ground and underground services on the subject property and within the municipal road allowance, fronting the property
- Location of future sidewalks, hydrants, utility poles, signs, storm and sanitary sewers, infiltration galleries, water and gas mains, MH, CB, curbs and gutter, etc.

4.2 Title Block

- As per City's Standard Drawing CW-101
- Project name and municipal address
- Name, address, and phone number of the Consultant and Developer where applicable
- Consultant Logo
- All applicable reference numbers
- Identification number if applicable (assigned by Engineering Services Staff)
- Key Plan indicating the location of the work
- Revision table for the last six revisions (as applicable) complete with:
 - Revision number, date, and initials of the originator
 - Purpose for issuing the drawing
 - Submission description and date submitted i.e., 1st Submission, 2nd Submission, etc.
- Name or initials of individuals who prepared and checked the plans
- Drawing title
- Drawing number if applicable (assigned by Engineering Services Staff)
- Drawing scale (metric)
- Location for seal and signature by a qualified professional

4.2.1 Capital Projects

- City of Waterloo Logo
- City of Waterloo standard title block

4.3 Cover Sheet

- The City's Project Manager will provide current cover sheet as needed
- Project name and municipal address - please contact City of Waterloo Building Standards Division if the municipal address is not known
- Name and address of the Developer
- Name, address and phone number of the Consultant
- All applicable reference numbers
- Key Plan indicating the location of the proposed development
- Index to each drawing constituting the complete set indicating drawing number and title
- Submission description and date submitted i.e., 1st Submission, 2nd Submission, etc.

4.4 Site Legal Reference Plan

- All legal reference plans are to be submitted by a licensed Ontario Land Surveyor (OLS)
- Drawing shall meet the minimum standards dictated by the profession, including but not limited to:
 - Legal property description
 - Survey information including date, name and contact information of surveyor
 - Property lines and all applicable bearings and distances of each property line
 - Existing and proposed lot lines, numbers and blocks (use dashed line for preliminary and solid lines for final lot lines) and external property boundaries including survey information

- Proposed approximate individual lot lines for freehold townhouses

4.5 Existing Conditions and Removals Plan

- Existing contours and spot elevations in Meters Above Sea Level
- Existing site conditions including property boundaries, structures, site services, adjacent and internal roadways, vegetation, and site furniture
- Items to be removed to facilitate development
- Service and utility disconnections and relocations
- Location of all existing utilities and underground services (gas, hydro, telecommunications within the municipal ROW and any adjacent easements)
- Direction of flow for all existing and proposed sewers shown in plan view

4.6 Erosion Control Plan

- Locations and dimensions of all proposed land disturbing activities
- Locations and dimensions of all temporary soil or dirt stockpiles
- Locations and dimensions of all construction site management control measures necessary to meet the requirements of Site Alteration By-law No 10-066 (such as check dams, filter fabric fences, staked straw bales, diversion dikes, sedimentation basins, etc.). Control measures shall be sized appropriately for the drainage area, slope length and site gradient contributing to each control measure
- Include a schedule of anticipated starting and completion date of each land disturbing or land developing activity including the installation of construction site management control measures needed to meet the requirements of the site alteration by-law
- Show details for all types of erosion protection measures during and post construction complete with detailed implementation notes. Should works be constructed in phases, Erosion Control Plans shall be revised to reflect staging so as to continue to provide adequate protection.
- Show the location of all tree protection fencing in accordance with Vegetation Management Plan and coordinate ECS measures where locations coincide
- Notes regarding control measure maintenance and inspection requirements
- Location of the construction entrance. A mud mat must be placed at the construction entrance to minimize sediment being tracked off site.
- Provide provisions for an emergency
- Construction haul route
- Location of construction parking
- Location where the crane will be situated, if required
- Location of the contractor's trailer and provisions for hydro and water
- Material storage
- Details for construction sign complete with address and contractor Emergency Access
- The perimeter of subdivision developments shall have heavy duty sediment control fencing per OPSD 219.131.

4.7 Conceptual Workspace Management Plan

When a proposed development is going through the Site Plan and Engineering Acceptance processes, it is not uncommon that a general contractor has not been chosen yet. The purpose

of having the engineering consultant put together a Conceptual Workspace Management Plan (CWMP) is to ensure that construction staging and planning is considered early on in the process.

The CWMP serves as an opportunity for the design team and the City to identify any special constraints or considerations for the development. These items are to be identified on the CWMP along with the applicable items on the Conceptual Workspace and Workspace Management Plans Checklist.

The intent is this plan will form part of the tender drawings and ensure the contractor is aware of what their requirements are early on. This “conceptual” plan is intended to provide a template and provide direction to the general contractor to create their Workspace Management Plan, which is required prior to the issuance of the Building Permit.

For a complete list of the drawing requirements refer to Appendix V3-A for a copy of the Conceptual Workspace and Workspace Management Plans Checklist.

4.8 Workspace Management Plan

Prior to Final Engineering Acceptance and issuance of the Building Permit, a final Workspace Management Plan must be submitted to the City’s Development Engineering Representative for review and acceptance.

The selected general contractor is to use the Conceptual Workspace Management Plan along with the Conceptual Workspace and Workspace Management Plans Checklist to complete their Workspace Management Plan.

For a complete list of the drawing requirements refer to Appendix V3-A for a copy of the Conceptual Workspace and Workspace Management Plans Checklist.

4.9 Construction Traffic Plan

- Details on the management of construction traffic using municipal highways
- Indicate approved access routes for construction traffic with the intention of directing traffic away from residential streets
- Show the emergency routes and access routes
- Identify all parking locations for construction vehicles
- Plan should be prepared by the contractor and reviewed prior to construction
- Plan may form part of the road occupancy permit, if required

4.10 Construction Detour Plan

The Plan details safe pedestrian/cyclist movement through or alongside active construction zones. Three important principles must be considered in the development of an appropriate plan:

- Separate pedestrians/cyclists from conflicts with work site vehicles, equipment and operations.
- Separate pedestrians/cyclists from conflicts with the main flow of vehicular traffic moving through, around or alongside the work site.
- Provide pedestrians/cyclists with a safe, accessible and convenient route that duplicates as nearly as possible the most desirable characteristics of sidewalks or pathways.

