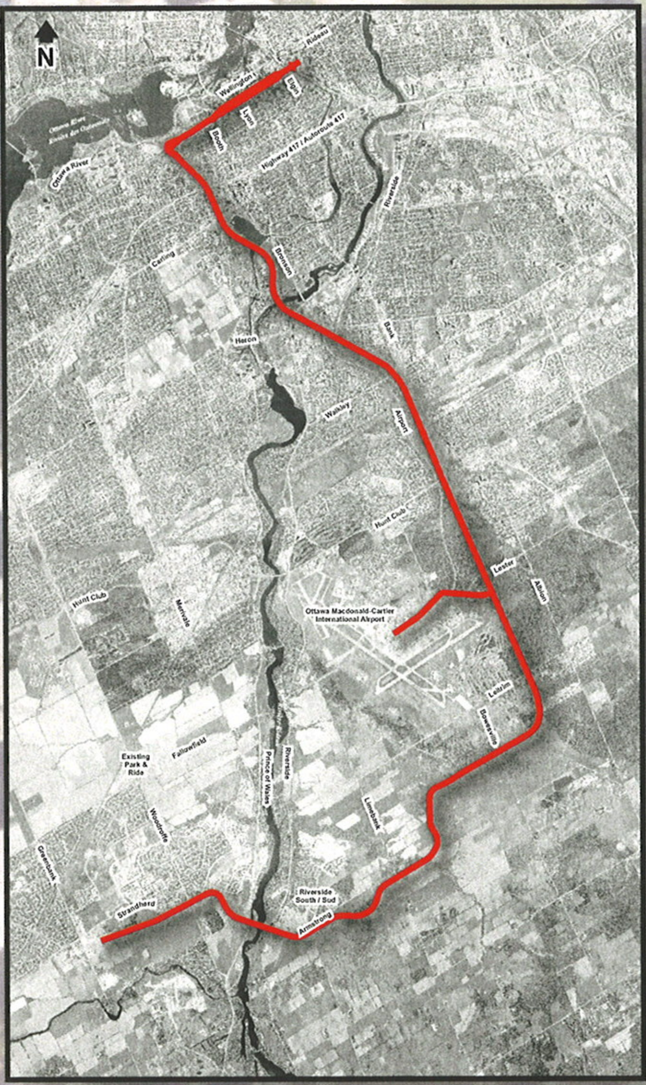
Ottawa

NORTH-SOUTH CORRIDOR LRT PROJECT
(Rideau Centre to Barrhaven Town Centre)



CEAA SCREENING REPORT

May 2006

MRC McCORMICK RANKIN CORPORATION

Hatch Mott MacDonald

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CEAA SCREENING REPORT

A. PROJECT IDENTIFICATION

Project Title / Type: **Ottawa North-South Corridor LRT Project (Rideau Centre to Barrhaven Town Centre)**
Cost Estimate: $905 Million - Ultimate Configuration (2021)
Project Location: City of Ottawa

Project Scheduling:

Estimated Work Start Date: Late 2006 or early 2007
Estimated Work Completion Date: Late 2009 (first phase)

CEAA Triggers: land, funding, Law List approval/permit/authorization

CEAA Start Date: February 21, 2005

CEAR No.: 05-01-9399

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C. NOTIFICATION

Federal departments notified in accordance with Federal Co-ordination Regulations:
Yes [X] None identified [ ]

Other Responsible Authorities: Yes [X] None identified [ ]

PUBLIC PARTICIPATION PURSUANT TO SUBSECTION 18(3) OF THE *CANADIAN ENVIRONMENTAL ASSESSMENT ACT*

Public participation pursuant to ss 18(3) deemed necessary [ ]
Public participation pursuant to ss 18(3) deemed not necessary [X]

PROJECT ENVIRONMENTAL MANAGEMENT PLAN

Yes [X] None identified [ ]

FOLLOW-UP PROGRAM PURSUANT TO SUBSECTION 38(1) OF THE *CANADIAN ENVIRONMENTAL ASSESSMENT ACT*

Follow-up program pursuant to ss 38(1) deemed necessary [ ]
Follow-up program pursuant to ss 38(1) deemed not necessary [X]

DETERMINATION

The Responsible Authorities have taken the following course of action in respect of this project after taking into consideration this screening report:

Taking into account the implementation of the mitigation measures identified in this Screening Report, the project is not likely to cause significant adverse environmental effects.

