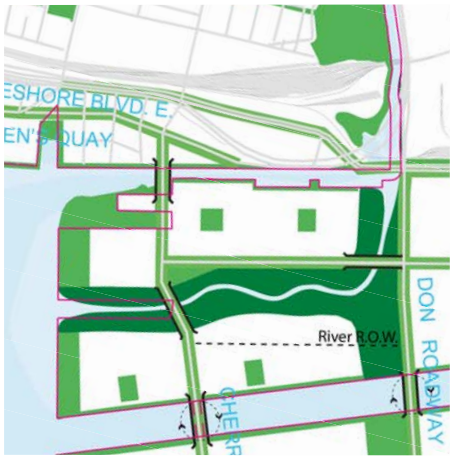
2003 - Central Waterfront Secondary Plan

2007 - Design Competition MVVA Winning Submission

2010 - DMNP EA / Framework Plan



May 2012 - PLAI Realigned

August 2012 - PLAI Recommended Realigned

October 2015 - Refined Design - Due Diligence

Figure 6 *Evolution of Plan Development*

In February of 2007, Waterfront Toronto launched an International Design Competition, seeking a master vision that recognized the need for an integrated solution to naturalization, flood protection, infrastructure and the land use potential of the area. The competition's stated goal was to obtain a bold and comprehensive concept design and a unifying vision to guide revitalization of the Port Lands and surrounding area, merge the natural and urban fabric, and establish an iconic identity for the Don River that accommodates habitat restoration and crucial flood protection. In May 2007, the submission from Michael Van Valkenburgh Associates Inc. (MVVA) ''Port Lands Estuary'' was announced as the winning design. The jury felt the MVVA design of big bold moves impressively integrated the natural and wild elements of the river mouth and the Port Lands with urban placemaking, creating a spectacular and compelling vision for the area. The submission also best addressed the competition's two key objectives of providing a naturalized mouth and iconic identity for the Don River, and creating a comprehensive plan for addressing urban design, transportation, naturalization, sustainability and other ecological issues. As well, it was the most cost-effective solution and also maximized developable land.

In April 2008, Waterfront Toronto, the City of Toronto and the Toronto Transit Commission, as tri-proponents, began a study to integrate the Municipal Class Environmental Assessment (Class EA) process with the precinct planning process. The result was a Master Plan for transportation, water/wastewater and storm water management. This integrated planning process allowed for work on the design of the site as a whole, and the integration of the Project's numerous concurrent Environmental Assessments. This included the Lower Don Lands Master Plan Class EA (LDL MP EA), which proposes transportation and servicing infrastructure necessary to support revitalization and development, and the DMNP EA, which proposes the route for the new river, other flood protection, naturalization and city-building requirements, along with the design of the Precinct Plan for the Keating Channel and Villiers Island neighbourhoods.

On September 21, 2011, Toronto City Council unanimously adopted a protocol, later to be called the Port Lands Acceleration Initiative (PLAI), to review the city's priorities for the Port Lands. The goal of the PLAI was to refine the DMNP EA and develop a business and implementation plan with the objective of accelerating revitalization in the Port Lands and maximizing its value to the City.

A refinement of PLAI, PLAI 2, was initiated in 2012 and is now almost complete. It includes the development of the Port Lands Framework Plan, Villiers Island Precinct Plan and the Port Lands and South of Eastern Transportation and Servicing Master Plan Environmental Assessment. The findings from these three studies were presented at a public meeting and consultation in November 2015. Final reports are anticipated for early 2017.

The DMNP EA was approved in early 2015 and the LDL MP EA came into effect concurrently. Extensive planning and design work has been done, and the Project is ready to proceed once funding is received.

Once completed, the Project will achieve several critical priorities for all orders of government:

- Protect against the potential loss of human life as a result of a catastrophic flooding at the mouth of the Don River;
- Reduce the financial risk to governments relating to the potential loss of property and rebuilding due to flood damage, as investment in flood protection infrastructure will result in savings equal to a multiple of the initial investment;

- Mitigate the risk of flooding in a key part of Toronto through building strategic infrastructure;
- Manage existing soil, groundwater and water contaminants from historical industrial uses and fill placement;
- Contribute to a healthier Lake Ontario by providing important ecological systems through the creation of new terrestrial and aquatic habitat connections. The naturalized connection of the mouth of the Don River to Lake Ontario is recognized as a key project that will contribute to the delisting of Toronto as an ''Area of Concern'' by Environment Canada and therefore contribute to the Remedial Action Plan objectives for water quality and habitat in Lake Ontario;
- Contribute to a stronger local, regional and national economy by creating jobs and economic value through the investment in construction, residential and commercial development and other employment-generating uses;
- Enable development of a strategic area in downtown Toronto to create strong and sustainable communities that will serve the city's growing population and economy;
- Deliver long-term tax revenues that flow to all orders of government;
- Revitalize Toronto's waterfront by extending the continuity of high-quality public space throughout the waterfront for the enjoyment of residents and visitors; and
- Maintain Toronto's working port.

Also of importance, this Project will deliver benefits to the surrounding area through flood protecting nearby commercial and residential areas and helping to unlock the development value of the First Gulf/Unilever site, where a planned large-scale commercial development (12 million square feet, accommodating 50,000 jobs – according to First Gulf) is effectively blocked due to flood risk.

The Project creates resilient, attractive urban infrastructure that mitigates the flooding risk to governments, and unlocks a vast area for revitalization and development that creates billions of dollars of economic development opportunities. The Project has already undergone extensive stakeholder engagement and public consultation over the past decade, enjoys broad public support and has secured key environmental assessment approvals from the MOECC.

3. Due Diligence Overview

The creation of a new river valley, carved from post-industrial lands, is a unique undertaking with no local, regional or national precedents. While the original $975 million cost estimate was reasonable based on the information available at the time, the ability to generate an accurate capital cost estimate was restricted in a number of ways, including:

- Limited engineering studies had been completed;
- A site-specific environmental approval process had not been determined;
- Very limited site-specific characterization data was available, such as environmental and geotechnical soil properties specific to planned designs;
- Detailed construction logistics had not yet been determined, particularly with respect to excavation and soil management operations;
- Specific design concepts for erosion protection and the required extent of such protection had not yet been established; and
- Project scheduling and implementation planning had not yet been examined in any depth.

3.1 Due Diligence Program Goals

A robust due diligence program was established with the following goals in mind:

- Reducing cost and schedule uncertainty, particularly the uncertainty arising from environmental and geotechnical factors, to allow for more informed and accurate cost estimating;
- Making and documenting reasonable assumptions regarding site characteristics, design parameters, construction methods, regulatory approval requirements, and implementation strategies and scheduling;

