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A.5 Pre-Design Engineering Services

A.5.1 General

A.5.1.1 Existing Documents and Drawings

1. The City will provide copies of available drawings, reports, and other documents pertaining to the project. The Consultant shall note that changes may have been made over time without updating the documents or drawings. Prior to commencement of the pre-design, the Consultant shall review the existing background information, as well as conduct a site review at the facility to confirm changes or omissions, if any, in the drawings. Visit the site to determine existing conditions, equipment locations, process layout and flow, services, features, connections, routes, access, interference, etc., related to the project. The expected level of the site review includes a walk through the facility, visual observations and verification of the available drawings and documents. The Consultant shall record its findings on the drawings and advise the PM of any significant changes or omissions in the drawings.

2. Any redesign work required due to the Consultant's failure to review and verify documents or drawings will be at the Consultant's own cost.

A.5.1.2 Review scope of current projects and identify potential impacts on the project. Ensure that any potential impacts/conflicts are identified and discussed with the City's project team.

A.5.1.3 Provide a site plan clearly identifying the anticipated extent of construction activities related to the project, including all work required in underground tunnels/duct banks, etc. The purpose of this site plan is to assist the City in identifying and mitigating the obligations associated with Constructor status.

A.5.1.4 At each facility, the City of Toronto maintains a complete set of Master Process and Instrumentation Diagrams (Master P&IDs) that schematically represent the functional relationship of all piping, system equipment, electrical, instrumentation and components.

The Master P&ID sets typically include;

1. Process piping, size and service
2. Flow directions
3. Interconnection references to other drawings
4. Valves with tag designations
5. Mechanical equipment with tag designations
6. Instrumentation with tag designations
7. Tankage, size and service
8. Electrical distribution and control and assets inclusive of tagging
9. Control inputs and outputs, interlocks, annunciation inputs
10. Identification of components and subsystems delivered by others
11. Intended physical sequence of the equipment
12. Equipment rating or capacity

All demolition and new tie-in points are to be identified on the Master P&IDs to show the effect on the existing systems. Additions may be documented (to the PFD level of detail) on a separate drawing.

A.5.1.5 At each facility, the City maintains a complete set of Master Single Line Diagrams (Master SLDs) that schematically depict paths for power flow from incoming power source to each downstream load – including the ratings and sizes of each piece of electrical equipment, their circuit conductors and their protective devices. The City also maintains a Master Lighting Panel (LP) drawing / schedule for each facility.

A.5.1.6 All demolition and new tie-in points are to be identified on the Master SLD's and Master LPs, to show the effect on the existing systems. Additions may be documented on a separate drawing. Refer to Appendix A.11 for the details of the requirements.

A.5.1.7 At each facility, the City of Toronto maintains a complete set of Master SCADA Architecture Drawings.

The Master SCADA Architecture drawings typically include:

1. Core closets
2. Access closets
3. RPUs
4. Servers
5. HMIs

All demolition and new tie-in points are to be identified on the SCADA Architecture Drawings to show the effect on the existing systems. Additions may be documented on a separate drawing.

A.5.1.8 The City of Toronto maintains other Master drawing sets for facilities, such as Fire Safety drawings and Building Floor Plans. As applicable, all demolition and new tie-in points are to be identified on the Master sets to show the effect on the existing systems. Additions may be documented on a separate drawing.

A.5.1.9 Equipment Redundancy and Selection

1. The Consultant shall ensure that the level of redundancy for process and/or equipment at City's facilities meets the Environmental Compliance Approval (ECA) criteria, operating objectives, and the functionality of the associated process equipment. The City has adopted, in principle, a policy to provide firm capacity for major processes and equipment. Under the policy for each process one or two process units could be offline for maintenance and repair, while still complying with the ECA, as well as other provincial or federal regulations.
2. Discuss with City staff their preferences for equipment selection. Identify suppliers and recommend equipment based on the following: best performance, reliability, flexibility, availability, life cycle costs, ease of maintenance, expandability, spatial requirements and supplier/owner references with respect to service in existing installations. List features, benefits, as well as advantages and disadvantages of the selected equipment, including information on equipment delivery and its impact on construction timelines. Except for proprietary equipment, consider at least three suppliers for each component, whenever possible.
3. In consultation with the City, prepare equipment list and data sheets for inclusion in the pre-design report. Ensure that the selected equipment/system can be fully automated and is suitable for unattended operation, where appropriate.