Completely closing the sidewalk/pathway and forcing pedestrians/cyclists to use the opposite side of the street should be considered as a last resort. The following are some details to be considered when designing for pedestrians through work zones:

- Where pedestrian/cyclist volumes are high, a wider temporary sidewalk/temporary route is necessary
- Provide detour for trail closures
- Where additional materials are required to create the temporary route, pedestrian/cyclist volume and the anticipated length of the construction period should be considered when making selections. Typical materials include properly compacted gravel, asphalt, concrete or steel plates. Slip resistance should be considered when selecting a temporary surface material.
- During winter months, temporary sidewalks/routes must be maintained to a 1.8 m width
- For long duration construction sites where there is danger of falling objects and debris from overhead work, a lit canopied walkway is required
- The designated route/walkway must not be used for storage of construction equipment, materials, or vehicles. Furthermore, stopping or parking of work vehicles or delivery vehicles alongside the pedestrian pathway/walkway should be discouraged as this may indirectly encourage the movement of workers, materials and equipment across the pedestrian path of travel.
- Schools in close proximity to projects should be notified in the preconstruction letters and kept informed of progress.
- Protective barriers may be needed to prevent pedestrians from entering into the work site
- Consider the wide range of needs (various levels of mobility, visual and hearing impairments, etc.)

4.10.1 Drawing Requirements

- Clearly mark objects that are a potential trip hazard
- Ensure that there are no objects protruding into the walkway zone (i.e., from scaffolding, signs etc.)
- Crossings of the pedestrian route/walkway should be minimized
- Where construction accesses must cross the pedestrian path of travel, signals, traffic control persons or police officers should be considered as a means to control movements

4.10.2 Protective Barriers

- Protective barriers should be sturdy and non-climbable.
- High fencing (2.4 m or greater) should be installed in areas of high pedestrian activity
- Simple pedestrian/cyclist barricades to separate pedestrians/cyclist from the work area are acceptable so long as they are not also being used for vehicular traffic control, then traffic cones, markers, flexible drums, barricades or barriers would be required as per OTM Book 7.

4.10.3 Temporary Sidewalk / Route

- Should be clearly identified, safe, accessible and convenient
- Minimum width of 1.5 m (1.8 m is preferred)
- Protect or separate from adjacent vehicular traffic
- Shall be as level as possible, and free from pedestrian/cyclist hazards such as holes, debris, obstacles, abrupt changes in grade, standing water, and mud

4.10.4 Signage

- Temporary conditions should be signed using standard orange-on-black warning signage
- The signage should indicate:
 - type of closure or restriction
 - detour routes (with maps) or actions such as "keep to left/right" or "proceed with caution"
 - length of trail affected
 - expected duration of the closure
- Provide signage at trail access points and closest decision before the closest decision point in advance of the closure, or at the beginning of any designated detour route
- Confirmation-type signage along the detour route is recommended if the detour is over 1.0 km or passes other decision points
- If it is not possible to accommodate the pedestrian/cyclist route on the same side of the street as the construction, then pedestrians/cyclists should be directed to use the opposite side of the street
 - In this case, signing should be placed in advance of the intersections closest to either end of the construction zone, allowing pedestrians/cyclists to cross at an intersection prior to entering the construction zone

4.10.5 Standard Notes

- Place signs as soon as the conditions become known, or in the case of planned closures signs should be placed a minimum of two weeks before the closure
- If the signs apply to only part of the day or are otherwise intermittent, this information should be included, and covering the signs when the conditions of closure are not present should be considered
- Daily inspections of the pedestrian route/walkway are required. Modifications should be made to adapt to changes in the nature of the construction site, to further direct pedestrian movement where the route is not functioning as planned or where unanticipated conflict points are observed.
- Remove signs immediately upon re-opening the trail/sidewalk

4.11 Salt Management Plan

- Designers are expected to apply best practices of winter salt management to minimize ice conditions on the site
- Show winter maintenance procedures such as the quantity and type of snow/ice melting materials used
- Show the storage and handling of these materials
- Show the storage of snow cleared from common facilities such as the parking areas
- Salt management procedures shall adhere to the Region of Waterloo 'Smart about Salt' program requirements.

4.12 Stormwater Management Plan (SWM)

- Show the existing drainage pattern, including overland flow routes and the existing storm system if applicable. Illustrate the major and minor overland flow pattern with arrows.
- Include existing topographic contours
- Show contributing external drainage areas

- Show the proposed drainage pattern for both overland flow and the storm sewer system
- Identify and detail all stormwater quantity and quality management measures; i.e., roof drain, catchbasin restrictors, oil-grit separators etc.
- Indicate ponding area and depth for the 5-year and 100-year storm events
- Show number of roof drains required on a building and/or show all downspout locations

4.13 Grading Plan

The grading, stormwater management and landscape designs are interconnected. It is therefore required that the site grading and the stormwater management designs are completed by the same engineering firm in coordination with the Landscape Architect.