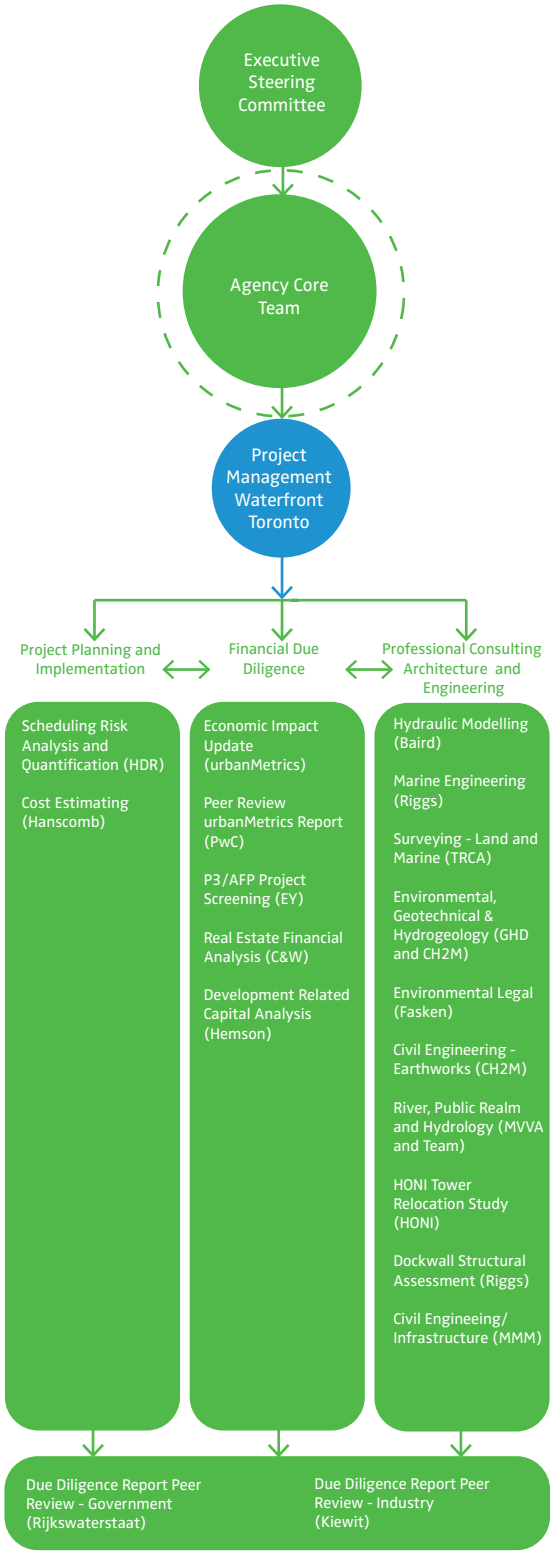


Figure 7 *Team Organization Chart and Integration*

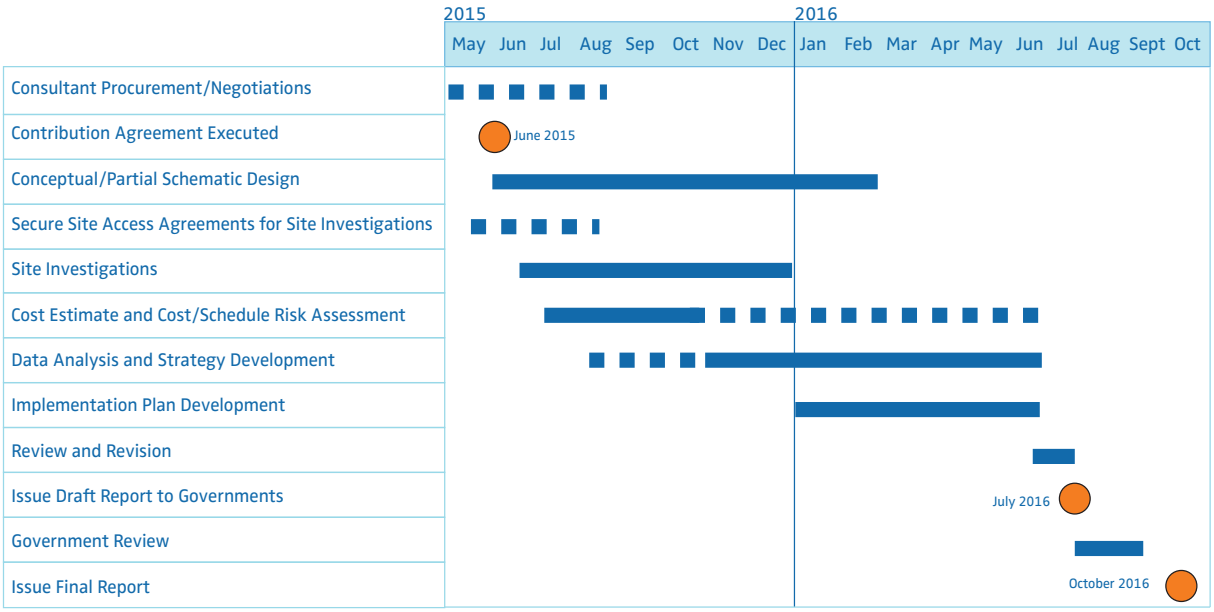


Figure 8 *Due Diligence Schedule Overview*

- Thoroughly understanding and quantifying the risks and uncertainties (as well as opportunities) inherent in this early stage of the Project, in order to support risk analysis, and confirm the Project scope and budget to government partners; and
- Determining the best project delivery strategy.

3.2 Project Team Organization and Approach

The structure of the team for the Project's due diligence program is depicted in **Figure 7.** Executive level leadership for the program was provided by an Executive Steering Committee, comprising senior executives from Waterfront Toronto, TRCA and the City of Toronto; the three co-proponents of the DMNP EA. Coordination across organizational boundaries was accomplished through a core team, which included representatives from the Toronto Port Lands Company (TPLC) in addition to Waterfront Toronto, TRCA, and the City. As the project manager, Waterfront Toronto was charged with engaging expert consultants, coordinating consultant and partner workflow and inputs, and delivering the due diligence report in 2016.

Waterfront Toronto began retaining the required consultants in June 2015, with each consultant completing a specialized scope of work that was coordinated within a broader, integrated team. Integration of work-in-progress was ensured through weekly meetings, coordinated cross communication between team members on a daily basis, and strict reporting requirements and timelines. This approach allowed for complete transparency in workflow. It also allowed all consultants and partners to actively monitor the work and progress of their peers, facilitating rapid response and alignment to planning, process, engineering, cost and risk issues, as they arose.

Figure 8 provides a high-level overview of the due diligence program schedule and the key milestones.

Site investigations were undertaken across the Project site in order to fill gaps in available soil and groundwater data. Building on fresh data, a comprehensive grading plan was prepared for the overall site and conceptual design developed for the flood protection features, new land to be created through lakefilling, and enabling municipal infrastructure. Potential approaches and

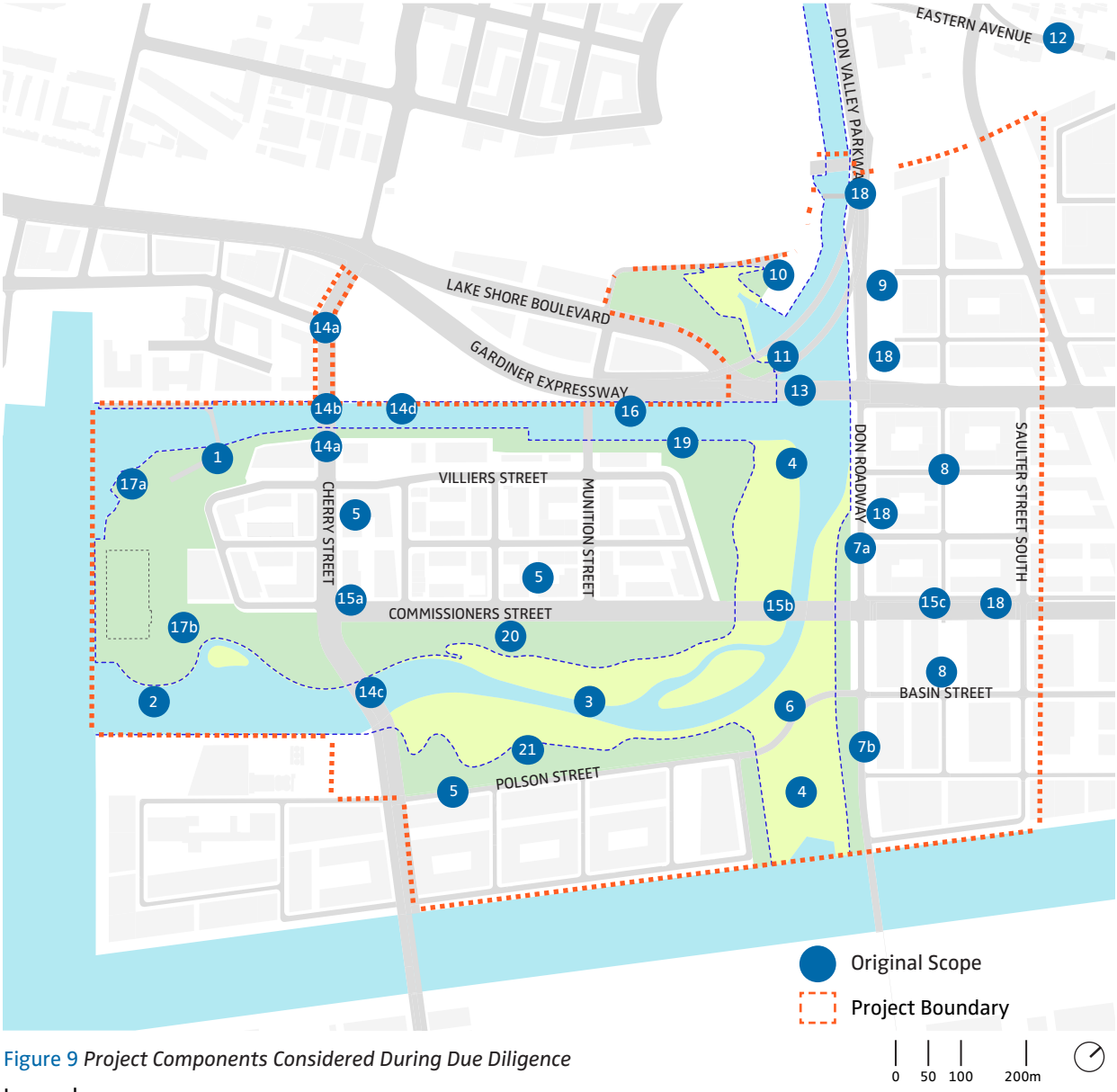


Figure 9 *Project Components Considered During Due Diligence*

Legend

- 1 Essroc Quay Lakefilling
- 2 Polson Slip Naturalization
- 3 River Valley System
- 4 Don Greenway (Spillway & Wetland)
- 5 Site Wide Muncipal Infrastructure
- 6 Basin Street Bridge
- 7a Don Roadway North
- 7b Don Roadway South
- 8 Don Roadway Valley Wall Feature
- 9 First Gulf/Unilever Site Flood Protection Land Form
- 10 Sediment and Debris Management Area
- 11 Flow Control Weirs
- 12 Eastern Ave. Flood Protection
- 13 Lake Shore Road & Rail Bridge Modifications
- 14a Cherry Street Re-alignment
- 14b Cherry Street Bridge North
- 14c Cherry Street Bridge South
- 14d Old Cherry Street Bridge Demolition
- 15a Commissioners Street West to New Cherry Street
- 15b Commissioners Street Bridge
- 15c Commissioners Street East to Saulter Street
- 16 Keating Channel Modifications
- 17a Promontory Park North
- 17b Promontory Park South
- 18 Hydro One Integration
- 19 Villiers Island Grading
- 20 River Park North
- 21 River Park South

sequencing options for completing the required earthworks were worked out in parallel, allowing for the production of cost estimates and a Project implementation schedule.