A.5.1.10 I&C and SCADA Requirements

1. Ensure that the selected equipment/system can be fully automated and is suitable for unattended operation, where appropriate.
2. Comply with the requirements of the Toronto Water Process Control System (PCS) Implementation Guidelines and Appendix A.12 – Process Control Systems.

A.5.1.11 Approvals

1. Refer to Appendix A.3 for general information. During pre-design, the Consultant shall determine the project specific approvals and co-ordinate the process with the City and the approval agencies.

2. If applicable, conduct pre-consultation with the Ministry prior to submitting an application for amendments to the Environmental Compliance Approval.
3. Near the conclusion of the pre-design phase, identify if a pre-start health & safety review will be required at the conclusion of the design phase of the project.

A.5.1.12 If the Consultant undertakes any activity falling within the definition of “construction” in the Occupational Health and Safety Act (OHSA), through its delivery of the project, then it shall be designated the “constructor” for the purposes of OHSA and shall assume all of the responsibilities and carry out all of the duties of a constructor as set out in OHSA and its regulations. Any agreement the Consultant enters into with a person who undertakes such construction (a subcontractor), or with another consultant who retains a subcontractor, shall designate the “constructor” for purposes of the OHSA, and shall require the party undertaking the construction to assume all of the responsibilities, and carry out all of the duties, of a constructor as set out in OHSA and its regulations. The Consultant (or subcontractor, as the case may be) shall provide a copy of the Notice of Project filed with the Ministry of Labour, Immigration, Training and Skills Development and a health and safety plan for the performance of the work at the site, prior to commencing the work. For greater clarity, in no circumstances will the City undertake any construction and it shall assume none of the responsibilities of a constructor in relation thereto.

A.5.2 Field Reviews, Studies and Surveys

A.5.2.1 General

1. The Consultant shall identify and conduct all necessary field reviews, studies, and surveys to suit the project scope.
2. Any redesign work required due to the Consultant’s failure to conduct field reviews, surveys will be at the Consultant’s own cost.

A.5.2.2 Existing Conditions and Utilities

1. Visit the site as required to determine existing conditions, locations, services, features, connections, routes, access, interference, availability of spare power and circuit-breaker, etc., related to the proposed design.
2. Submit plans to utility companies to obtain locations of all below and aboveground utilities. Provide field survey within the limits of the construction area and obtain accurate field ties to all buried utilities as identified by utility companies.
3. Develop an approach to ensure that critical utilities are maintained during construction. Where necessary, coordinate and arrange to expose if accurate location is critical for design purposes. Cost to expose will be borne by the City.

A.5.2.3 Field Edit of Aerial Mapping

1. On projects where the City provides the Consultant with aerial mapping in digital format within the project limits, the Consultant shall conduct a field edit (survey) of the aerial mapping. The purpose of the survey is to confirm the location, accuracy, and completeness of all topographic information; verify inverts and materials of existing pipes and manholes where new system will connect, and verify location of all above ground utilities. The Consultant shall comply with the following
 - b) Set horizontal control line in accordance with the City’s requirements with ties to existing property bars and topographic information.
 - c) Set elevation control benchmarks clear of the expected construction area to allow referencing of further detailed elevation information, as well as the development and control of elevations of the works to be constructed under this project.
 - d) Provide any other necessary survey work required to complete the design of the project.

- e) Provide all survey notes for layout purposes.

A.5.2.4 Topographical survey

1. A topographical survey of the project area is required.

A.5.2.5 Existing Equipment

1. Perform a field review of existing piping, process, mechanical and electrical equipment relevant to the project. Verify existing equipment and piping capacities, conditions and layout. Provide recommendations on what existing equipment can be re-used and what equipment should be replaced. All demolition, alteration or addition must be documented using the Master P&IDs, Master SLDs, and Master LPs drawings to show the effect on the existing systems. Provide three separate drawings (Existing, Demolition, New) to show existing facility, scope of demolition, and new additions.

A.5.2.6 Existing Structures

1. Undertake a visual survey of the existing building envelope within the project areas, including process tanks, roofs, and surfaces finish conditions. Summarize your findings and recommendations in a technical memorandum to the City. Review and discuss with the City further specialized investigation, if required.
2. Determine load carrying capacity of the existing structures. Confirm the structural integrity of the existing facility to accommodate the proposed equipment and loadings, and develop pre-design to upgrade the structural integrity if necessary.