- Indicate proposed elevations in metres above sea level at pertinent locations, including the top and bottom of curbs
- Indicate proposed slopes with directional arrows
- Clearly indicate drainage splits
- Show existing contour information at 0.5 m intervals for the site and surrounding properties for a minimum of 5 m from the property line, or further if required to determine external drainage areas draining onto the property.
- Include existing spot elevations at all property boundaries, match in points, and on adjacent lands to clearly indicate drainage patterns
- Clearly present irregular or steep topography
- Show all required information for proposed retaining walls including but not limited to spot elevations of top and bottom of retaining wall, location, length, height, and type of proposed walls
- Show all required accessibility ramps including all proposed slopes and indicate locations and lengths of drop curb locations or areas of ramped asphalt
- Indicate all site furniture including transformers complete with concrete pad elevations and required Enova easements
- Indicate Finished Floor Elevation (FFE) and Basement Finished Floor Elevation(s) (BFFE) (if applicable)
- Indicate the location of the gas meter and easement, if required
- Show existing public roadway centerline elevation (as surveyed)
- Show pertinent existing road elevations
- Show all existing and / or proposed easements.
- Show all trees, buildings, hydrants, utilities etc. on the subject property, abutting street(s) and within 6 m of the property line on abutting properties.
- Show phasing limits (if applicable)
- Indicate proposed locations for snow removal
- Indicate location of swales
- Indicate the direction of major overland flow route
- Indicates the limits of underground parking structures, if required
- Show ramps required for underground parking and slopes on the ramp including transitions, if required

4.14 Dewatering Plan

If groundwater management is required to facilitate construction, the engineer must provide a proposed method of dewatering to the Engineering Services Division. The dewatering plan shall

be based on a hydrogeological investigation of the site completed to the satisfaction of the Director of Engineering Services and shall include but is not limited to the following:

- Methods to ensure compliance with Section 34 of the Ontario Water Resource Act (OWRA), PTTW or EASR Approval
- Water quality criteria must meet Regional Sewer Use By-law 90-1
- Documentation of consultation with the Region's Water Services Department
- A Dewatering Discharge Plan illustrating locations of well points/sumps and amount of water permitted to take
- Storm sewer capacity confirmation (should be required if discharging to storm sewer to verify it can accommodate the discharge)
- Contingency plan
- Standard Notes:
 - If groundwater is encountered during construction contractor to provide proposed method of dewatering to the City
 - If the City storm sewer will be used for the discharge of the groundwater the following conditions will apply:
 - Prior to any discharge the City of Waterloo is provided with a clearance letter from the Regional Municipality of Waterloo stating that the proposed discharge meets the requirements of Regional Sewer-use By-law 1-90
 - If the volume of groundwater to be pumped exceeds 50,000 l/day, a valid site-specific certificate of approval for the proposed discharge issued by the Ontario Ministry of Environment, Conservations and Parks (MECP) is required prior to pumping
 - The location and method of connection to the City's storm sewer must be approved by the Director of the City's Water Services Division and Waterloo's Public Works Services Department
 - At no time should the discharge of water from the site is to cause ponding, flooding, or the formation of ice on any road surfaces, sidewalks, or lands adjacent to the dewatering activities
 - The City of Waterloo may terminate or temporarily suspend, without notice or cost to the City, the authorization for this storm sewer use should it be deemed necessary for any reason by the general manager of public works services or his designate
 - The name and contact information of the dewatering contractor must be provided by the City

The City's standard policy is that a formal dewatering plan for any construction dewatering activity that contemplates the use of City sewers is submitted to City Engineering Services for review and approval. Use of the sewer for such purposes will not be permitted without the following information:

- A letter requesting discharge to the municipal storm sewer system.
- A formal dewatering plans.
- A copy of the 'Application for Permit to Take Water' issued by MECP.
- Method of dewatering.
- Anticipated date the system will be installed and length of time dewatering.
- Confirmation of the intended discharge point.
- Confirmation of the discharge rate and daily total maximum, as well as duration and pumping times.

- Emergency Plan including backup system and contact in the event the pumping must be shut down/reduced.
- Confirmation the storm sewer has the capacity to convey the discharge. A capacity analysis may be required.
- Groundwater sampling and analysis and confirming compliance with the Regional Municipality of Waterloo Sewer Use By-Law 1-90 for water quality.
- On-Site water quality unit with monitoring and maintenance plan, if required.
- Measures in place to reduce sediment entering into the storm sewer.
- Monitoring plan including measures to ensure contaminants are not conveyed to the storm sewer. There is known petroleum hydrocarbon contamination at the intersection of Columbia and Phillip Streets which has a potential to migrate to the dewatering point, therefore; at a minimum, monitoring for COC's must be in place.

Once the City is satisfied with the above noted information, a letter of consent from the City's Engineering Services will be provided.

4.15 Servicing Plan

- Direction of flow for all existing and proposed sewers shown in plan view
- Engineering plans that do not include consideration of actual site conditions will not be processed
- Indicate all municipal servicing including existing conditions to remain and all proposed conditions
- Illustrate the complete stormwater design including infrastructure and control measures
- Indicate that "all service connections to the property line must be installed to the City's satisfaction prior to any internal servicing works"
- Show the locations, invert elevations in metres above sea level, materials, lengths and slopes of all existing and proposed services
- Provide a detail of temporary and permanent water connections on the plan
- Provide top of pipe and bottom of pipe elevations at all utility, sewer, and watermain crossings
- Indicate where shallow buried insulation is required
- Show, dimension, and label all existing and proposed easements
- Overall servicing plans shall depict the entire site in relation to adjacent properties including municipal roads, and indicate both internal and external servicing requirements
- The following information must be indicated on all overall servicing plans:
 - All existing services, utilities and abutting property limits
 - All proposed services and site furniture
 - Existing buildings with labels for those to be demolished

4.15.1 Site Plan

- Show all existing services within abutting right-of-way including invert elevations, sizes and materials as surveyed. Indicate date of survey for the services, and who conducted the survey
- Show water meter location and remote location (if applicable)
- Indicate on plans that private hydrants shall be painted red
- Show all roof drains required on a building and indicate how the roof will drain. Show all downspouts.

4.15.2 Subdivision

- Show water meter location and remote location (if applicable)

4.16 Storm Drainage Area Plan

- Indicate the project area divided into individual drainage areas and include the following information for each:
 - a) the catchment number
 - b) the drainage area in hectares
 - c) the run-off coefficient
- Provide overland flow routes, external drainage areas (ha), all storm sewers including maintenance holes (MH), catch basins (CB), structure names/IDs, and pipe information (size, length, and slope)
- Clearly indicate how external drainage is to be accommodated within the project limits and provide a drawing that clearly details the full extent of the anticipated drainage within the project limits
- When subdivision is shedding flows out to adjacent properties a drawing, or a note shall be provided to explain how these flows shall be accommodated

4.16.1 Subdivision

- When a proposed temporary or permanent condition is shedding flows out to adjacent properties, a drawing and/or note shall be provided to explain how these flows shall be accommodated. The above requirements shall be met for the temporary conditions as well.