A risk workshop provided an opportunity for the Project Team to collectively review the cost estimates to pinpoint key issues and uncertainties, further refine the design, approval, and implementation schedule, and identify risks and opportunities. This information, together with the Project Team's consensus view of the potential risk and opportunity impacts, provided the necessary input to build an integrated cost and schedule risk model of the Project and to conduct a probabilistic risk simulation in order to better understand the range of possible cost and schedule outcomes for such a large and complex undertaking. The estimate and risk assessment results were reviewed in detail by the Project Team and recommendations were developed to adjust the Project scope to respond to the updated cost projections.

A second risk workshop was held to refine the outputs from the initial workshop and to identify proactive responses to key Project risk factors, which could reduce risk and uncertainty.

3.3 Project Scope

The Project scope is multi-faceted and complex, comprising multiple components as generally depicted in **Figure 9.**

While the Project builds upon the work begun in the DMNP and LDL MP EAs, and is being coordinated with other parallel planning initiatives – such as the Villiers Island Precinct Plan, Port Lands Planning Framework, and the Port Lands and South of Eastern Transportation and Servicing Master Plan Environmental Assessment – the Project's primary focus is delivering flood protection infrastructure integrated with improved natural habitat and public open spaces in order to enable development. The Project also includes new and modified municipal and marine infrastructure that is necessary to maintain transportation and servicing networks and enable construction of the flood protection components. The Project is not intended to deliver all of the infrastructure described in the LDL MP EA and/or required to support the development of Villiers Island, although it will effectively deliver nearly all of the needed major municipal infrastructure. The remaining infrastructure, described in the approved LDL MP EA and the Villiers Island Precinct Plan, can be categorized as "development driven". That is, it can be constructed independently of the flood protection and enabling infrastructure, in co-ordination with development. That additional infrastructure has been excluded from the Project scope.

3.4 Due Diligence Program Scope and Deliverables

In addition to Waterfront Toronto, the City of Toronto, TRCA and TPLC, the Project Team comprises a team of consultants with a depth of experience in conducting the required due diligence and Project planning. The following is a brief description of each scope of responsibility. A more detailed scope of work and deliverables can be found in the appended reports submitted by each consultant.

Role and Responsible Team Member(s)	Deliverables
Project Management **Waterfront Toronto, City of Toronto, TRCA, TPLC**	• Manage Project Team • Procurement strategy development • Due Diligence Report
Site Characterization, Data Validation, and Feasibility Assessment	
Environmental, Geotechnical and Hydrogeological Site Investigation: **GHD Limited (GHD)**	Stage 1 field sampling program, focused on accessible excavation and fill areas, including: • 127 boreholes drilled to depths ranging from 3.05 to 24.8 metres below ground surface • 72 boreholes instrumented with groundwater monitoring wells • Field screening of soil and groundwater samples • Collect groundwater levels from the monitoring wells • Analyze select soil and groundwater samples for chemical content • Test soil and bedrock samples to determine geotechnical properties Stage 2 field sampling program, focused on portions of the site inaccessible during the 2015 Pan/Parapan Am Games, including: • 52 additional boreholes drilled • 26 additional groundwater monitoring wells established • Monitoring well testing, sample collection and laboratory testing similar to Stage 1 work program Report on Stage 1 and 2 investigation findings, including: • Subsurface soil conditions • Bedrock elevation contours • Site hydrogeology • Laboratory test results for soil and groundwater environmental quality and soil geotechnical properties
Land and Marine Survey Data Compilation and Validation: **City of Toronto** and **Toronto Region Conservation Authority (TRCA)**	• Confirmatory bathymetric surveys in Don Narrows • Topographic surveys at underpasses in the Lower Don, as required to eliminate data gaps • Acoustic Doppler Current Profiler (ADCP) stream discharge measurements for two storm events • Bathymetric surveys for Essroc Quay, Polson Quay, and Ship Channel areas • Supplementary topographic surveys for various areas east of the Don River, including the Eastern Avenue underpass and Don Roadway (north of Lake Shore Blvd.) areas • Geo-referencing of existing topographic survey of First Gulf (21 Don Roadway) site
Dockwall Structural Assessment: **Riggs Engineering (Riggs)** (through TPLC)	• Visually assess structural condition of existing dockwalls from both the topside and the waterside • Document changes in condition compared with previous studies • Conceptual level cost estimates for rock revetments (dockwall supports), dockwall demolition, and dockwall repairs, prepared as input to consolidated cost estimates

Role and Responsible Team Member(s)	Deliverables
Preliminary (Concept) Design and Strategy Development	
Design Lead and Landscape Architect: **Michael Van Valkenburgh and Associates (MVVA)** Hydrology/Geomorphology Sub-consultant: **LimnoTech** Ecology Sub-consultant: **Inter-Fluve**	• Site grading plan • Conceptual geomorphology and slope armouring design • Conceptual wetland design • Flow control weir design parameters • Conceptual design of other flood protection features • Conceptual design of park program areas • Integration of sub-consultant design
Municipal Engineering: **WSP/MMM Group (MVVA Sub-consultant)**	• Preliminary bridge design parameters • Conceptual design of municipal services to suit Recommended Scope • Confirm road cross sections • Refine designs to accommodate construction phasing and interim (pre-development) requirements
Geotechnical and Environmental Engineering: **Golder Associates Ltd (Golder)** (MVVA Sub-consultant)	• Assess environmental conditions and implications for design of roads, municipal services, parks and public realm
Earthwork Engineering, and Environmental, Geotechnical and Hydrogeological Strategy Development **CH2M**	• Review and analyze available historical investigation data and data collected as part of GHD Stage 1 and 2 field sampling and laboratory testing program • Digital Elevation Model (DEM) and preliminary cut/fill balance • Preliminary constructability assessment and design optimization (in collaboration with MVVA and other Project Team members) to resolve constructability issues related to ground conditions • Suite of Reports, including: - Conceptual Site Model - Screening Level Risk Assessment - Regulatory Approach - Geotechnical Conditions - Remediation and Treatment Options - Soil Management Plan - Groundwater Management Plan - Earthworks Methodology - Cost Opinion of Environmental Work • Community Based Risk Assessment (CBRA) Terms of Reference
Environmental Legal Services **Fasken Martineau Dumoulin LLP (Fasken)**	• Legal opinion regarding proposed environmental approvals and instruments
Flood Modelling (for Regulatory Purposes) **W.F. Baird & Associates Coastal Engineers Ltd. (Baird)**	• Refine hydrodynamic model previously developed in support of DMNP EA • Support TRCA in application of hydrodynamic model to test design refinements and construction sequencing options

Role and Responsible Team Member(s)	Deliverables
Marine Engineering (Lakefill) Design (through TRCA): **Riggs Engineering** with Geotechnical Sub-consultant Peto McCallum and Natural Heritage Sub-consultant Natural Resource Solutions Inc.	• Review existing conditions and identify design considerations and constraints • Confirm foundation conditions for perimeter containment structures • Engineering concepts and construction methodology options for perimeter containment structures, shoreline protection works, and land creation process for the proposed lakefill surrounding Essroc Quay • Concept design for naturalized shoreline area and aquatic habitat • Conceptual level cost estimates for proposed confinement structures, based on purchasing rock materials at market value • Designed filling operations for containment structures, in collaboration with CH2M • Review proposed habitat enhancement features and extent of proposed habitat creation with Aquatic Habitat Toronto (AHT)
Financial Due Diligence	
Real Estate Financial Analysis **Cushman + Wakefield (C+W)**	• Update market demand forecast and land sale revenue projections over the 2023-2042 time horizon in the Port Lands • Complete summary report
Development Charges Analysis **Hemson Consulting Ltd. (Hemson)**	• Development Charge (DC) Revenue Analysis, including forecast of potential revenue projections over the 2016-2045 time horizon
Peer Review of Economic Impact Analysis (urbanMetrics Report) **Pricewaterhouse Coopers LLP (PwC)**	• Peer review report assessing conclusions of urbanMetrics report (previously commissioned by WT)
Economic Benefits Analysis update **urbanMetrics**	• Update analysis of the economic benefits associated with the Waterfront Toronto 2.0 investment program specifically relating to the Project • Update report based on PwC recommendations.