A.5.2.7 Operating Procedures

1. The Consultant shall become fully familiar with the facility's operating procedures/systems.

A.5.2.8 Abatement Activities

1. Undertake the initial project specific survey in accordance with A.2 and provide recommendations & work scope for abatement activities.

A.5.3 Energy Management Plan (EMP)

A.5.3.1 Energy Management Plan

1. Refer to Appendix A.14 for the Energy Management Plan (EMP) requirements.
2. Provide an EMP (Preliminary) at the pre-design stage of the project.
3. Provide an updated EMP (Final) at 70% detailed-design stage of the project.

A.5.4 Review of Design Alternatives

A.5.4.1 The Consultant shall prepare a review of design alternatives and summarize in a technical memo.

A.5.4.2 The technical memo shall outline project specific options, provide an analysis of these options and include a recommendation of the preferred alternative. The analysis shall be based on the technical information provided by the engineering study if applicable, and based on the consultant's research and expertise. For each option, the analysis shall include, but is not limited to, the following:

1. Cost of ownership including annual fixed/amortized costs
2. Land requirements
3. Impact on future and current land use
4. Site constraints
5. Technology applicability

6. Equipment reliability
7. Operational issues and concerns
8. Operational and maintenance costs
9. Constructability
10. Design and construction schedule

A.5.4.3 On selected projects the review of design alternatives and the pre-design report may be combined in one document. Refer to the project specific scope of work in the RFQ.

A.5.5 Pre-Design Report

A.5.5.1 General

1. Prepare a comprehensive Pre-Design Report (PDR), which will provide the basis and details for the detailed design and construction of the proposed facilities.
2. Submit a report outline to the City for approval prior to commencement of the report.
3. Prepare a draft PDR for review by the City. Meet with City staff after their review of the draft report, and where agreed to by the City, incorporate proposed changes in to the final PDR.
4. The final PDR must be signed and stamped by a Professional Engineer licensed in Ontario.
5. Upon approval of the PDR by the City, changes will not be permitted unless authorized in writing by the City.

A.5.5.2 Plant & Facility Projects PDR

The scope of the PDR shall include the following sections:

1. Executive Summary
2. List of Abbreviations
3. Project Description
 - i. Background
 - ii. Objectives
 - iii. Process units
 - iv. Applicable guidelines and standards
4. Location plan
 - i. Preliminary site plan including existing facility property
 - ii. Land to be acquired, if applicable
5. Site Services
 - i. Municipal water supply
 - ii. Municipal wastewater connection
 - iii. Electrical power supply, including standby generator power
 - iv. Site access and egress
 - v. Storm water drainage management
 - vi. Communication Services
 - vii. Natural gas
6. Basic Design Data
 - i. Basic design data as required by the regulatory agencies.
 - ii. Preliminary process design calculations, as required, using existing Plant data where available.

- iii. Rationale for the design criteria used.
- iv. List of standards, codes, and guidelines applied in the design
- 7. Process Design Elements
 - i. Provide Master P&ID showing all demolition and new tie-in points. Provide additions on separate drawing(s) to the Process Flow Diagram (PFD) level of detail.
 - ii. A preliminary hydraulic profile, identifying major unit operating liquid levels. All assumptions and calculations used to develop the hydraulic profile must be included in an appendix.
 - iii. Equipment list and data sheets for major equipment, including product information and catalogue sheets.
 - iv. Recommendations on pre-selection or pre-purchase of process equipment, where appropriate.
- 8. Conceptual Layout
 - i. Preliminary layout plan
 - ii. Equipment location and orientation including, but not limited to, equipment control panels and tanks including major ventilation units, electrical transformer, switchgear, Power Distribution Panel (PDP), Motor Control Centre (MCC) and in-line measuring devices.
 - iii. Identify all process and piping modifications required to accommodate new systems. Develop pre-design of necessary modifications as required
- 9. Building and Landscape Design
 - i. Finished architectural elevations.
 - ii. Description of all internal and external architectural finishes.
 - iii. An area classification schedule, including the classification of each room or building area for new facilities, as well as for existing facilities that will be upgraded under the project.
 - iv. Structural and architectural designs of new/expanded facilities are to be designed to ensure that the exterior will complement the surrounding environment and comply with the standards expected for extended lifespan.
 - v. Landscaping must be given careful consideration to ensure that the end result will blend in with the existing surrounding area and ensure adequate drainage.
 - vi. Ensure access for personnel and maintenance/service/delivery/emergency vehicles as required.
- 10. Electrical system
 - i. Provide Master SLD drawing(s) and electrical equipment layout drawing(s) showing all existing, demolition and new tie-in points. Refer to Appendix A.11 for the details of the electrical system requirements and the following systems:
 - 1. Fire alarm
 - 2. Telephone/Communication System
 - 3. Public Address System
 - 4. Security System
 - 5. Emergency Standby Power
- 11. Mitigating Measures
 - i. Proposed mitigating measures reducing impact on natural, economic, and community environment, such as noise attenuation, air emission reduction, and visual aesthetics.
- 12. Process Control System (PCS) Including Instrumentation