4.17 Sanitary Drainage Area Plan

- Show the project area divided into individual drainage areas and include the following information for each:
 - a) the drainage area in hectares
 - b) the catchment number
 - c) For residential: the population, For Commercial/ Industrial: the unit flow per hectare
- Include all external drainage areas (ha), peak flows (m³/s) and all existing and proposed sanitary sewers including MHs with structure names/IDs, and pipe information (size, length, and slope)
- Clearly indicate how external drainage is to be accommodated within project limits, provide a drawing that clearly details the full extent of the anticipated drainage

4.18 Watermain Commissioning Plan

- Plan must be prepared and provided by the contractor to City staff for review to ensure that all testing and sampling requirements for new watermain installation are satisfied
- Plan provides outline of the acceptable procedures required for installation and testing of all new mains and services as required by the Safe Drinking Water Act and in accordance with the requirements of the Drinking Water Works Permit
- Refer to DGSSMS for an example of a general Watermain Commissioning Plan and the criteria requirement

- A Redline Drawing identifying any modifications that differ from the For-Construction set of drawings, and including measurements, swing ties, must be submitted before the final connection. Redline drawings must be submitted digitally (PDF) to the Project Manager and the Manager of Water Operations and Maintenance. Final connection will not be made until the redline drawings have been submitted.

4.19 Plan & Profile Drawing

- Show match lines and chainages, at the start and end of each profile drawing and at the limits of construction. All intersections shall be labeled, and centerline chainages and elevations noted at all intersecting roads
- Show all service laterals (sanitary, storm and water)
- Include the material and diameter individually for every pipe (sanitary, storm and water)
- Number all maintenance holes and catchbasin maintenance holes and append the sanitary maintenance hole numbers with an A. City standard nomenclature should be included as soon as it is available for sanitary and storm structures and pipes, and it must be included on all “for construction” and “as-recorded” drawings. Identification numbers to be assigned by staff from the Engineering Services Department of the City of Waterloo
- Show all existing and proposed sewer lengths, sizes, types, slopes, pipe inverts (at catch basin, maintenance holes, etc.). Indicate the pipe slopes (in percentage) and top of casting elevation to two and three decimal places respectively
- Label diameter of all maintenance holes and reference all maintenance holes to an OPSD number and revision date in the notes
- Show all non-standard maintenance hole details on the plan view at a scale ratio of 1:50
- An elevation for the sanitary service at the property line must be shown whenever the sanitary sewer in the street has less than 3.0 m cover
- Show all existing and proposed watermain sizes, valves and hydrants and bends
- Show road centerline stations at every 20 or 25 m in plan view. Indicate road elevations at these stations in profile view
- For each tangential segment of profile, show the following information in the profile view:
 - a) Slope of section expressed as a percent ($\#.\#\%$)
 - b) Slope arrow indicating the direction of the flow of water
 - c) Label elevations at a minimum of 10 m intervals along tangent section
- For each vertical curve, show the following information in the profile view:
- PVI Station & Elevation
 - a) L, Length of Curve (m)
 - b) K value (including $K=0$)
 - c) Apex station and elevation
 - d) Beginning and end of the vertical curve (BVC & EVC elevations & station)
 - e) Label elevations at 5 m intervals along curve
- For each horizontal curve, show the following information, measured along the centerline in the plan view:
- BC & EC station
 - a) Radius
 - b) Arc length
 - c) Tangent length
 - d) Super elevation limits and slopes
- All existing and proposed services, curbs and sidewalks, pavement and Right of Way width, etc. must be dimensioned within the street line. Show elevations on these existing

works where they abut or connect to proposed new works. Provide a standard cross-section drawing number in the notes

4.19.1 Subdivision

- Show match lines and chainages at all subdivision limits, at the start and end of each profile drawing and at the limits of construction. All intersections shall be labeled, and centerline chainages and elevations noted
- Label stations at all standard iron bars

4.19.2 Standard Notes

Include the following City of Waterloo standard notes on each plan/profile drawing:

GENERAL NOTES

- The position of pole lines, conduits, watermains, sewers and other utilities, features and structures are not necessarily where shown on the contract drawings and where shown, the accuracy of the positions is not guaranteed. Before starting construction, the contractor shall inform him/herself of the exact location of such utilities and structures.
- All dimensions shall be checked by the contractor and inconsistencies reported to the project engineer.
- All units are in metres unless otherwise noted.
- All work reported in accordance with the latest relevant sections of the OPSDs, OPSSs, Ontario Building Code and the requirements of the City of Waterloo and the Region of Waterloo.
- All disturbed areas restored to original conditions or better in accordance with City of Waterloo and Region of Waterloo drawings/specifications.

SANITARY, STORM AND WATER SERVICING

- All sewers, watermains, appurtenances and services shall be installed in accordance with the DGSSMS.
- Minimum 2.5m clear horizontal and 0.5m clear vertical separation from watermain to all sewers at all times. Clear separation is measured from outside of pipe wall to outside of pipe wall.

PAVEMENT CONSTRUCTION

- _____ mm HL 3 Surface Asphalt compacted to 97 % Marshall
- _____ mm HL 8 Base Asphalt compacted to 97 % Marshall
- _____ mm Granular 'A' compacted to 100 % SPMDD as per OPSS 501
- _____ mm Granular 'B' compacted to 100 % SPMDD as per OPSS 501
- Standard curb radii at intersections to be 6.0 m minimum, unless otherwise noted. Where larger radii are required at intersections with Regional Roads, or to accommodate transit, school buses or fire vehicles, these shall be noted on the drawings.
- Geotechnical investigation performed by _____. Dated _____. Report # _____.