Role and Responsible Team Member(s)	Deliverables
Project Execution Planning	
Cost Estimating Consultant **Hanscomb Ltd. (Hanscomb)**	• Recommendations and rationale for construction cost escalation factors • Preliminary cost estimates for Original Scope Project components • Preliminary cost estimates for proposed additional Project components • Consolidated cost estimate for Recommended Project Scope
Scheduling, Risk Analysis, and Quantification **HDR Inc. (HDR)**	• Baseline project schedule • Baseline cash flow projection • Facilitate risk workshops and produce risk register • Elicitation and documentation of treatment strategies for identified risks • Probabilistic risk simulation model • S-curves depicting target budgets and timelines for various risk thresholds
Public Private Partnership (P3)/Alternative Finance and Procurement (AFP) Screening **Ernst & Young Orenda Corporate Finance Inc. (EY)**	• Compile market sounding participant list and draft questions to be explored during market sounding • P3/AFP suitability screen matrix • Preliminary identification of procurement alternatives • Complete P3/AFP suitability screen • Complete market sounding of potential constructors, developers, lenders, and equity providers accessing interest in P3 procurement approach and obtaining feedback on opportunities/contraints • Undertake qualitative assessment of procurement alternatives • Undertake commercially-focused risk assessment workshop to allocate project risks and value retained vs. transferred risks • Financial model and Value for Money (VFM) analysis • Final report
Due Diligence Peer Review	
Due Diligence Peer Review - Government **Rijkswaterstaat Ministry of Infrastructure and the Environment, Government of the Netherlands**	• Review due diligence report and interact with Project Team as needed in order to evaluate the approach, methodology, costing/scheduling, procurement, and implementation • Make further recommendations as warranted
Due Diligence Peer Review - Industry **Peter Kiewit Infrastructure Co.**	• Review due diligence report and interact with Project Team as needed in order to evaluate the project approach, methodology, costing/scheduling, procurement, and implementation. • Make further recommendations as warranted
Agency Advisors	
AFP Procurement Delivery Subject Matter Expert: **Infrastructure Ontario (IO)**	• General review and advice regarding: - Market sounding process and participants - P3/AFP suitability screen matrix - P3/AFP process - Risk transfer considerations and P3 procurement opportunities • Provide input to risk workshop and qualitative and quantitative (VFM) assessment of procurement alternatives
Hydro Transmission Line Relocation Feasibility Study: **Hydro One Networks Inc. (HONI)**	• Complete a feasibility study of transmission line and utility bridge relocation options • Generate and evaluate options; develop cost estimates and finalize report

4. Technical Due Diligence Results

Over the past year, the Project Team has defined a Recommended Scope, key Project components and how the Project can effectively be implemented. Additional characterization of sub-surface site conditions and hydraulic validation has provided essential information to support design refinement, the development of approval and implementation strategies, and cost estimate validation.

The due diligence work has produced:

- A strong understanding of the environmental and geotechnical site conditions;
- A workable environmental approvals process, developed in collaboration with regulatory authorities;
- A logical plan for completing the major earthwork and land creation at the heart of the Project;
- A summary of the Project's scope and conceptual design;
- Results of integrated cost, schedule, and risk assessment; and
- A Recommended Scope, cost estimate, and target time frame for completion.

The following is a summary of the work completed to date. For the benefit of readers seeking additional detail on a particular aspect of the work, cross-references to appended supporting documentation prepared by the Project Team are also provided.

4.1 Subsurface Site Conditions

The Port Lands is the result of decades of infilling what was once one of the largest wetlands on Lake Ontario. Beginning in the early 1900s, the area was gradually infilled to make more land available to serve the city's growing industrial and shipping sectors. The current and historical uses include: storage facilities for coal and oil, an electrical generating station, cement storage and production, a residential waste transfer station (previously operated as an incinerator), film studios and media arts, port facilities, bulk salt storage, and a variety of municipal yards and facilities.

Native soils in the area generally consist of layers of poorly graded sand and silt, and extensive areas of peat, organic clays and other compressible soils. Soil properties, determined through analyzing data from 288 previously-drilled and 179 newly drilled boreholes, 98 monitoring wells and several excavated test pits across the Project site, identified one to five metres of debris, ash, coal, concrete, wood, brick and other waste materials intermixed with imported soil (much of it dredged sediments) covering the native soil. These properties increase the amount of unsuitable soil that may need to be removed and constrain design because of the need to prevent unacceptable soil settlement under the weight of additional fill or new construction. Bedrock is present at depths of typically ten 10 metres to 20 metres below the present ground surface, with some limited areas up to 40 metres below the present ground surface.

Laboratory analyses of soils sampled from across the site indicate the presence of a variety of chemical contaminants, all of which are common to the previous industrial uses. Petroleum hydrocarbons (PHCs), such as oil, gas, and solvents, were found to be the main contaminant present across the area at very high concentrations in some places. Groundwater was also found to be impacted by the same contaminants. In several areas, free-phase petroleum was found in the groundwater table.

The appended GHD report, *Port Lands Environmental, Geotechnical, and Hydrogeological Investigation,* summarizes soil and groundwater physical and environmental properties determined through drilling 179 boreholes and installing 98

monitoring wells, excavating test pits, collecting soil and groundwater samples, and performing field testing and laboratory analysis on selected samples.

4.2 Environmental Management Approach

There is no current environmental regulatory approval process in Ontario for a project of this nature. Therefore, the Project Team has collaborated with the Ministry of Environment and Climate Change (MOECC) and other regulatory agencies to develop a feasible and mutually acceptable approach for the regulatory approval of this unique and complex Project. The Project Team anticipates that the environmental protection and management of the Project site will be achieved using a combination of regulatory tools, including:

- Community-Based Risk Assessment (CBRA) process carried out in consultation with MOECC and Aquatic Habitat Toronto, which includes federal, provincial and municipal agencies; and
- Site-specific risk assessment (RA) processes that may be conducted under Ontario Regulation (O. Reg.) 153/04 prior to beginning site-specific development projects that require land use changes to more sensitive uses.

Although the area comprises a number of individual properties, from an environmental perspective, the Project will be dealt with as a single entity. This means when remediation is undertaken, soils can be moved, treated and placed across the entire Project site rather than contained to individual properties.

The appended CH2M *Report C: Regulatory Approach (Definition of RSC Areas)* further details the recommended approach to securing environmental approvals, which is the subject of on-going discussions with MOECC and other regulatory authorities. Further details are provided in **Section 7.3: Permitting and Approvals.**

A CBRA process will be completed to evaluate risks, establish site specific soil and groundwater standards, and design soil and groundwater management plans to reduce contaminant levels. Through this process, risk management measures (RMMs) will also be developed to protect people and the environment from potential exposures to any remaining contaminants.

The CBRA will support the creation of land (i.e., through lakefilling around Essroc Quay) and a water lot (i.e., the river and floodplain), as these are not activities subject to the O. Reg. 153/04 Record of Site Condition (RSC) process. The O. Reg. 153/04 requires that an RSC – a document summarizing the environmental condition of a property – be filed before changing its use to a more sensitive land use (e.g., conversion from commercial or industrial to residential or parkland use). This process will be followed for development lands. Filing an RSC, where permitted by regulation, addresses future liability for new owners. As there is no regulatory framework for constructing a river valley under the brownfield regulation, liability issues are addressed through the CBRA and implementation of the Project, which improves the environmental condition of the area.

The CBRA will be the main mechanism for defining the environmental remediation objectives and risk management measures to be incorporated into the design and specifications for construction of the new river mouth, flood protection landforms, municipal infrastructure and all the other components of the Project. This will ensure the protection of people and the environment from any remaining contaminants in soil or groundwater.