- i. Provide SCADA Architecture drawing(s) and P&ID drawings showing all demolition and new tie-in points. Provide additions on a separate drawing(s)
 - ii. Address the following requirements:
 - 1. Paging and security
 - 2. Equipment and instrumentation list
 - 3. Process control narrative
 - iii. Refer to Appendix A.12 for the details of the PCS requirements
- 13. Heating and Ventilation
 - i. Area schedule consisting of room description, seasonal temperature objectives, minimum ventilation requirement.
 - ii. Identify and classify hazardous/confined areas in compliance with NFPA 820, where applicable.
 - iii. Fan schedule, including equipment listing all units and throughput capacity.
 - iv. Odour treatment equipment capacities, type, location and design performance parameters.
 - v. Heating system and its components including, as applicable, boiler sizing, re-circulation and booster pump capacities, equipment list with catalogue sheets, distribution piping sizes and unit heaters and other radiant heater capacities. The description of the heating system must be complemented by a schematic flow diagram that includes all components.
 - vi. Assessment of the existing heating system to ensure that the expanded facility heating requirements are met.
 - vii. Dehumidification system describing the dehumidification components, equipment sizing and equipment list with catalogue sheets.
 - viii. Cooling system describing the components, equipment sizing and equipment list with catalogue sheets.
- 14. Ancillary Systems
 - i. Plant water requirement list, frequency of use, flows and pressures.
 - ii. Plant potable water requirements, including a list showing frequency of use, flows, pressures and temperature.
 - iii. Fire protection system requirements, including areas to be supplied with sprinklers, standpipes, fire cabinets, hydrants, fire doors, fire dampers etc. Use a site plan and identify the areas and their respective fire protection system coverage and/or location. Where wet protection systems are applicable, identify capacity requirements and source of water.
- 15. Reduced Drawings
 - i. Provide reduced drawings (11"×17") of the following with the pre-design report:
 - 1. Site Plan
 - 2. Process diagrams
 - 3. Hydraulic grade line
 - 4. Electrical Master SLDs and equipment layout drawings
 - 5. Architectural elevations
 - 6. Floor plans/ sections
 - 7. HVAC
 - 8. I&C and SCADA drawings in accordance with the PCS Guidelines and Appendix A.12.

16. Cost Estimates

- i. Prepare construction cost estimate using preliminary quantity surveys and current unit prices within $\pm 25\%$ accuracy. Include overhead costs including bonding, profit, and insurance. Include estimating contingency of 10%.
- ii. Identify cost of new works.
- iii. Identify cost of renovation works impacted by construction works because of changes to the various codes or legislation.
- iv. Include all work sheets of quantity take-off

17. Operating and Maintenance (O&M) Cost Estimates

- i. Provide a summary of all operation and maintenance cost components affected by the project with a brief explanation including the following:
 1. Hydro / Electricity
 2. Potable water and other utilities as required
 3. Chemicals, fuel and other consumables
 4. Spare parts
 5. Staffing requirements

18. External specialty services such as maintenance contracts, testing services, calibration services

19. Approvals & Regulatory Issues

- i. List of required approvals for the project, including identification of those to be provided by the contractor, and those to be obtained by the consultant/City.
- ii. Assess construction site boundaries and identify likely constructor status.
- iii. Prepare preliminary list of confined spaces created during and after construction.