4.20 Lot Development Plans

- Lot Development Plans are required for each lot within each subdivision
- The maximum drawing size is 11" x 17"

- Include the following information in the title block of each Lot Development Plan:
- Municipal Address
 - a) Lot Number
 - b) Registered Plan Number or Reference Plan Number
 - c) Builders name and address
 - d) Prepared by - Company Name, Person's Name and Date
 - e) Approved by - Company Name, Person's Name and Date
 - f) Drawing Scale & Scale Bar
 - g) Geodetic Benchmark # and Elevation
- Show one lot per drawing
- Label the true dimensions of the lot, building and setbacks to all property lines. Also show the dimensions and location of the driveway and any retaining walls (where applicable)
- Show abutting streets, curbs, sidewalks, walkways and easements
- Show the location of services to the house (storm, sanitary, water). If available also show the proposed utility locations (Gas, Hydro, Bell, Cable, and telecommunications)
- Where applicable, show the location and sizing/design calculations of infiltration galleries
- Label the top of foundation grade and finished basement floor grade. If a step foundation is required, label all foundation grades
- Show the proposed grades at all property corners and drainage splits as per the overall subdivision grading plan
- Show the proposed grades at all building corners (refer to lot grading types Standard Drawings)
- Show the proposed driveway elevation at the house and indicate the slope to the street. Minimum and maximum slopes as per Standard Drawings. Where the driveway is adjacent to the house the driveway is to have a minimum crossfall of 2.0 % away from the house
- Where the driveway is close to the property line, show additional driveway grades and property line grades. These grades must be compatible with the side-yard swales
- Label slopes and grades along swale inverts
- Use drainage arrows to indicate flow directions
- If grading on the adjacent lot is completed (sodded/seeded), show the pertinent existing grades on that lot
- For all lots with existing trees attach the Tree Data Sheet to the Lot Development Plan
- Show locations of all downspouts and window wells
- For all lots with existing trees show the additional following information on the Lot Development Plan:
- Existing lot grades in the vicinity of the trees
 - a) Cut and fill areas if required
 - b) Location of proposed topsoil stockpiles where applicable
 - c) Location and extent of woodlot area, including clearly marked buffer areas
 - d) Location and number of trees for preservation and removal according to the Vegetation Management Plan
 - e) Location of Tree Protection Fencing

4.21 Landscape Plans

4.21.1 Site Plan

Refer to Vegetation Management and Landscape Plan Checklist (Appendix V7-A).

4.21.2 Subdivision

4.21.2.1 Submission Format Requirements

For subsequent submissions, include a cover letter outlining the submission content and advising of specific changes to the plan(s).

All formal submissions are to be forwarded to the Development Engineering Landscape Architect. Final and As-Recorded drawing submissions shall include the seal of the Professional Landscape Architect who must be a member in good standing of the Ontario Association of Landscape Architects.

4.21.2.2 Digital Submissions

The City of Waterloo requires submission of digital files for all Final Approved and As-Recorded landscape architectural plans. Digital submission will consist of all plans approved by the City of Waterloo for park/open space development:

- Full-scale PDF files stamped and signed by the approved representative
- DWG (AutoCAD) files with an index of all layer names and contents

See Volume 2 for further information.

4.21.3 Standard Drawing Requirements:

See Sections 4.1 and 4.2 for general drawing and title block requirements.

Additional requirements for Landscape Plans to be included as information/labeled:

- source of the base information upon which the design is made should be stated so that it can be verified if discrepancies are found during construction
- legend shall be shown on all plans
- Subdivision name, T-File number, lot and block numbers
- Approved plans shall include “For Construction - Approved by the City of Waterloo” stamped on all plans in the drawing set
- Existing and proposed curbs, sidewalks, road allowances and street names
- Existing and proposed hydrants, utility poles, signs, storm and sanitary sewers, infiltration galleries, water and gas mains, MH, CB, etc. as applicable to drawing type
- Existing environmental features (e.g., woodlot, wetland) and associated buffers
- Abutting properties – Uses/Structures labeled for context
- Existing contours:
 - Dashed or broken lines at 0.5m interval, clearly marked along the perimeter of the development boundaries, at the edges of the proposed sport facilities, along drainage swales and on berms
- Proposed contours:
 - Solid lines at 0.5m intervals
 - Clearly marked along drainage swales, on berms and on proposed facilities (e.g., playgrounds/areas, sports fields, etc.)
- Spot elevation on top of curb, top of wall/bottom of wall, top of berm, etc.

- Direction of flow of all existing and proposed grade changes shown in plan view
- Sheet Match lines
- Limit of Work/Contract lines

4.21.3.1 Park/Open Space Concept Plans

In addition to the Standard Drawing Requirements noted above, the Concept Plan must accurately demonstrate that the proposed landscape development can be satisfactorily achieved on the site. Space should be allocated for grading and drainage requirements, a passive open space component, park/open space facilities, structures and/or equipment, trails/pathways, buffers and site furnishings.

4.21.3.2 Park/Open Space/Trail Grading & Layout Plans

All park/open space grading and layout plans should indicate at least the following:

- property lines
- locations of property fencing, demarcation posts and/or living fence (as applicable)
- surface drainage
- cross slopes
- drainage swales indicating direction of flow and percentage of slope
- grading adjacent to property lines
- grading on easements
- existing and proposed spot elevations
- service connections
- all existing vegetation, indicating those to be preserved
- tree preservation and protection measures
- culverts and foot bridges
- above- and below-ground utilities
- pathway systems (width and material)
- pathway lighting (if applicable)
- sports facility (including layout dimensions, location of goal posts and buffer zones)
- sports facility lighting (if applicable)
- ice rink hydro and water connections
- parking lots
- playground equipment/areas
- fencing heights and materials
- hard surface areas
- furniture and accessories
- proposed location(s) of park signage with civic address information
- Molok/garbage receptacles
- retaining/free standing walls
- sight triangles
- pre-approved and existing easements and utility services
- traffic islands
- road allowances
- traffic lights and centre medians within the road allowance
- underground services not in easements
- existing above-ground services