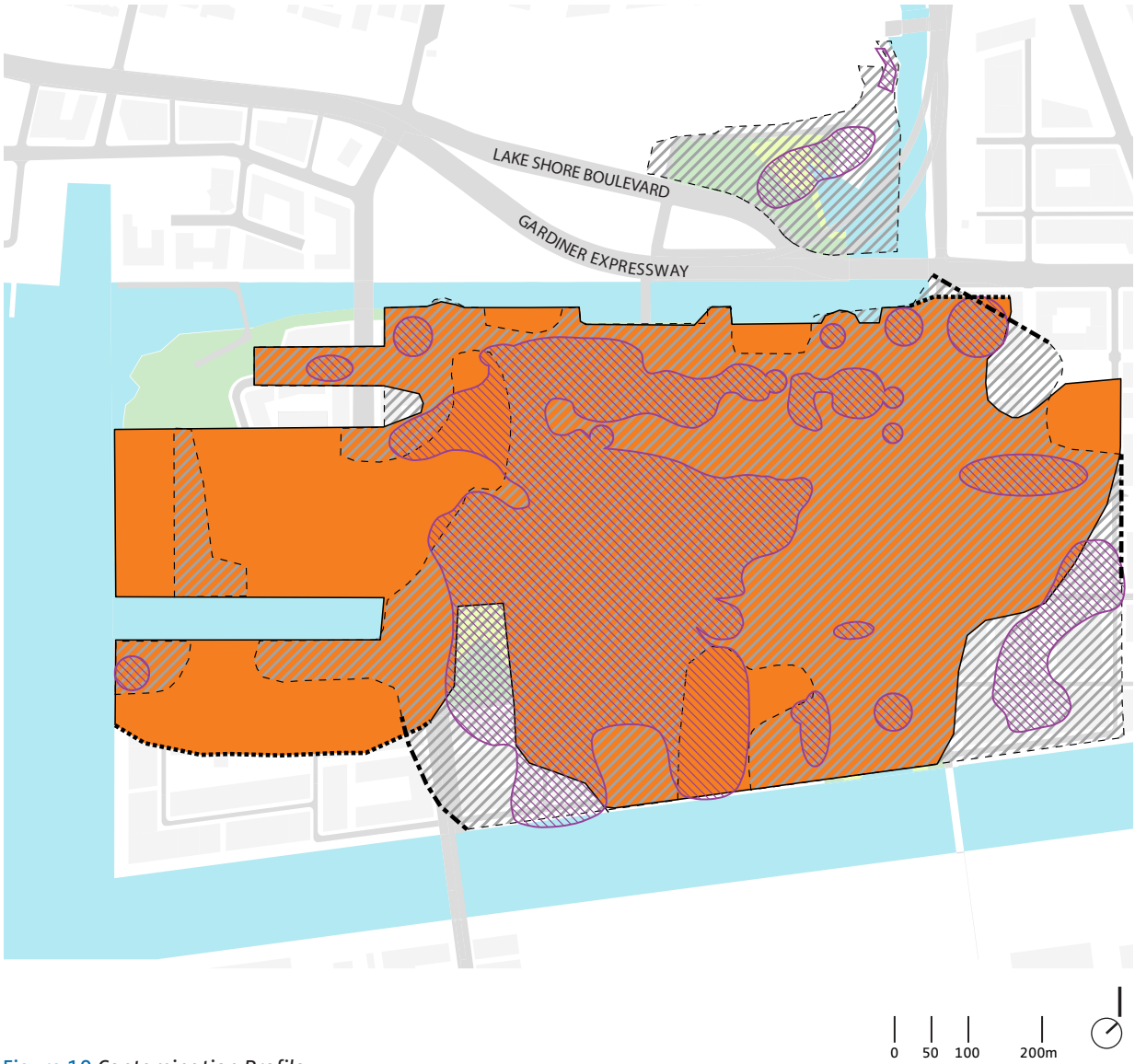


Figure 10 *Contamination Profile*

Legend

- Zone affected by Surface Contamination
- Zone affected by Sub-surface Contamination
- Zone affected by Significant Contamination
- Surface Contamination Extent
- Sub-surface Contamination Extent
- Surface Contamination Extent Unknown
- Sub-surface Contamination Extent Unknown

Although the proposed risk management measures have not yet been fully defined, it is anticipated that they will fall into the following general categories:

- Building physical barriers, which are intended to limit the potential for future contact between existing soils that do not meet current site condition standards and humans (e.g., park users or maintenance workers) or ecological receptors (e.g., plants or wildlife);
- Building physical barriers to limit the potential for migration of impacted groundwater or separate liquid contaminants into the river channel; and
- Building barriers to limit the potential for migration of contaminant vapours (particularly associated with petroleum hydrocarbon or solvent impacts) into commercial or residential buildings or other enclosed occupied spaces (e.g., enclosed park pavilions, maintenance facilities or similar structures).

The appended CH2M *Report B: Screening Level Risk Assessment* outlines the preliminary process applied as part of the due diligence to examine the potential for elevated risks and understand the need for risk management measures, remediation of contaminated soils and groundwater, or a combination, across the Project site.

4.3 Earthwork

A defining aspect of the Project is the extensive earthwork (excavation, soil handing and fill placement) required to:

- Create the naturalized river valley and Don Greenway (forms part of **Scope Items** 2, 3 and 4);
- Reclaim land around Essroc Quay by means of lakefilling (**Scope Item** 1);
- Create a sediment management area north of the Keating Channel (**Scope Item** 10); and
- Implement grade changes for flood protection.

To support an accurate calculation of excavation (cut) and fill volumes for cost estimating purposes, CH2M generated a three dimensional Digital Elevation Model (DEM) with a series of layers that represent individual elements of the Project and physical site settings (e.g., existing ground, final excavation surface and bedrock surface). The DEM projected the following requirements in order to achieve final grades: approximately 1.5 million cubic metres of soil excavation, approximately 1.1 million cubic metres of earth fill, and approximately 0.45 million cubic metres of gravel, rock and other specialized materials. The appended CH2M *Report F: Soil Management Plan* details the assumptions, guiding principles and process used to perform preliminary soil/fill balance analysis and matching.

The depth of the required excavation along much of the river valley is expected to be approximately six metres, increasing to approximately ten metres near the downstream portion. These depths include approximately two metres of excavation beyond the planned final river and floodplain grade elevations (shown in the set of plans (the "MVVA Plans") accompanying the MVVA Report), in order to remove potentially contaminated and otherwise unsuitable soil. Opportunities to