20. Constructability

- i. Identify preliminary construction staging strategy.
- ii. Identify the provision of temporary systems to maintain plant operations during construction. Include in the temporary systems any necessary temporary or permanent plumbing, piping, valves, bypasses, temporary electrical systems and temporary modifications to the existing control, monitoring and alarm systems to allow the plant to operate during construction.
- iii. Address co-ordination of the construction in recognition of the other construction projects underway or proposed at the plant, noting potential interferences, construction issues, etc.
- iv. Include pre-design of the demolition and decommissioning work required.
- v. Confirm and show that isolation and tie-ins to existing systems are possible without impacting the facilities ability to meet all regulatory requirements.
- vi. Review hydraulic models and other tools to ensure that the ability of the facility to meet regulatory requirements without flooding is maintained at all stages of construction.
- vii. Obtain details on past shutdowns at the specific facility, similar shutdowns at similar facilities and other details to demonstrate to the City that the proposed construction methods are achievable.
- viii. Provide a workplan to coordinate and perform test isolations of the existing isolation devices, including gates and stop logs / bulkheads, if required

21. Schedule

- a. Prepare a preliminary schedule for final design, construction, commissioning, and post-construction services of the project. Incorporate reasonable timelines into the schedule, addressing approvals requirements and City of Toronto Council award requirements.
- b. Propose sequence of construction required to minimize disruption to plant operations.

A.5.5.3 Water and Wastewater Mains PDR

The PDR should include the following sections:

1. Project Description
 - i. Background
 - ii. Objectives
2. Plan and Profile Drawings
 - i. Preliminary plan and profile including:
 1. Existing soils information
 2. Land to be acquired, if applicable
 - ii. Include reduced drawings (11"×17") with the pre-design report
3. Mitigating measures
 - i. Proposed mitigating measures reducing impact on natural, economic, and community environment, such as noise attenuation, air emission reduction, and visual aesthetics.
4. Basic Design Data
 - i. Basic design data as required by the ECA.
 - ii. Complete preliminary process design calculations, as required, using existing available system data.
5. Cost Estimates
 - i. Prepare construction cost estimate using preliminary quantity surveys and current unit prices within ±25% accuracy.
 - ii. Identify cost of new works.
 - iii. Identify cost of renovation works impacted by construction works because of changes to the various codes or legislation.
 - iv. Include all work sheets of quantity take-off.
 - v. Include equipment pre-purchased by the City (valves, pipes, etc.).
6. Schedule
 - i. Prepare a preliminary schedule for final design, construction, and post-construction services of the project. Incorporate reasonable timelines into the schedule, addressing approvals requirements and City of Toronto Council award requirements.

A.5.6 Specialty Sub-Consultants

A.5.6.1 Geotechnical Investigation

1. Retain the services of a specialized firm that will conduct a sub-surface field investigation to establish geotechnical design parameters.
2. If the Consultant undertakes the drilling of boreholes itself, then it shall be designated the "constructor" for the purposes of Occupational Health and Safety Act (OHSA) and shall assume all of the responsibilities and carry out all of the duties of a constructor as set out in OHSA and its regulations. Any agreement the Consultant enters into with a person who undertakes the drilling of boreholes (the "Driller"), or with another consultant who retains a Driller, shall designate the "constructor" for purposes of the OHSA, and shall require the Driller to assume all of the responsibilities, and carry out all of the duties, of a constructor as set out in OHSA and its regulations. The Consultant (or Driller, as the