Note: The documentation for this project consists of the sections of the CEAA Screening Report and appendices. All commitments reflected in this material shall be adhered to by the proponent in the construction, operation, and maintenance of this project.

Glossary

AAQC	Ambient Air Quality Criteria
ACM	Asbestos Containing Material
ANSI	Area of Natural and Scientific Interest
AEC	Areas of Concern
APEC	Areas of Potential Environmental Concern
AST	Aboveground Storage Tank
AWRA	Area Wide Risk Assessment
BCG	Business Consultation Group
BIA	Business Improvement Area
BOMA	Building Owners and Managers Association
BRT	Bus Rapid Transit
BTEX	Benzene, Toluene, Ethyl Benzene, Xylene
CAEAL	Canadian Association for Environmental Analytical Laboratories
CCME	Canadian Council of Ministers of the Environment
CCTV	Closed-Circuit Television
CDP	Community Design Plan
CEAA	Canadian Environmental Assessment Act
CEPA	Canadian Environmental Protection Act
CFAW	Construction, Fill and Alteration to Waterways
CMHC	Canadian Mortgage and Housing Commission
CNR	Canadian National Railway
CO	Carbon Monoxide
COC	Contaminants of Concern
COMAP	City of Ottawa Municipal Accessibility Plan
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
COSSARO	Committee on the Status of Species At Risk in Ontario
CPR	Canadian Pacific Railway
CRTC	Canadian Radio-Television and Telecommunications Commission
CSE	Communications Security Establishment
CTA	Canadian Transportation Agency
CWR	Continuously Welded Rail
CWS	Canada Wide Standard
dB	Decibel
dBA	Decibel (A Scale)
DBH	Diameter At Breast Height
DC	Direct Current
DFO	Department of Fisheries and Oceans
DMU	Diesel Multiple Unit
DOUDS	Downtown Ottawa Urban Design Strategy 2020
EA	Environmental Assessment
EC	Environment Canada
ELC	Ecological Land Classification

END	Endangered
EO	Element Occurrence
ESS	Earth Sciences Sector
FTA	Federal Transportation Authority
GMP	Groundwater Monitoring Program
HADD	Harmful Alteration, Disruption or Destruction
HC	Health Canada
LRT	Light Rail Transit
LRV	Light Rail Vehicles
MBCA	Migratory Birds Convention Act
MNR	Ontario Ministry of Natural Resources
MOE	Ontario Ministry of the Environment
MTO	Ontario Ministry of Transportation
NAAQO	National Ambient Air Quality Objectives
NAC	National Arts Centre
NAPL	National Air Photo Library
NAPS	National Air Pollution Surveillance
NAR	Not At Risk
NCC	National Capital Commission
NESS	Natural Environment Systems Strategy
NHIC	National Heritage Information Centre
NO_2	Nitrogen Dioxide
NOSS	City of Ottawa Natural and Open Spaces Study
NO_X	Oxides of Nitrogen
NR	Noise Sensitive Receptor
NRCan	Natural Resources Canada
NRC-CSTT	National Research Council – Centre for Surface Transportation Technology
NRVIS	Natural Resources and Values Information System
nT	nano-Teslas
O_3	Ozone
OAOIZ	Ottawa Airport Operating Influence Zone
OCR	Ottawa Central Railway
ODA	Ontarians with Disabilities Act
OEPA	Ontario Environmental Protection Act
OHSA	Occupational Health and Safety Act
OLA	Outdoor Living Area
OMCIAA	Ottawa Macdonald-Cartier International Airport Authority
OP	City of Ottawa Official Plan
OWRA	Ontario Water Resources Act
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
PCG	Public Consultation Group
PCP	Pentachlorophenols
PEMP	Project Environmental Management Plan
PINS	Passenger Information System