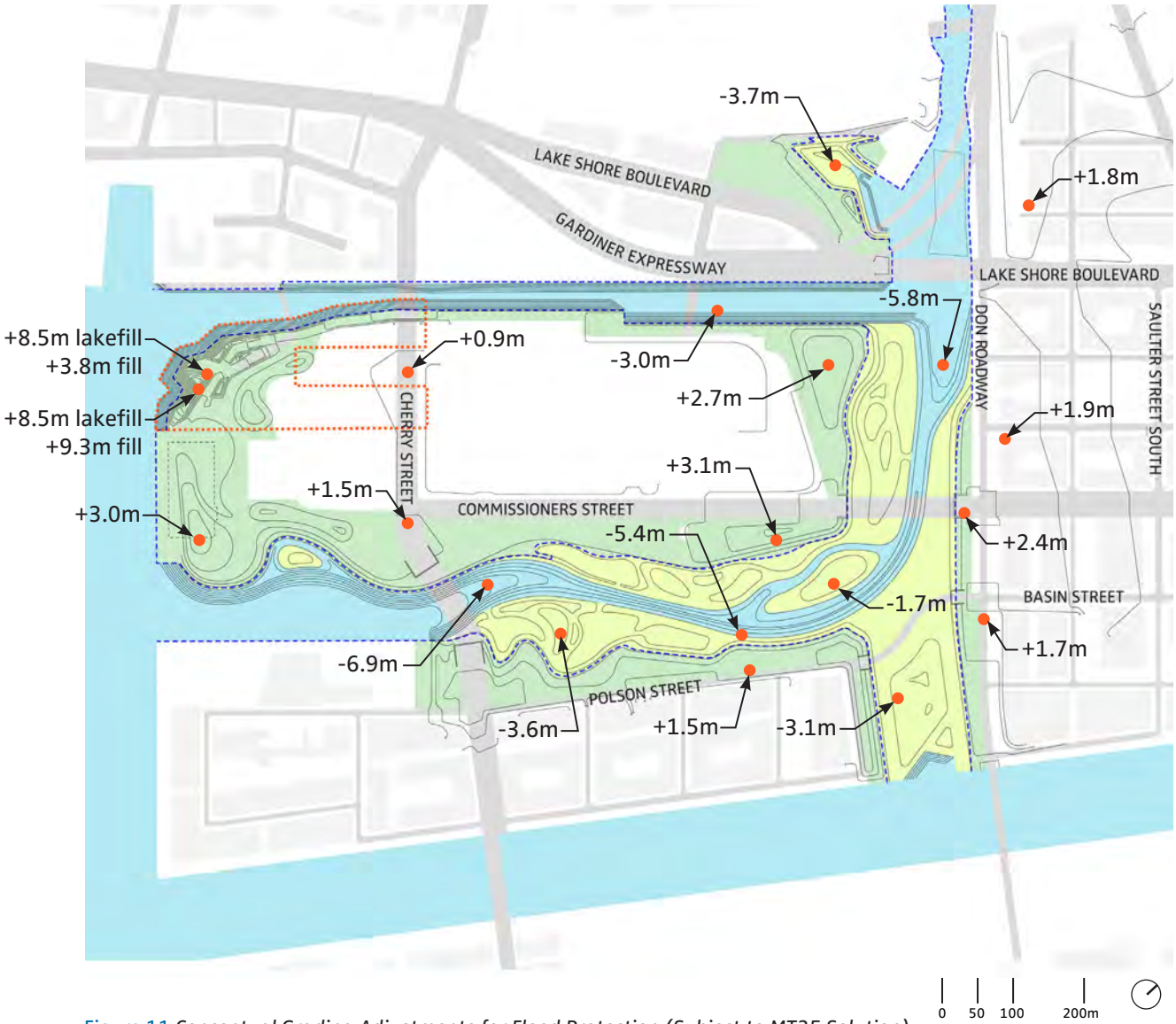


Figure 11 *Conceptual Grading Adjustments for Flood Protection (Subject to MT35 Solution)*

Legend

- Spot Elevation
- ±m Grade Difference
- Proposed 1m Contour Line
- Regulatory Flood Line
- Zone of Lakefill

reduce clean soil coverage depths within the river valley, while still meeting environmental and geotechnical requirements, will be explored in the future approval and design phases. This extra excavation depth will also provide sufficient space to build the grade control structures (forming part of the armouring described below), wetlands, and other river valley features. Much of the material excavated from the river valley will be loose or flowing native sands and, as a result, sheet

piling and additional excavation will be required to compensate for predictable erosion that is experienced with this type of soil. These areas will need to be replaced with structural/granular fill in order to create stable river banks. Sheet piling will be installed behind the location of structural/ granular fill before excavation in order to minimize the excavation in the loose material and to perform as a second erosion/ failure barrier system during flood events.

The appended CH2M *Report H: Earthworks Methodology* describes a practical approach to carrying out the required major earthworks, including work sequencing and construction methodologies. Dry material will be excavated using conventional excavating equipment and wet material (below the water table) may be most efficiently excavated using dredging techniques.

The following overall conceptual approach to treating excavated soils, illustrated in CH2M *Report E: Remediation and Treatment Options,* has been used for developing cost estimates. That report also provides a preliminary evaluation of potential soil treatment technologies.

Excavated soils will be dewatered and then sorted into different streams for treatment and future reuse. Mobile soil processing systems will be established at multiple locations near excavation areas. Soil will be screened, dry soils will be washed and wet soils dewatered, after which they will be immediately categorized for treatment or direct reuse. Soil that does not meet site-specific quality standards will be hauled to and treated at a central soil processing and stockpiling facility to reduce contaminants to protective levels before it can be reused. Approximately 80 per cent of the soil from the river valley is expected to be reusable, however, some unsuitable soil will be exported and there will be a need to import a minimal amount of soil to meet fill requirements in a timely manner. Excess fill will be stockpiled and used as needed.

It is estimated that about 0.4 million cubic meters of excess soil will be available for use at the end of the Project; this material will be placed on development sites on Villiers Island and vacant areas in the South River precinct.

4.4 Earthwork Staging

As illustrated in **Figures 12, 13, 14** and **15,** a four stage earthwork plan is proposed. As part of this implementation plan, the Project Team considered various timing options for opening the new river channel. This plan keeps the newly cut river bed isolated/ disconnected from both the lake and from the Keating Channel until the final phase of related construction activity. This is considered the most balanced approach to dealing with environmental constraints related to managing contaminated soil and groundwater in the excavated river valley area, while also allowing plantings and the natural habitat to establish.

The schedule for the remaining Project components – such as roads, bridges, municipal services, parks and open spaces, and the First Gulf/Unilever site – is affected by the earthwork sequencing. The necessary assumptions have been taken into account to enable such a coordination once the Project progresses to implementation. We specifically examined the construction sequencing and methodology needed to address business operations and heritage buildings currently in place in the Villiers Island Precinct and on Polson Quay. Implications of the proposed construction sequencing will have a limited impact on the interim flood risk as noted in **Section 4.6: Hydraulic Validation.**