- environmental features (e.g., wetlands)
- adjacent trails

4.21.3.3 Street Tree/Boulevard/Park/Open Space Planting Plans

Planting plans should indicate all relevant information included above and the following:

- Proposed vegetation (deciduous and coniferous trees, shrubs, groundcover and vines, aquatic plant species, etc.)
- Plant schedule to include quantity, common and botanical name, height and spread, caliper, root condition, on centre spacing and remarks/comments
- Areas to be seeded or sodded (by type) and areas to remain undisturbed
- Proposed seed mixes
- Preservation and protection of existing vegetation
- Landscaping details and specifications

In addition to the above planting plan requirements, the following plans shall include these additional items:

4.21.3.4 Stormwater Management Area Planting Plan

- Forebay, inlet and outlet (materials, etc.)
- Maintenance access route (materials, width, etc.)
- Average water level elevation (permanent pool)
- Access routes and pathways
- Drainage flow indicating direction of flow and percentage of slope
- Shoreline, submerged and inundated planting location and schedule

4.21.3.5 Demarcation Layout and Planting Plan

- Locations of fencing, property demarcation posts, and living fence (as applicable) (See Standard Drawings)

4.21.3.6 Entrance Feature Plan

- Fencing (height, materials, installation detail, etc.), signage (materials and location) and additional features (stones/boulders, hard surfacing, etc.)
- Elevation drawing of entire feature
- Property lines
- Sight lines
- Underground services
- See City of Waterloo Entrance Features Policy approved April 1997 for further requirements

4.21.3.7 Vegetation Management Plan

- Identify locations of all existing vegetation on site. Individual tree locations must correspond with tag numbers. Locations of trees, particularly boundary trees and trees on adjacent properties must be accurate to the satisfaction of City staff.
- Identify locations of all existing vegetation located within six (6) metres of the site on adjacent private and/or public properties. Refer to the City's Street Tree Bylaw (No. 2014-078) for protection and removal requirements for boulevard trees.

- Provide a Tree Inventory Schedule, which includes species (common and botanical names), condition, trunk size (diameter at breast height), drip line/canopy size, identification tag number of the tree, minimum Tree Protection Zone, location (site, adjacent private property with address, shared boundary tree with address, public ROW, etc.), and recommendation action to indicate whether the tree is proposed to be preserved, preserved with impact, removed, or transplanted. This list should include recommendation action for existing trees identified on adjacent properties.
- Identify on the VMP existing trees proposed to be removed, preserved, preserved with impact, or transplanted. Each category noted must have individual graphic representation and must correspond with the Tree Inventory Schedule.
- Where tree preservation is proposed, provide detail(s) of Tree Protection Fencing. Staff's preference is for a 1.2m high paige wire fencing secured to 2.4 m height steel T-bar posts positioned at a maximum of 3.0m on centre and at all changes in direction. The paige wire fencing will be wired in three (3) places evenly spaced along the steel T-bar with #10 galvanized wire. Tree Protection Zone signage shall be installed on all sides of the Tree Protection Fencing. The distance between signs shall not exceed 30 meters on any one side of the fencing.
 - Where site works are expected to occur over an extended period of time, Tree Protection Fencing shall also include 150 mm diameter cedar posts with a height of 2.4 m, positioned at a maximum of 21.0 on centre along extent of tree protection fencing.
- Install tree protection fence at minimum of 1m outside of the tree drip line to delineate the required Tree Preservation Zone (TPZ).
 - In locations where space is limited and proposed work cannot be avoided, Tree Protection Fencing shall be located at the Minimum TPZ Distance, as referenced in Table V3-2 below:

TABLE V3-2: MINIMUM TREE PRESERVATION ZONE DISTANCES

Trunk Diameter (DBH at 1.4m)	Minimum TPZ Distances Required
<10 cm	1.8 m
11 – 40 cm	2.4 m
41 – 50 cm	3.0 m
51 – 60 cm	3.6 m
61 – 70 cm	4.2 m
71 – 80 cm	4.8 m
81 – 90 cm	5.4 m
91 – 100+ cm	6.0 m

- Show the minimum TPZ for all trees where the standard TPZ cannot be provided. This should be shown as a distinct line type from the dripline/canopy limit.
- A description of the extent of anticipated injury type and extent and an assessment of impact to long-term health should be clearly documented for each tree where the Minimum TPZ is provided, as provided by a qualified expert.
- Provide existing and proposed grading information
- Include the following City Standard VMP notes as applicable to the application:
 1. All existing vegetation located on site, and on adjacent properties within 6m of the property line (both private and public) have been identified on the VMP.
 2. The Location of all trees and property boundaries have been accurately located/represented on this plan. Tree ownership determination has been based on accurate tree locations, field review and property boundary information.

3. No vegetation removals may occur from the site until the issuance of the building permit. Where no building permit is required, tree removals may not occur until the time of final site plan approval (inclusive of engineering approvals).
4. All tree clearing shall be in accordance with the federal Migratory Birds Convention Act, 1994, and the provincial Endangered Species Act, 2007. Clearing activities shall be completed in accordance with all recommended bird nesting windows and the protection of Species at Risk habitat.
5. Tree Protection Fencing (TPF) shall be certified by the Consultant to be in compliance with the approved Vegetation Management Plan. Upon receipt of TPF certification and a satisfactory site inspection by an Engineering Services Landscape Representative, final approval shall be granted by City Staff prior to the commencement of any work or vegetation removals.
6. Tree preservation fence will remain installed for the duration of construction.
7. Any trees identified to be preserved that are impacted by development (further to the approved VMP plan) will be replaced with the same species or an approved alternate, to the satisfaction of the City of Waterloo, at a minimum of 70 mm caliper size for deciduous trees and a minimum 250 cm height for coniferous trees.
8. Any root and branch pruning of existing vegetation to be preserved on site shall be in conformance with current ANSI A300 Standards.
9. Every effort to preserve and protect vegetation located on adjacent properties will be undertaken during construction/site works
10. Approvals as granted by the City of Waterloo through the Site Plan approval process do not supersede any civil or common law property rights. It is the applicant/Owner's responsibility to:
 - i. determine ownership and coordinate and obtain approvals of:
 - a. Any removal of a shared boundary tree or tree located on adjacent property;
 - b. Any injury to a shared boundary tree or tree located on adjacent property;
 - c. Encroachment and access requirements;
 - ii. resolve any property disputes;
 - iii. and ensure compliance with all applicable laws.
11. Where impact/injury to preserved shared boundary trees or trees on adjacent properties has been identified the applicant agrees to provide an assessment of the impact to the long-term health of each tree, to be prepared by a qualified expert (i.e. Certified Arborist).
12. The City recommends that the Owner obtain written owner acknowledgement and approval of the required work and potential impacts where potential injury has been identified within the TPZ.
13. All trees located on shared property boundaries or on adjacent properties that are proposed to be removed (as identified on this plan or in the accompanying arborist report) will have Owner approval documented through a signed Letter of Understanding for each property to be provided.