PM	Particulate Matter
PPV	Peak Particle Velocity
PSW	Provincially Significant Wetland
PTTW	Permit To Take Water
PVC	Polyvinyl Chloride
PWGSC	Public Works and Government Services Canada
PWL	Sound Power Level
RMOC	Regional Municipality of Ottawa-Carleton
ROW	Right-of-Way
RVCA	Rideau Valley Conservation Authority
SAC	Spills Action Centre
SAR	Species At Risk
SARA	Species At Risk Act
SC	Special Concern
SCADA	Supervisory Control and Data Acquisition System
SPCC	Spill Prevention, Control and Countermeasures
SPL	Sound Pressure Level
STO	Société de Transport de l'Outaouais
SVOC	Semi-Volatile Organic Compound
SWC	Special Waste Compound
SWM	Stormwater Management
SWMP	Stormwater Management Pond
TBCS	Treasury Board of Canada Secretariat
TC	Transport Canada
THR	Threatened
TMP	City of Ottawa Transportation Master Plan
ToR	Ontario Environmental Assessment Terms of Reference
TPSS	Traction Power Substation
TSSA	Technical Standards and Safety Authority
TTC	Toronto Transit Commission
UCC	Ottawa Utility Coordinating Committee
UNA	Urban Natural Area
UST	Underground Storage Tank
VOC	Volatile Organic Compound

Executive Summary

This report has been prepared in accordance with the requirements of the *Canadian Environmental Assessment Act* (CEAA) to review and document the potential environmental effects of the proposed City of Ottawa North-South Corridor Light Rail Transit (LRT) Project. The report was structured based on the information request included the Federal Scoping Document (September 2005) prepared by the Federal Environmental Assessment Team (copy provided in Appendix L). The following provides an overview of the various sections of the report.

Project Description/Scope of Project (Chapters 1 and 3)

This project is the critical first step towards implementing Light Rail Transit as part of the overall expansion of the City of Ottawa's rapid transit network, which is a fundamental requirement of the City of Ottawa Official Plan (OP) and Transportation Master Plan (TMP). It delivers on several key Smart-Growth objectives, including providing high-quality rapid transit services *early* in the development of major growth areas, thereby setting the stage for attaining the City of Ottawa's long-range objectives of increasing the share of peak-hour travel from the current 17% transit ridership to 30% transit ridership by 2021.

The City of Ottawa North-South Corridor LRT is expected to deliver a number of benefits, including:

- **environmental benefits**: cleaner air by reducing greenhouse gas emissions from the burning of fossil fuels through the replacement of current diesel technology with electric power, as well as by the proven success of Light Rail in converting more residents from using cars to choosing transit;
- **reduced traffic congestion**: reducing the number of cars on parallel roads, increasing the current reductions of over 600 fewer cars on Bronson Avenue and other roads as a result of the O-Train Pilot Project, and enhance transit service to a number of federal properties including: Confederation Heights, 870 Carling, Booth Street Complex, Plouffe Park and other federal properties in the core area;
- **social benefits**: connecting communities and fostering travel and participation between communities, as well as offering more housing options for the City of Ottawa's university students along the Light Rail line; and
- **economic benefits**: providing new opportunities for residents and visitors to access downtown businesses, shops and entertainment districts, especially on weekends and in off-peak hours; enabling some residents to reduce expenses related to the number of family vehicles owned; providing increased commuter choice and flexibility; financial savings for both employee and employer; better linkages between federal employment nodes and enabling the City of Ottawa to achieve significant cost efficiencies in the operational costs of transit services delivery.

The recommended North-South Corridor LRT Project consists of 31 km of twin-track electrically powered Light Rail Transit service running from its southern terminus (end point) in the future Barrhaven Town Centre to the Rideau Centre, and includes a link to the Macdonald-Cartier International Airport. By 2021, a projected ridership of 60,000 to 70,000 people per weekday will be served on the City of Ottawa's North-South Corridor LRT line, accessed at up to 34 different station locations. Four new Park & Ride lots, with a potential total collective capacity of over 7000 parking spots, have been planned at Leitrim, Bowesville, River Road and Woodroffe stations.

The selected route is centred on the expansion of the existing O-Train Pilot Project (former CP Ellwood) corridor, with a southern and western extension through Riverside South to Barrhaven Town Centre, and an eastern extension through LeBreton Flats, up the escarpment sharing the bus transit lanes along

Albert and Slater Streets to a terminus at the Rideau Centre on the Mackenzie King Bridge. Alignments and station locations through Barrhaven and Riverside South were determined through separate community planning processes, with refinements made through the Environmental Assessment. The alignment through LeBreton Flats was developed in close cooperation with the National Capital Commission. Additional details on the project are included in Chapters 1 and 3 of this CEAA Screening Report.