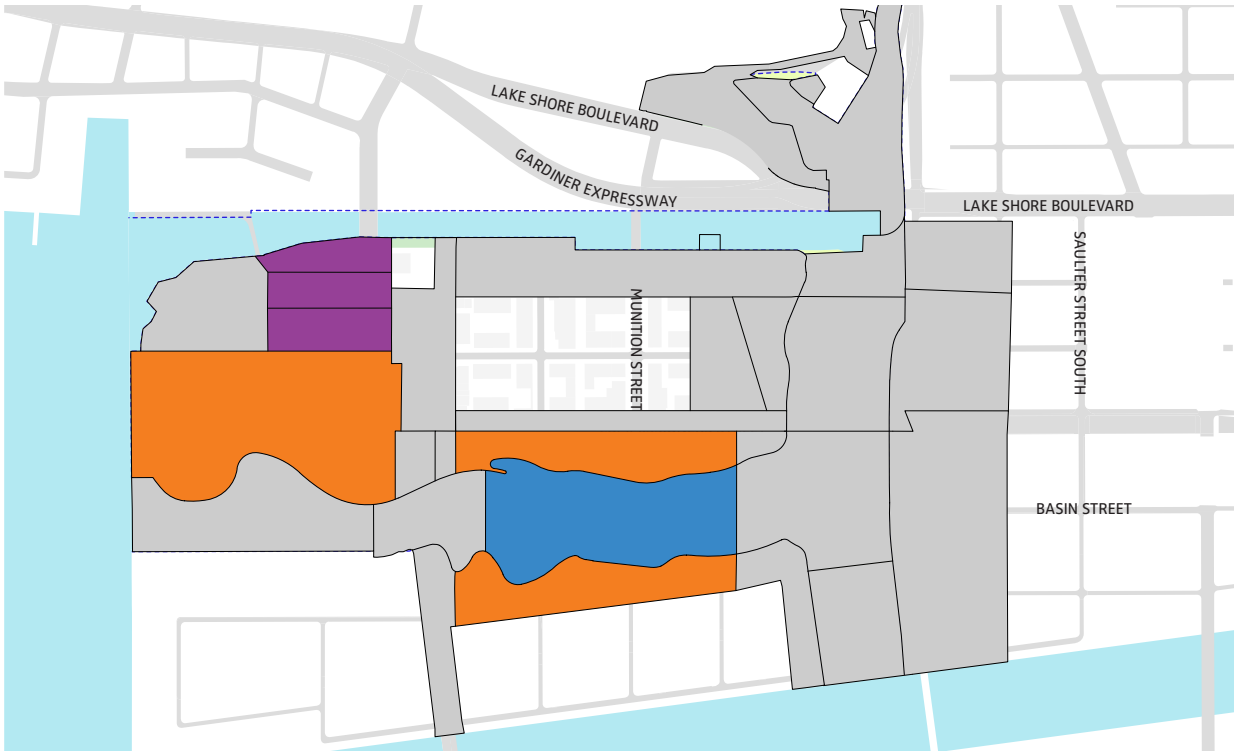


Figure 12 *Earthworks: Stage I*

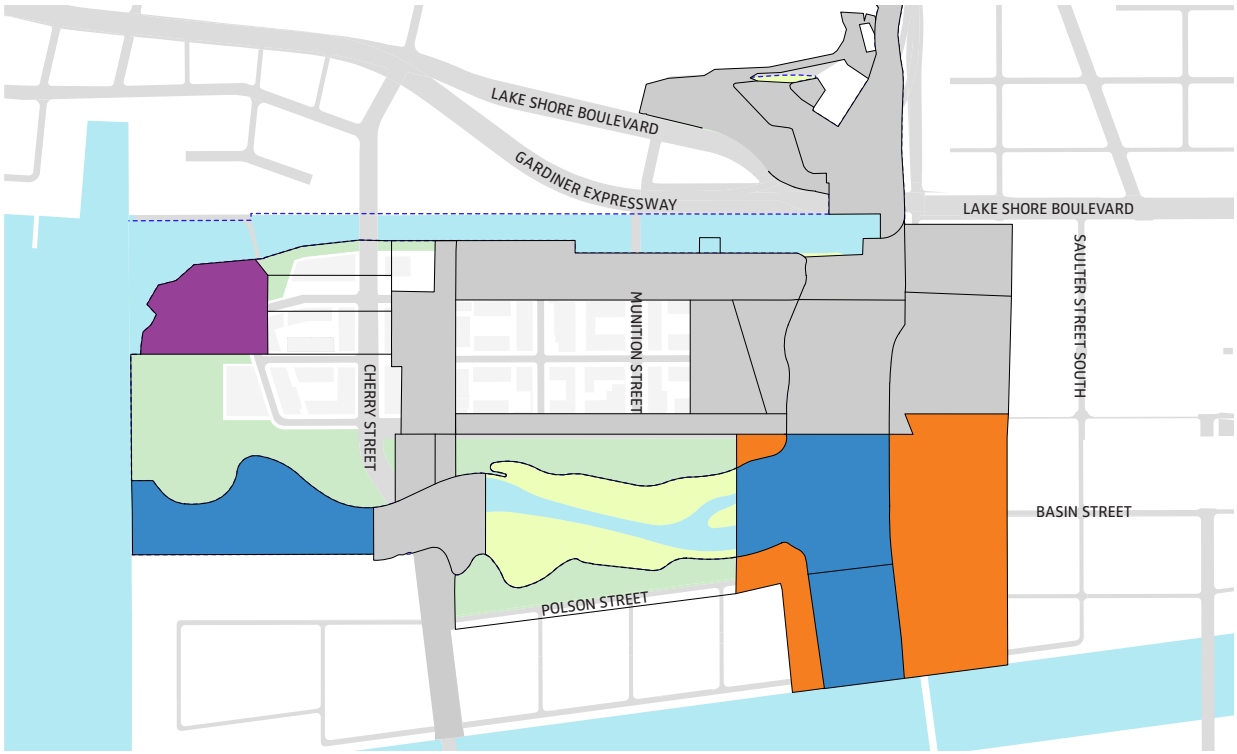


Figure 13 *Earthworks: Stage II*

Legend

Area to Cut

Area to Fill

RA/RM Cut Area to Fill

Area to be Constructed

0 50 100 200m

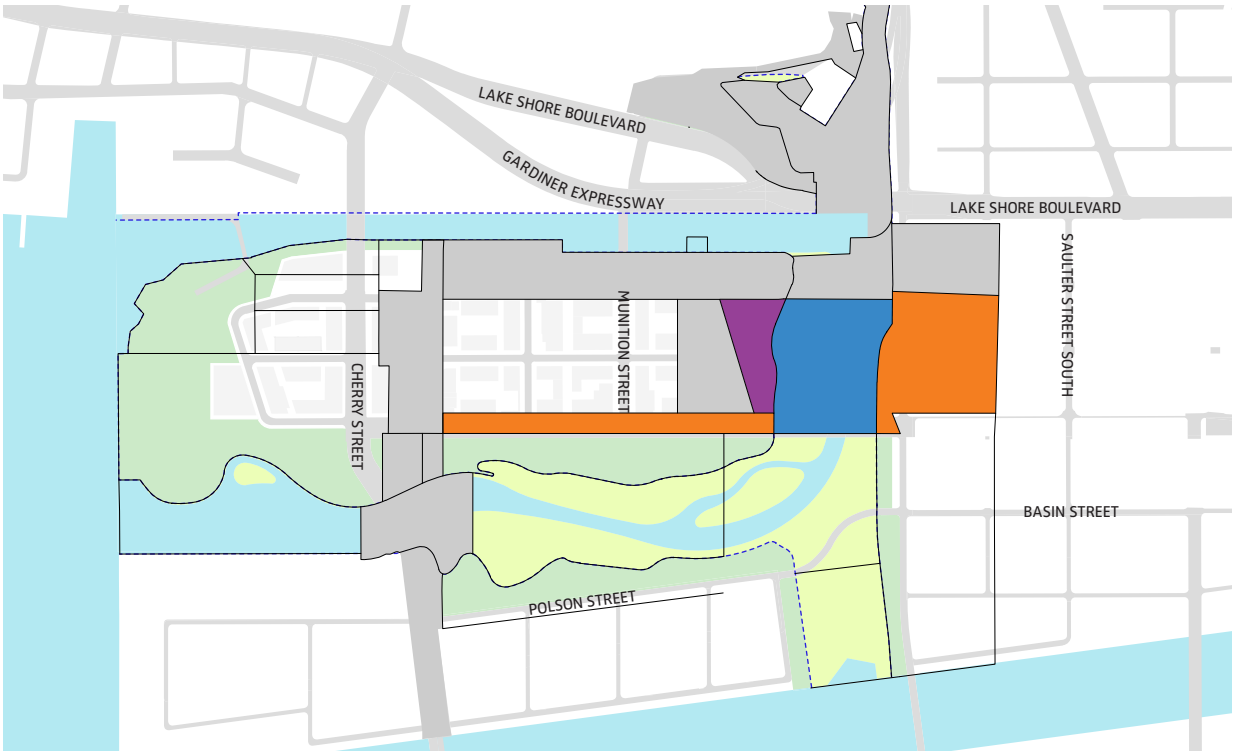


Figure 14 *Earthworks: Stage III*

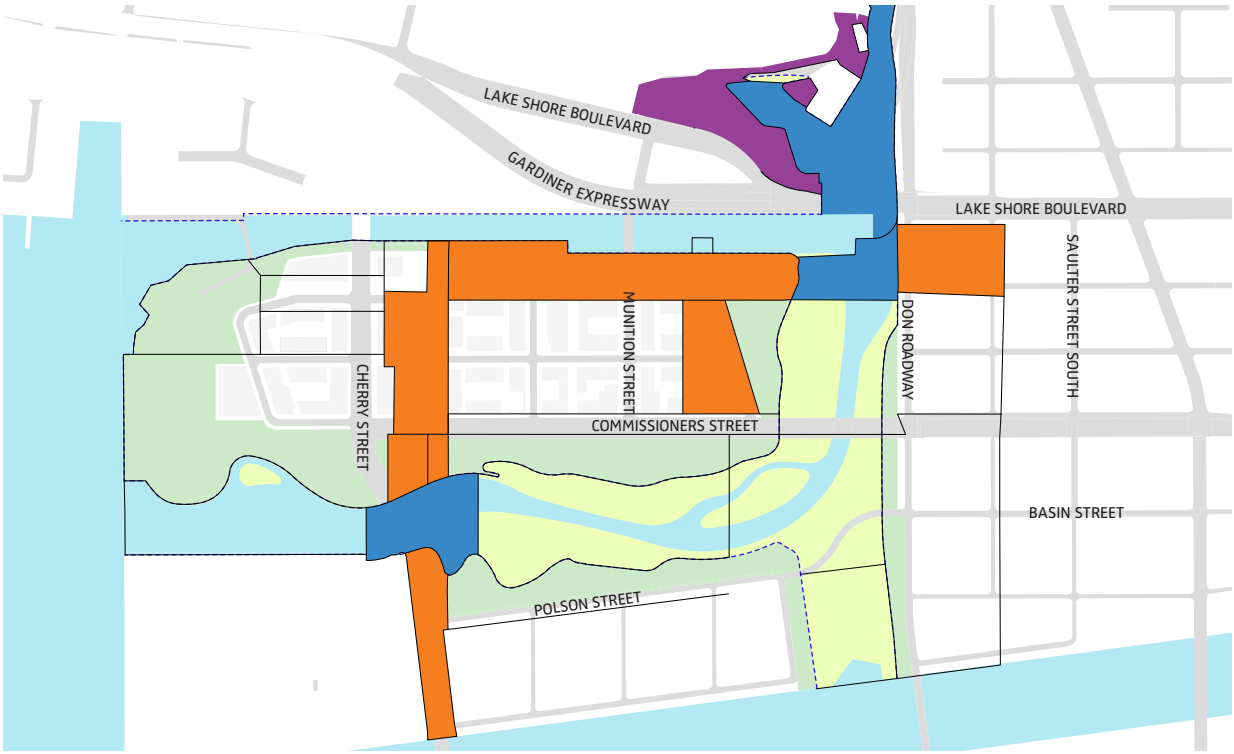


Figure 15 *Earthworks: Stage IV*

Legend

Area to Cut

Area to Fill

RA/RM Cut Area to Fill

Area to be Constructed

0 50 100 200m

4.5 Flood Protection Features

The Project's solution to flood protection is more than pure engineering. The innovative approach couples flood protection and river hydrology with the creation of a river mouth that will promote biodiversity and serve as the center around which new neighbourhoods can emerge. The validated conceptual design and new findings have been consolidated and summarized in the appended MVVA Report and MVVA Plans.