4.22 As-Recorded Drawings

In addition to the requirements in the Region of Waterloo Design Guidelines and Supplemental Specifications for Municipal Services (DGSSMS), include the following:

- As-recorded drawings must be submitted within **three (3) months** following construction

- As-recorded drawings must be reviewed and approved by the Project Manager prior to submission to the municipality
- As-recorded drawings must be submitted in:
 - digital PDF format, stamped and signed by the approved representative; **and**
 - digital AutoCAD format
- Be scaled to the original drawing scale used at time of building permit request or issuance for construction
- Include surveyed information for all underground works approved
- City nomenclature of all structures and appurtenances
- Lengths, invert elevations and material type of all sewers
- Locations and invert elevations of all service laterals at the property line.
- Lengths, diameters and material types watermains
- Locations of all water distribution fittings, including valves, hydrants, main stops, curb stops, tees, bends, and tracer wire test boxes complete with swing ties to visible structures
- Details of all vertical watermain deflections including dimensions indicated on profile drawings
- Include the date the survey and visual inspection was performed
- Show slopes in percentage along all swale routes complete with directional arrows
- Include all modifications (i.e., decks, sidewalks, patio's, pools, raised gardens, fencing, etc.) that may affect the lot drainage patterns
- Provide adjacent lot/block numbers and fronting street name
- Include a legend that clearly indicates design and as-recorded information

4.22.1 Site Plan

- Within 30 days of the installation of the servicing works with the right of way, the Developer is required to submit a field set of as-recorded drawings to the City.
- As-recorded drawings must be submitted within three (3) months following construction of the servicing works within the right of way.
- The City will require “as-built” drawings for the final conditions of the site development located within private property and at a minimum shall include the following:
 - Include both design and “as-built” elevations for key locations. Key elevations shall be defined as all parking lot corners, split drainage points, low points (CB structures), top and bottom of embankments, drainage swales, building corners etc.
 - Top of grate and invert elevations at all sanitary and storm structures
 - Any deviations in pipe size, slope, alignment, structure locations etc.

4.22.2 Subdivision

- Include both design and “as-recorded” elevations for key locations. Key elevations shall be defined as all lot corners, split drainage points, top and bottom of all embankments, drainage swales, house corners with spot elevations in side yard swales adjacent to corresponding house corner, driveways at house and property line, any obvious low points and/or areas of settlement and in the case of Type ‘A’ lots spot elevations for the rear apron
- Show locations of all downspouts and window wells

5 Reports

5.1 Stormwater Management Report

Land development has a direct impact on the quality and quantity of stormwater runoff. Stormwater design for development within the City of Waterloo must incorporate both quality and quantity control of stormwater runoff to mitigate the impacts of development in order to protect the downstream watershed ecosystems and minimize localized flooding. Therefore, all developments within the City of Waterloo are subject to appropriate stormwater management (SWM) practices in accordance with City of Waterloo design criteria and provincial stormwater management guidelines.

The Stormwater Management Report shall include but is not limited to:

- Introduction
 - Site description
 - Site proposal
- Modelling
 - type and version of computer model used;
 - all parameters and specific simulation assumptions used (table)
- Existing SWM and Drainage Plan
 - Design criteria
 - Existing conditions
 - Downstream capacity
 - Water balance
 - Infiltration and groundwater conditions
- Proposed SWM Plan
 - Minor/major system routing
 - Model, rainfall data
 - Water quantity
 - Water quality
- Erosion and Sediment Control Plan
 - Inspection requirements
- Conclusion and recommendations
- Figures
 - Site Location
 - Subcatchment area for pre and post conditions
 - Model schematic
 - Stage-storage-discharge
 - Storage draw down graph
- Tables
 - Modelling parameters and specific simulation assumptions used
 - Rainfall data
 - Peak flow comparison – pre and post
 - Attenuate peak flow comparison – pre and post, performance of on-site facilities
 - Quantity control analysis
- Appendices
 - Engineering design drawings
 - Design calculations
 - Modelling output

- Quality control specifications/record drawings
- Sizing calculations
- Storm sewer design calculations
- Orifice rating calculations

For more information on Stormwater Management refer to Volume 6.

5.2 Geotechnical Report

A geotechnical investigation report must be submitted as part of the development design and included in the Complete Engineering Submission. The geotechnical investigation shall include at a minimum a detailed summary of the investigation procedures, subsurface soil conditions, groundwater conditions encountered at the subject site, and borehole logs. The report shall include comments and recommendations for, but not limited to, excavations and shoring, foundation design, underground parking garage design, elevator pits, site servicing including complete road design, soil characteristics in support of infiltration measures, and groundwater elevations.

The geotechnical report shall also include test results and opinion by an MECP Qualified Professional on the potential use and/or disposal of any unsuitable or contaminated materials in accordance with Ontario Regulations 153 and 347 of the Environmental Protection Act, as amended.

The geotechnical engineering report provided to the City shall include a reliance clause allowing the City to rely on the contents for the report to make development approvals.