Federal Environmental Assessment Process and Environmental Assessment Methodology (Chapter 2)

The Federal Environmental Assessment Team is comprised of Federal Agencies that have an approval authority for a component of the project (Responsible Authorities) and those that provide expert advice to assist in the Responsible Authorities review. Additional details on the Federal Environmental Assessment Team are included in Chapter 2 of this report.

The Responsible Authorities have a legal responsibility to review the City of Ottawa's North-South Corridor LRT project in accordance with the requirements of the CEAA to determine whether the project is likely to cause a significant adverse environmental effect. This CEAA Screening Report is intended to assist the Responsible Authorities in making their determination.

The impact assessment process was designed to meet the information requirements outlined in the Final CEAA Scoping Document (Appendix L) prepared by the Federal Environmental Assessment Team received in September 2005. The potential environmental effects outlined in this report are based on the details of the project as identified at the end a Functional Design Stage (September 2005). Potential effects as a result of known design changes since that time have also been included in this report. It should be noted that potential construction staging areas and construction accesses are currently being identified. A preliminary description of these areas is included in Section 5.1.2.18 of this report. It is recognized that detailed impact assessment has not occurred on these sites. However the City is committed to providing the necessary details on the potential effects and proposed mitigation measures as design progresses.

It is recognized that as the project proceeds through the design process additional details relating to construction staging and mitigation will be developed (please refer to Chapter 5 and Chapter 9 for details and commitments). The overall objective of undertaking the Federal Review at this stage of planning and design is to coordinate Federal and Provincial Environmental Assessment Requirements in accordance with *Canada-Ontario Agreement on Environmental Assessment Cooperation* and to allow the Responsible Authorities an opportunity to undertake a review of the project early enough in the planning process. As such it is not possible to provide final details of all the mitigation measures and all the potential effects as detail design and detailed construction staging has not been developed.

A Project Environmental Management Plan (PEMP) included in Chapter 9 of this Report outlines the process that the City of Ottawa will follow as design proceeds to ensure that the mitigation commitments outlined in this document are realized during the design and construction stages. It is also recognized that additional details will be provided at the time specific permits and approvals are sought.

Existing Environmental Conditions (Chapter 4)

The project study area is located within the City of Ottawa and runs from the Rideau Centre to Barrhaven Town Centre. Major features within this study area include Downtown Ottawa, the Rideau River and Rideau Canal, Carleton University, and the Macdonald-Cartier International Airport. The

Albion Road (Leitrim) Wetland is the most significant natural area located within the study area. A detailed description of the existing bio-physical and socio-economic environment is provided in Chapter 4 of this report.

Potential Environmental Effects and Mitigation (Chapter 5)

The environmental factors considered in the assessment of potential environmental effects were based on the factors outlined in the Federal Scoping Document (September 2005) (Appendix L). Details on the potential environmental effects and proposed mitigation measures are included in Chapter 5 of this report. The environmental assessment examined potential environmental effects during the construction phase as well as during operations and maintenance (Section 5.1). In addition, potential environmental effects associated with accidents and malfunctions (Section 5.2), effects of the environment on the project (Section 5.3), decommissioning (Section 5.4) and cumulative effects (Section 5.5) were examined. Section 5.6 provides a summary of the potential environmental effects of the City of Ottawa North-South Corridor LRT Project. Section 5.7 provides a summary of the mitigation measures proposed as well as the commitments to future work/studies. With the implementation of the proposed mitigation measures described in Chapter 5, no significant adverse environmental effects are anticipated as a result of the construction, operation and maintenance of the City of Ottawa North-South Corridor LRT Project.

Table E -1 provides a summary of the specific environmental factors examined and references to sections in this report that provide additional details. Given the urban nature of much of the area and the fact that a significant portion of the project is located within an existing rail corridor, no significant adverse environmental effects are anticipated. As discussed in Chapter 5, most of the potential adverse environmental effects of this project will occur during the construction phase. Chapter 5 also outlines the detailed commitments for mitigation that will be employed to further reduce potential adverse environmental effects. A summary of these mitigation measures is included in Section 5.7.