4.5.1 Site Grading Strategy

Preliminary phasing plans had relied upon developers to flood protect individual sites when they are developed over time. The MVVA Plans now detail required grading, or berms, along the new river edge, the green spillway and Keating Channel that will provide full flood protection upon the completion of the Project. Grades on individual sites within the Project boundaries will need to be raised when development takes place. In the interim, grading strategies are needed to tie the existing grades into the above-mentioned berms. Future grading of individual sites will be the responsibility of the developer, done at the developer's cost and to suit the timing of development.

Our due diligence has confirmed that the approach outlined above will provide full flood protection upon completion of the Project, and enable future development to proceed at a pace established by market forces. A fully coordinated, comprehensive and permanent grading plan for Villiers Island, Polson Quay and South River, which considers flood protection requirements, existing heritage structures on site and public realm aspirations will be developed as part of the Project to guide these developments in the future.

In order to avoid potential gaps in the overall system of flood protection it is necessary to raise the grades in the areas of the future Keating Channel Esplanade, the east side of Villiers Park, the strip of land between Commissioners Street and the Regulatory Flood Line to the south, and the strip of land between the easternmost South River Precinct development blocks and the Regulatory Flood Line. The earthwork required to accomplish this and interim finishing of the newly raised areas has been added to the Recommended Scope.

Some areas where extra fill will be needed to raise current grades may experience soil settlement due to the presence of peat and other organic materials that will compress in response to the additional load. Preloading (applying fill as soon as practical and allowing sufficient time for compression and settlement to take place) and surcharging (a technique involving the application of excess soil to accelerate settlement and then cutting back to the desired grade) may be employed to reduce post-construction settlement to acceptable levels. As surcharging involves additional material handling cost, it will need to be used selectively in areas such as road rights-of-way where earthwork completion is time-critical.

The application of fill to raise grades will take place generally in accordance with the earthwork staging plan described previously, with local modification as necessary to accommodate pre-loading or surcharging requirements, or to allow for the timely use of generated soils. In some fill areas, soil cutting may also be required to accommodate risk management measures, such as clean fill cap. These areas are presented as ''RA/RM Cut Areas to Fill'' in **Figures 12-15.**

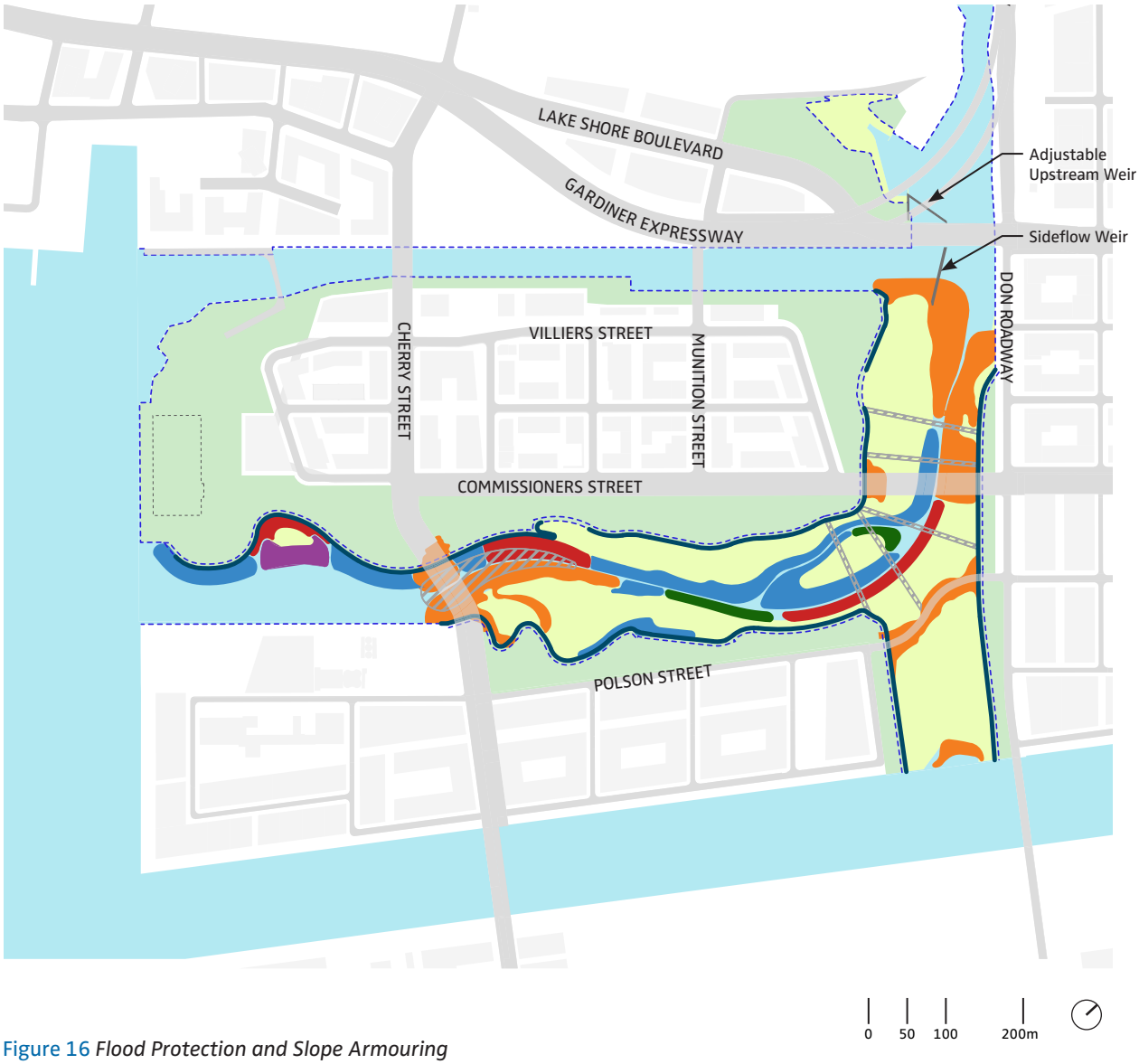


Figure 16 *Flood Protection and Slope Armouring*

Legend

- Bioengineered Bank *
- Buried Grade Control Structure
- Exposed Armour **
- Gravel Bank
- Large Wood Stabilization ***
- Rocky Harbor Edge
- Parkland
- Floodplain
- Buried Armour/ Dock Wall
- Regulatory Flood Line

* See Figure 18
** See figure 17a & 17b
*** See figure 19

4.5.2 River Slope Armouring

Engineering design and landscape treatment combine to address the need for armouring strategies to resist the forces of flood water during storm events. Consideration has also been given to the integration of these armouring strategies with control structures along the river, as well as with elements of the public realm, such as pedestrian paths and bridges. See **Figure 16.**

Shear stresses imposed by flood waters on the river channel and banks were calculated for a range of flooding scenarios and their accompanying water flows. These are depicted in Appendix A of the MVVA Report. Based on those stresses, and considering the need to protect adjacent infrastructure from flood damage, the naturalized channel has been designed with armouring for the river bed and adjacent slopes where necessary to prevent erosion (forms part of **Scope Items** 2, 3 **and** 4). In areas where the stress of flood water is greatest, as well as in the ice management area and areas where the public may access the water, hard armouring is proposed to protect the channel and the banks from erosion. See examples of armouring in **Figures 17a** and **17b.**

In areas where the channel bottom is susceptible to erosion, particularly during a flood, buried grade control structures are proposed to maintain the basic channel elevation and alignment. In other areas, particularly inside the bend of the new river valley, the channel can be protected using bioengineering techniques, which will simultaneously serve as naturalized habitat areas. See **Figure 18.**

Large wood treatments will be focused on the outer bends, or strategic habitat points where the force of water flow is high, to maintain pools and provide fish habitat. See **Figure 19.**

Additional stabilization measures will also be required for critical areas near the bridge piers, as well as an isolated area upstream of the Cherry Street Bridge South. This is based on shear stress exhibited during a Regulatory Flood event and other lower flow storm events.

4.5.3 Don Greenway (**Scope Item** 4)

The Don Greenway is a naturalized open space that connects the new river valley with the Ship Channel to the south. Its primary function is as a naturalized area but it will also function as a spillway that provides additional flood water conveyance capacity when needed. Water level control structures, with adjustable weirs for water regulation, will be installed to optimize the performance of the spillway and the wetland systems along the naturalized channel. These control structures will be tied into the levees (the natural raised edges) that contain the wetlands. This will allow the water level in the wetlands to be actively controlled to optimize their ecological performance, permitting them to be filled, retain water, or be drained throughout the year without being directly governed by lake and river system water levels.

4.5.4 Don Roadway Valley Wall Feature (**Scope Item** 8)

A valley wall feature, which is a geographic feature created through fill placement and grading that is stable from its toe to the top of bank, is required to form the perimeter of the flood zone along the Don Roadway and to eliminate the risk of flooding for lands east of the Project site.