5.3 Fire Flow Analysis Report

A Fire Flow Analysis Report must be submitted as part of the development design and included in the Complete Engineering Submission. The purpose of the Fire Flow Analysis is to demonstrate that the required fire demands for the development, including existing buildings, will not exceed the water available for fire protection from the municipal distribution system.

The Fire Flow Analysis Report shall include but is not limited to:

- Site Servicing Plan detailing the water service and its distribution across the development
- Description of the building construction materials and intended use
- Calculation of fire demands of the entire site development including new and existing buildings (summary only for sprinkler calculations)
- Details of hydrant flow test(s) including time and date of the test(s), company whom conducted the test(s), residual and pitot pressure readings, graph of results and a map / sketch of flow and residual test hydrant locations
- Use metric units (L/min, kPa)
- List of the codes, standards, guidelines used in the preparation of the report
- Calculations of what the theoretical flows and pressures will be at the proposed hydrant(s) or building(s), including all friction losses through all pipes and fittings, losses or gains due to the change in elevation, etc.
- The fire demands must be supplied by the water distribution system at a minimum pressure of 140 kPa in the main at the fire hydrant (municipal or private) to provide fire protection.

6 Cost Estimates

6.1 Capital Projects

- Deliverables at each milestone submission:
 - Construction Cost estimate to -20% to +30% accuracy at 30% Design
 - Construction Cost estimate to -15% to +20% accuracy at 60% Design
 - Construction Cost estimate to -10% to +10% accuracy at 90% Design and Tender Submission
- Estimates do not include engineering fees, approval fees, or contingencies. These estimates are to be an estimate of the cost to construct the scope as defined at the point of time of the deliverable. Allowances for items known to be required but quantity not yet defined are permitted.
 - For example, topsoil and sod total area may not be known at 30% but the work is known to be required. An allowance may be added to capture this scope until the areas can be better defined in the next deliverable.

6.2 Site Plan

Engineering Review Fees and Site Plan Securities are calculated from a capital cost estimate for the total cost of site servicing (i.e., undergrounds), surface and landscape works. Engineering Review Fees are 5% of the approved total cost estimate and the Site Plan Securities are 50% of the approved cost estimate.

The cost estimate must include line items for individual elements and must be split into a minimum of 3 sections, site servicing, surface and landscape works, including site furniture. A cost estimate template can be found in Appendix V2-A (Volume 2, Process). The cost estimate template is not an exhaustive list of items related to developments, the developer's engineering and landscape consultants are responsible for ensuring any items that are not included in the cost estimate template are added.

***Appendix V3-A: Conceptual Workspace Management Plan
Checklist***

Conceptual Workspace and Workspace Management Plans - Checklist

City of Waterloo Engineering Services Division

Use this list to ensure that your **Conceptual Workspace Management Plan** is complete to allow efficient review by City Staff.

The Conceptual Workspace Management Plan along with this checklist must also be used by the selected general contractor when preparing the final **Workspace Management Plan** required for Building Permit Issuance.

If a particular requirement is not applicable, include a brief explanation in the remarks column. Submit this form with your application. Note that more than one drawing may be necessary if the project consists of multiple phases.

General Plan Requirements

Description	Remarks
Project name and overview including development type	
Location map	
Legend	
Seal and signature of Professional Engineer	
Property limits and right-of-way surveyed and indicated	
Locations of all utilities and easements	
Show all existing and proposed improvements	
Drawings are to scale (metric)	

Workspace Management

For Conceptual Workspace Management Plans, if the items below are not known, ensure all applicable items are covered schematically and include notes providing direction to the General Contractor to ensure they cover them off in their Workspace Management Plan which is required prior to Building Permit Issuance.

Locations of all site facilities including but not limited to: trailers, material storage, site toilet, access points, gates, security, ingress/egress operations, emergency parking etc.	
Locations of material stockpiles	
Designated area for unloading of materials including hoisting area	
Proposal on managing and staging concrete trucks	
Construction parking details	
Emergency vehicle access	
Locations of cranes (if applicable) with live load and counter weight swing limits	
Construction Notes and Details	
Haul route map	
On-site construction traffic flow	
Traffic control plan based on Ontario Traffic Manual (OTM) Book 7	
Notation on drawing referencing the accepted Traffic Plan approved by City of Waterloo Transportation Services, and copy must be maintained onsite at all times.	
Notation that the municipal sidewalk will remain until it is replaced and must always be accessible	
Illustrate how pedestrians and cyclists will be rerouted to avoid construction.	
Illustrate traffic control at the construction entrance/exit	
Notation that property line is to be identified prior to clearing the site and protective fencing is to be placed behind the property line. Public Way Protection to comply with Ontario Health and Safety Act and Regulations for Construction Projects O.reg. 213/91 s.64 and s.65	
Notation that all work and equipment is to be maintained within the site and that the City the right-of-way is not to be occupied **	
Notation that street sweeping & dust control to be conducted daily or as required by the contractor.	
Notation that the contractor is responsible for winter maintenance of the municipal sidewalk(s) adjacent to the site for the duration of construction.	
Notation of signage required for the site identifying the owner, consultant, and engineer and contractor, complete with 24 hour emergency contact information	

Sediment and Erosion Controls

Drainage and erosion control plan	
Site Fence and Detail	
Vehicle tracking controls (mud mat, etc.)	
Catchbasin protection on site and in the municipal road	

Vegetation Protection

Tree and natural resource protection measures	
Tree dripline protection zones delineated	
Stabilization plan for phased or interim conditions	

Documentation Requirements

Only required for Contractor's Workspace Management Plan

Intended public notification plan	
Notation on plan with project contact list with names & numbers for General Contractor, Subcontractors for road servicing & on-site servicing, Consultant's inspector etc.	
Construction schedule with item details	
Delivery schedules, phasing of construction, timing plans including estimated dates for road closures and/or lane reduction	

**** Note - the use of a City right-of-way requires a Road Occupancy Permit from City of Waterloo Transportation Services**