Project Environnemental Management Plan (Chapter 9)

Chapter 9 outlines the process to develop a Project Environmental Management Plan (PEMP). The purpose of this plan is to outline a systematic process to ensure that mitigation, protection and monitoring measures identified in Chapter 5 are implemented and effective during the design, construction and operation phases of this project. The PEMP provides the necessary continuity from planning into design and through to construction, operation and maintenance to ensure that all commitments made during the Environmental Assessment are carried through via a partnership between the City of Ottawa, the designer and the contractor.

Consultation (Chapter 6)

Consultation with affected parties was an essential and productive component of the study process and provided a mechanism for the City of Ottawa to define and respond to issues before limiting decisions were made prior to the Environmental Assessment document submission. The study was organized so that affected parties were:

- involved throughout the study;
- provided access to information;
- provided responses to questions and data requests; and
- encouraged to participate in an issue identification/resolution process.

A “Consultation Plan” was developed that identified key consultation objectives, target groups and activities to address consultation.

Four sets of Public Open Houses were held at locations accessible to all residents in the study area and were staged to seek input at the following key decision points:

- Development of Ontario Environmental Assessment Terms of Reference (Study Process/Problems and Opportunities);
- Evaluation of Alternatives to the Undertaking and Generation of Alternative Methods;
- Route Evaluation/Recommended Alternative; and
- Functional Design.

In addition, the Consultation Plan identified four groups (Public, Business, and two Agency groups) to advise and comment on issues that directly affected each group. The Consultation Groups met prior to each of the four Open House sessions. Details on the results of consultation are included in Chapter 6.

Table E-1 Summary of Responses to Federal Information Requirements

Federal Information Requirements	Proponent's Response	Section Reference
GENERAL CONSIDERATIONS		
Accidents and Malfunctions	Section 5.2 provides an overview of potential accidents and malfunctions (e.g. spills) and associated precautions and mitigation measures during operation and construction. Sample O-Train operational procedures for spill response and dangerous goods are provided in Appendix H. Additional details regarding pedestrian and traveller safety are outlined in Section 5.1.2.5. Additional details regarding precaution and mitigation related to effects of the environment are provided in Section 5.3.	5.1.2.5, 5.2 and 5.3
CONSTRUCTION		
Air Quality	An overview of ambient air quality is provided in Section 4.1.5. Potential adverse environmental effects to air quality during construction may result from dust and equipment emissions during construction. These effects are not considered significant as they are short-term in duration and can be mitigated by employing the following measures: • Use of proper watering and/or other dust suppressant techniques (e.g. OPSS 506); • Seeding any open, unpaved areas after construction; and • Minimize the idling of equipment, especially during smog alerts. Additional details on proposed mitigation measures are included in Section 5.1.1.7	4.1.5 and 5.1.1.7
Archaeology and History	An overview of existing and potential archaeological resources and known cultural resources is provided in Section 4.2.6. A Stage 1 Archaeological Assessment of the corridor was undertaken to identify areas of archaeological concern and identify any additional archaeological assessments that will be required prior to construction. The potential for archaeological finds in areas of construction exists at some relatively undisturbed sites. With the implementation of the following mitigation measures potential for adverse effects can be minimized and no significant residual adverse effects are anticipated. Proposed construction mitigation and commitments to future work include: • Stage 2 Archaeological Assessments at selected locations as outlined in Section 5.1.2.9. Copies of the Archaeological Assessments will be provided to the RAs.; • Stage 3-4 Archaeological Assessments if warranted by finding of Stage 2 Archaeological Assessment. Consultation will occur with the Ontario Ministry of Culture and relevant First Nations to discussion mitigation strategies as part of this work; and • Typical construction requirements should buried archaeological deposit or human remains be discovered during construction (i.e. stop work, consult an archaeologist, Ontario Ministry of Culture and relevant First	4.2.6, 5.1.2.8 and 5.1.2.9