- case may be) shall provide a copy of the Notice of Project filed with the Ministry of Labour, Immigration, Training and Skills Development and a health and safety plan for the drilling of boreholes at the site, prior to commencing the drilling of boreholes. For greater clarity, in no circumstances will the City undertake the drilling of boreholes and it shall assume none of the responsibilities of a constructor in relation thereto.
3. Prepare and submit a Soil Investigation Report that addresses the following as a minimum:
 - i. Soil Classification(s)
 - ii. Borehole logs
 - iii. Grain size analysis curves
 - iv. Type and quality of bedrock (if encountered)
 - v. Depth of overburden
 - vi. Ground water elevation(s)
 - vii. Soil proctors for overburden material
 - viii. Bearing capacity of soils
 - ix. Recommendations for soil parameters to be used for calculation of thrust blocks, and restrained joints, including coefficient of friction, shear angle, and bearing capacity.
 - x. Concerns as to trench bottom uplift.
 - xi. Recommendations for pipe bedding (materials) requirements with respect to City's standards.
 - xii. Recommendations for dewatering (if required) describing available methods including well points.
 - xiii. Provide recommendations relative to bedrock excavation and removal (if required).
 - xiv. Recommendation for open cut trench excavation, type of shoring system, methods of tunnelling, or jacking and boring.
 - xv. Recommendation on the use of native backfill, placement depth of layers, and compaction specification for same.
 - xvi. Evaluation of pertinent soil characteristics (resistivity of the soil, as in-situ and fully moistened, chloride ion concentration, pH corrosivity, etc.) and the implications with respect to the proposed pipe materials.
 4. If the Request For Proposal indicates that the City will separately retain the geotechnical services, Initiate and co-ordinate all work associated with the sub-surface investigation including:
 - i. Identify areas to be investigated based on the review of the existing reports and the proposed land use
 - ii. Prepare the terms of reference for a sub-surface investigation in compliance with the City's standards
 - iii. Review the quotations and recommend a specialized firm to be retained by the City
 - iv. Administer all work undertaken by the selected firm
 - v. Incorporate the recommendations in the relevant reports

5. Allow for a minimum of eight weeks for the City to retain these services.

A.5.6.2 On-Site and Excess Soil Management

1. Refer to Appendix A.15 – Excess Soil Management, specifically Section A.15.4 Scope and Deliverables for excess soil management scope and requirements during the pre-design phase.

A.5.6.3 Noise Study

1. Retain the services of a specialized firm to conduct a noise study in compliance with NPC and the City of Toronto Municipal Code.
2. If the Request For Proposal indicates that the City will separately retain the noise study services, the Consultant shall initiate and co-ordinate all work associated with the noise study as follows:
 - i. Identify areas to be investigated based on the installation of the existing and the proposed layout of the new facilities.
 - ii. Prepare the Terms of Reference for a noise investigation in compliance with the City's standards
 - iii. Review the quotations and recommend a noise consultant to be retained by the City.
 - iv. Administer all work undertaken by the noise consultant.
 - v. Incorporate the recommendations and ensure implementation of noise attenuation measures, as required.
3. Allow for a minimum of eight weeks for the City to retain these services.

A.5.7 Deliverables

A.5.7.1 The following provides a list of deliverables upon completion of the pre-design. The Consultant shall note that the RFP may contain additional project specific deliverables or delete some accordingly.

1. Review of Design Alternatives
2. First draft Pre-design Report
3. Second draft Pre-design Report
 4. Final Pre-design Report complete with design calculations
 5. Energy Management Plan
6. Technical Memorandum Building Envelope Evaluation
7. Noise Study
8. Deliverables for excess soil management during the pre-design phase, refer to Appendix A.15 – Excess Soil Management, specifically Section A.15.4 Scope and Deliverables.

A.5.8 Subsurface Utility Engineering (SUE)

A.5.8.1 Undertake SUE investigations to quality level defined in RFP per requirements below

A.5.8.2 Quality Level 'D'

Utility Records and Plans Research is the first level of engineering effort. The focus is on conducting utility records research to identify utility owners that may have facilities on, or may be affected by, the proposed project. The tasks include:

1. Records and Information Research - conduct appropriate investigation (e.g. Owner records, City of Toronto archival records, TPUCC records, personal interviews, visual inspections, etc.) to help identify utility owners that may have facilities within the project limits or that may be affected by the project
2. Record Collection - collect applicable records (e.g. utility owner base maps, “as built” or record drawings, permit records, field notes, geographic information system data, oral histories, etc.) on the existence and approximate location of existing involved utilities.
3. Records Review - review records for evidence or indication of additional available records. For duplicate or conflicting information, provide clarification.
4. Aerial or Ground-Mounted Facilities - include records research, identification, and depiction of aerial or ground-mounted facilities in Quality Level ‘D’ tasks when specified.
5. Compilation and Presentation of Data - transfer information on all involved utilities to appropriate plan sheets, electronic files, and/or other documents as required by the City of Toronto. Exercise professional judgment to resolve conflicting information. For information depicted, indicate; utility type and ownership; date of depiction; quality level (s); end points of any utility data; line status (e.g. active, abandoned, out of service); line size and condition; number of jointly buried cables; and encasement.