Table E-1 Summary of Responses to Federal Information Requirements		
Federal Information Requirements	**Proponent's Response**	**Section Reference**
	Nations). An overview of known existing and potential heritage resources (cultural landscape and built heritage features) is provided in Section 4.2.6. Although construction may potentially result in some effects to heritage resources, with the implementation of the noted mitigation measures potential for adverse effects can be minimized and no significant residual effects should occur. Proposed construction mitigation generally includes avoidance or ensuring sympathetic design (including consultation). The proposed construction mitigation is discussed in detail in Section 5.1.2.9	
Central Experimental Farm	An overview and description of the Central Experimental Farm (including the Dominion Arboretum) is provided in Section 4.2.3. Potential construction effects include removal of trees and shrubs and impacts to pedestrian movement and staff access during construction. As discussed in Section 5.1.2.2, these effects are not considered significant as they are short-term in duration and can be mitigated by employing the following measures: • Continue discussions with Dominion Arboretum staff as design progresses to develop construction staging details. • Transplant the 36 young trees and shrubs to a temporary nursery and after construction replanted to their original locations. Additional compensation for removal of mature trees and additional mitigation measures for transplanted trees and shrubs will be negotiated through discussions with Dominion Arboretum staff. • Employ sedimentation and erosion control measures. • Ensure existing hydrologic regime will be maintained. • Clearing and disposal of all construction-related debris following construction. • Ensure an environmental inspector is on site during construction to ensure compliance with mitigation measures. • Implement measures to protect nesting migratory birds (timing of vegetation clearing to avoid breeding period or implement nest surveys to confirm no nesting in affected areas prior to clearing – this relates to meeting requirements of the Migratory Birds Convention Act – MBCA). • Fencing and signage will be implemented during construction to ensure the safety of pedestrians during construction.	4.2.3 and 5.1.2.2

Table E-1 Summary of Responses to Federal Information Requirements		
Federal Information Requirements	**Proponent's Response**	**Section Reference**
Contaminated Sites and Waste Management	Areas of actual and potential site contamination are discussed in Section 4.2.7 with additional details provided in Appendix G. There is potential for impacts to contaminated sites during construction and waste will be generated that requires appropriate handling (i.e. OPSS 180). Section 5.1.2.10 outlines proposed mitigation measures including future site assessments, proper disposal and handling of materials (including identification of hazardous wastes) and prevention of spills during construction. With the implementation of the mitigation measures outlined in Section 5.1.2.10 the potential for adverse effects can be minimized and no significant adverse environmental effects are anticipated.	4.2.7, 5.1.2.10 and Appendix G
Fish and Fish Habitat	Section 5.1.1.2 provides a summary of the existing aquatic habitat and potential adverse effects at each of the twenty-seven potential watercourse crossings located along the study corridor. Additional details are provided in the Natural Environment Report (Appendix A). The primary effects of the project are related to the construction of extensions to existing structures and culverts over watercourses along the north portion of the project and construction of new crossing structures along the south portion. Table 5.1.1.2-1 outlines the potential effects and proposed construction mitigation measures for each watercourse. Mitigation generally encompasses design measures, timing constraints, and minimizing the potential for spills and direct or indirect effects to fish and fish habitat. With the implementation of proposed construction mitigation measure no residual adverse environmental effects are anticipated. In addition, formal authorization under the *Fisheries Act* (which will include compensation plans to ensure a net gain in habitat) will be obtained during Detail Design. All works will be undertaken in compliance with the requirements of Authorizations under the Fisheries Act.	4.1.1, 5.1.1.2 and Appendix A
Health and Wellbeing	Potential adverse effects to health and wellbeing during construction (including but not limited to air, noise and safety) are discussed in Section 5.1.2.5. The greatest potential effect to human health wellbeing is pedestrian and traveller safety. With the implementation of mitigation measures noted in Section 5.1.2.5 and 5.1.2.13 no significant adverse environmental effects are anticipated. Potential construction effects to traffic can be mitigated by properly planned detour routes and advance consultation and notification of construction and detours. Additional cyclist-specific construction mitigation measures are discussed in Section 5.1.2.13. Given the short-term nature of construction and the implementation of the mitigation measures discussed in Section 5.1.2.5 and 5.1.2.13 no significant adverse environmental effects are anticipated	5.1.1.7, 5.1.2.5 , 5.1.2.6 and 5.1.2.13
Land Use	Existing and future land uses are described in Sections 4.2.1 and 4.2.2 with additional details provided in Appendix C. The construction phase is anticipated to take approximately 3 years, effecting different stretches of the corridor over that period of time. Potential adverse environmental effects include noise, vibration, dust, temporary disruptions to property access, traffic detours. Mitigation for noise, vibration and dust are outlined in	4.2.1, 4.2.2,5.1.1.7, 5.1.2.1, 5.1.2.6,

Table E-1 Summary of Responses to Federal Information Requirements		
Federal Information Requirements	**Proponent's Response**	**Section Reference**
	Sections 5.1.2.6, 5.1.2.7, 5.1.1.7 and the appropriate sections of this table. Mitigation for access and traffic issues will be address by properly planned detour routes and advance consultation and notification of construction and detours. Additional traffic construction mitigation measures (including cyclist-specific measures) are discussed in Section 5.1.2.13. Land use construction mitigation is further described in Section 5.1.2.1. Given the short-term nature of the potential effects no significant adverse environmental effects are anticipated with the implementation of the proposed mitigation measures.	5.1.2.7, 5.1.2.13, and Appendix C
Noise and Vibration	Existing and future noise and vibration are discussed in Sections 5.1.2.6 and 5.1.2.7. Additional details are provided in the noise impact assessment (Appendix D), vibrations impact assessment (Appendix E) and the National Arts Centre (NAC) vibrations impact assessment (Appendix F). No significant adverse effects are anticipated given the relatively short-term duration of construction at specific locations and the implementation of proposed construction mitigation measures. Worst-case construction noise levels have the potential to be very loud during some short periods of time. However, adverse effects during construction are relatively short compared to operational noise effects, and therefore, they are usually better tolerated by the community at large. Of special concern are rock drilling and blasting noise from Dow's Lake Tunnel to beyond Gladstone Station. Noise impacts resulting from construction are relatively short term in duration and, with the implementation of mitigation measures, disturbances can be minimized. Noise impacts from construction activities will be mitigated through: • Restricting noisy activities to daytime hours where possible; • Adhering to the City's Noise Control bylaws; and • Implementing the noise control procedures outlined in the Construction Code of Practice included in this document. Construction vibration may at times be noticeable. A Code of Practice has been outlined in Section 5.1.2.7 to minimize the potential for construction vibration impacts. In addition, the following construction mitigation measures are proposed for the NAC: • Incorporate a floating slab system or other similar design which achieves a similar reduction in vibration in the track design on the structure in the vicinity of the NAC. • Undertake a detailed assessment once the train selection has been finalized to provide more specific recommendations accounting for specific frequency characteristics of the proposed LRT. The City will consult with the NAC to select an appropriate consultant to undertake that review. • Although the existing bus vibration is not caused or made worse by this project, efforts will be made during	5.1.2.6.1, 5.1.2.7, Appendix D, Appendix E and Appendix F