A.5.8.3 Quality Level “C”

Survey of Surface Features indicates the presence and approximate horizontal location of underground utilities by surveying visible above ground utility features, such as maintenance holes, valve boxes, posts, etc., and by using professional judgment in correlating this information with existing utility records. The tasks include:

1. All tasks indicated as required under Quality Level “D”. There is no prescribed order for completing the Quality Level D tasks versus the Level C tasks.
2. Identification of Surface Utility Features - identify surface features, from project topographic data (if available) and from field observations that are surface appurtenances of subsurface utilities.
3. Aerial or Ground-Mounted facilities - include survey and correlation of aerial or ground-mounted utility facilities in Quality Level C tasks if specified.
4. Utility Survey and Verifications - surveys of subsurface utility facilities or systems shall also include (in addition to subsurface utility features visible at the ground surface), determination of invert elevations of maintenance holes and vaults; sketches showing interior dimensions and line connections of such maintenance holes and vaults; any surface marking denoting subsurface utilities, furnished by utility owners for design purposes. Survey surface features of subsurface utility facilities or systems, if such features have not previously surveyed and carry out verification checks on previous survey data for accuracy and completeness.
5. Confined Space Procedures - confined entry procedures (including but not limited to maintenance holes, vaults, and pipes, etc.), are to comply with City of Toronto applicable procedures and requirements contained within the City of Toronto, Health and Safety Policy.
6. Correlation, Interpretation, Presentation of Data Resolution of Discrepancies - exercise professional judgment to correlate data from different sources, and to resolve conflicting information. Update (or prepare) plan sheets, electronic files, and/or other documents to reflect the integration of Quality Level ‘D’ and Quality Level ‘C’ data. Recommend follow-up investigations (e.g., additional surveys, consultations with utility owners, etc.) as may be required to further resolve discrepancies and conflicts. As appropriate amend the indicated quality level of depicted information.

A.5.8.4 Quality Level “B”

Designating Horizontal Position increases the accuracy of the information by utilizing surface geophysical measurement methods, such as electromagnetic, magnetic, ionic, or other energy fields to search for and trace existing utilities. The tasks include:

1. All tasks indicated as required under Quality Levels “D” and “C”. There is no prescribed order for completing the Quality Level B tasks versus the Level C and Level D tasks.
2. Line Detection and Marking - select/apply appropriate surface geophysical method(s) to search for and detect subsurface utilities within the project limits, and/or to trace a particular utility line or system. In conjunction with the City of Toronto standards and based on an interpretation of data, mark the indications of utilities and label individual utility information on the ground surface, for subsequent survey. Unless otherwise directed, mark centerline of single conduit lines, and outside edges of multi-conduit systems. As an alternative to the physical marking of lines, the Consultant may, with City of Toronto approval, utilize other means of data collection, storage, retrieval, and reduction that enables the correlation of surface geophysical data to the projects survey control.
3. Surveys - Survey all markings that indicate the presence of a subsurface utility. Perform surveys to a horizontal accuracy consistent with applicable City of Toronto survey standards. Reference surveys to the project's survey control. Record depth information of utility, which is indicated by the particular detection method, used. Clearly identify the means used to estimate depth, and the estimated level of accuracy.
4. Correlations, Interpretation, Presentation of Data Resolution of Discrepancies - exercise professional judgment to correlate data from different sources and to resolve conflicting information. Update and/or prepare plan sheets, electronic files, and/or documents to reflect the integration of Quality Levels D, C, and B data. Recommend follow-up investigations (e.g., additional surveys, consultation with utility owners, etc.) as may be needed to further resolve discrepancies. As appropriate, amend the indicated quality level of depicted information.
5. All completed design services must be certified as to accuracy by a licensed Professional Engineer. All drawings and reports must be stamped and signed.

A.5.8.5 Quality Level “A”

Locating Horizontal and Vertical Position is the most accurate assessment and is typically used in the final design stage, when utilities have a high potential for conflicts with the proposed construction. Test holes are completed using vacuum extraction or other comparable non-destructive approaches so as to not cause damage to the utility lines. After excavation is complete, a field survey determines the exact location and position of the utility line. The Quality Level A tasks include:

1. All tasks indicated as required under Quality Levels “D”, “C”, and “B”. There is no prescribed order for completing the Quality Level A tasks versus the Level B, C and D tasks.
2. Selection of Test Locations - City of Toronto may require Quality Level A data where the precise horizontal and vertical location of utilities, obtained by exposure and survey of the utility at specific points, is needed for conflict assessment and/or resolution purposes. The Consultant may recommend test locations based on the requirements of the project and on existing subsurface utility information.
3. Selection of Method - The Consultant shall use minimally intrusive excavation techniques, acceptable to the City of Toronto, where utility lines must be exposed and surveyed at specific locations that ensure the safety of the excavation, the integrity of the utility line to be measured as well as other lines, which may be encountered during excavation. The Consultant will ensure excavation shall be by means of air or water assisted vacuum excavation equipment manufactured specifically for the purpose. No other means of mechanical excavation shall be allowed.

4. Excavation of Test Holes - clean the test hole area of surface debris. In paved areas, neatly cut and remove existing pavement, cut not to exceed 0.15 square meters unless otherwise approved. Excavate test hole by method(s) approved by the City of Toronto and to the applicable standards. The nominal diameter of the test hole shall not exceed 375 mm unless otherwise approved. Expose the utility only to the extent required for identification and data collection purposes. Avoid damage to lines, wrappings, coating, and cathodic protection or other protective coverings and features. Hand dig as needed to supplement the excavation and to ensure safety of personnel and buried plant. Revise test hole location as necessary to positively expose the utility.
5. Collection, Recording, and Presentation of Data - measure and/or record the following information on an appropriately formatted test hole data sheet that has been dated and professionally sealed by Consultant. Elevation at top and/or bottom of the utility tied to the project datum, to a vertical accuracy of ± 15 mm. Elevation of existing grade over utility at test hole. Horizontal location of utility referenced to project coordinate datum, to a horizontal accuracy consistent with applicable City of Toronto survey requirements. Field sketch showing horizontal location referenced to a minimum of three (3) swing ties to physical structures existing in the field and shown on project plans. Approximate centerline bearing of utility lines. Nominal diameter of pipe, width of duct banks and configuration of non-encased multi-conduit systems. Utility structure material composition, when reasonably ascertainable. Identity of benchmarks used to determine elevations. Ascertain and note condition of utility. Pavement thickness and type when applicable. Soil type and site conditions. Identity of utility owner/operator. Other pertinent information as is reasonably ascertainable from test hole.
6. Site Restoration - replace bedding material around exposed utility lines in conformance with owner's specifications or as otherwise directed or approved. Backfill and compact excavated material in accordance with City of Toronto requirements. Re-install color-coded warning ribbon within the backfill area and directly above the utility line. Supply/install permanent surface marker (e.g. P.K. nail, peg, steel pin, or hub) directly above the centerline of the structure or edge of structure for duct banks and record elevation of marker. Restore paved areas using grout and 50 mm asphalt at surface. Dispose of all unused material that was removed in accordance with the City's standards and current regulations.
7. Interpretation of Data and Resolution of Discrepancies - provide professional expertise to correlate multi-sourced data and to resolve conflicting information. Update plan/profile sheets, electronic files, and/or other documents to reflect the integration of Quality Levels D, C, B and A data. Recommend follow-up investigations (e.g., additional surveys,

consultation with utility owners, etc.) as may be needed to further resolve discrepancies. As appropriate, amend the indicated quality level of depicted information.

8. All completed design services must be certified as to accuracy a licensed Professional Engineer. All drawings and reports must be stamped and signed.
9. If the Consultant undertakes excavation (including but not limited to: cutting existing pavement, excavation of test holes, and site restoration), then it shall be designated the "constructor" for the purposes of Occupational Health and Safety Act (OHSA) and shall assume all of the responsibilities and carry out all of the duties of a constructor as set out in OHSA and its regulations. Any agreement the Consultant enters into with a person who undertakes excavation as described in this section (a subcontractor), or with another consultant who retains a subcontractor, shall designate the "constructor" for purposes of the OHSA, and shall require the party undertaking the excavation to assume all of the responsibilities, and carry out all of the duties, of a constructor as set out in OHSA and its regulations. The Consultant (or subcontractor, as the case may be) shall provide a copy of the Notice of Project filed with the Ministry of Labour, Immigration, Training and Skills Development and a health and safety plan for the performance of the SUE-A work at the site, prior to commencing the SUE-A work. For greater clarity, in no circumstances will the City undertake any excavation and it shall assume none of the responsibilities of a constructor in relation thereto.

END OF APPENDIX A.5