Table E-1 Summary of Responses to Federal Information Requirements

Federal Information Requirements	Proponent's Response	Section Reference
	the design the design process to improve the existing situation if feasible. • The City will consult with the NAC to develop a construction schedule to minimize adverse effects to NAC operations. • Establish dialogue with NAC during design and into construction to coordinate construction efforts and minimize adverse effects.	
Rideau Canal	An overview and description of the Rideau Canal is provided in Section 4.2.4 with additional details regarding recreational uses provided in Section 4.2.5. The construction of the LRT system will result in minor construction effects to the Rideau Canal. With the implementation of the mitigation measures outlined in Sections 5.1.1.2, 5.1.1.4, 5.1.2.3 and 5.1.2.4 potential adverse effects to the Rideau Canal, including aesthetic, recreational (e.g. Winterlude, navigability), archaeological resources, and natural environment effects, can be minimized and no significant residual adverse effects are anticipated. Construction effects during the winter and Winterlude will be minor and of short duration. Construction will be staged to avoid adverse effects during key times (e.g. Winterlude activities). There will be no construction adverse effects in the spring or summer as construction will be timed such that through navigation will be maintained throughout the duration of the project. Heritage and aesthetic effects will be mitigated via consultation with Parks Canada and NCC and adherence to Strandherd-Armstrong Bridge Aesthetic Guidelines (du Toit Allsopp Hillier, November 2005). Recreational mitigation is further discussed in Section 5.1.2.4. Proposed mitigation to address potential construction effects to the natural environment within and surrounding the Rideau Canal are outlined in Section 5.1.1.2 and 5.1.1.5 and the appropriate sections of this table. With the implementation of the proposed mitigation measures outlined in Sections 5.1.1.2, 5.1.1.5, 5.1.2.3 and 5.1.2.4 no significant adverse environmental effects are anticipated.	4.2.4, 4.2.5, 5.1.1.2, 5.1.1.5, 5.1.2.3 and 5.1.2.4
Species of Special Concern	Section 4.1.4 provides an overview of species at risk and significant habitat within the study area. The standard mitigation measures recommended for the protection of 'designated natural areas' (Section 5.1.1.1), vegetation communities (Section 5.1.1.5), fisheries and aquatic habitat (Section 5.1.1.2) and surface and groundwater (Section 5.1.1.3) are applicable to the protection of potential habitat for rare species and species at risk. Some additional species specific mitigation measures are noted in Table 5.1.1.6-1. With the implementation of the proposed mitigation measures outlined in Sections 5.1.1.1, 5.1.1.2, 5.1.1.3, 5.1.1.5 and 5.1.1.6 no significant adverse environmental effects are anticipated.	4.1.4, 5.1.1.1, 5.1.1.2, 5.1.1.3, 5.1.1.5 and 5.1.1.6

Table E-1 Summary of Responses to Federal Information Requirements

Federal Information Requirements	Proponent's Response	Section Reference
Surface and Ground Water	Potential construction effects are discussed in Section 5.1.1.3 and include the disruption/alteration of groundwater flow, alteration of natural drainage and increased surface water runoff. Potential adverse effects during construction are relatively short-term in duration, can be contained and effectively mitigated so that no significant adverse environmental effects are anticipated. The proposed construction mitigation measures include mitigation for clearing and grubbing, cuts/excavations and grading, bridge crossings domestic, sediment and erosion control, measure to avoid spills, and monitoring private and municipal water wells during construction. The proposed mitigation measures are discussed in detail in Section 5.1.1.3 with additional details regarding stormwater management facilities provided in Section 5.1.1.4. Section 5.2 provides an overview of potential accidents and malfunctions (e.g. spills) and associated precautions and mitigation measures during construction. Sample O-Train operational procedures for spill response and dangerous goods are provided in Appendix H.	5.1.1.3 and 5.1.1.4
Transportation	The existing transit network, roadway network and future roadway expansions are discussed in Section 4.2.8. Potential effects during construction include impacts to traffic operations (Section 5.1.2.13) and freight movements (Section 5.1.2.14). Potential construction effects to traffic can be mitigated by properly planned detour routes and advance consultation and notification of construction and detours. The O-Train Service is to be kept operational as long as possible. However, closure of the system is required for construction and testing. This closure will be mitigated as much as possible by temporarily operating a parallel bus service. This type of alternative service has been proven to be effective in the past. Additional cyclist-specific construction mitigation measures are discussed in Section 5.1.2.13. NRC-CSTT access effects and construction mitigation are discussed in Section 5.1.2.14, mitigation includes the implementation of a communications plan to ensure proper communication regarding shut-down and overall operations during construction. Given the short-term nature of construction and the implementation of the previously noted mitigation measures no significant adverse environmental effects are anticipated.	4.2.8, 5.1.2.13 and 5.1.2.14
Vegetation and Wetlands	An overview of existing vegetation and wetlands is provided in Section 4.1.3. Construction mitigation techniques have been identified in Section 4.1.3 to ensure that vegetation communities and their associated wildlife habitat are protected to the extent possible during construction. Potential adverse effects to 'non-designated' vegetation communities and proposed construction mitigation are outlined in Table 5.1.1.5-1. Although most construction effects to designated natural areas are limited to edge effects, additional mitigation measures are warranted for Vincent Massey Woods, Albion Road (Leitrim) Wetland and Chapman Mills – East Woodlot (Nepean Woods). Table 5.1.1.1-1 outlines the potential adverse effects to designated natural features and	4.1.3, 5.1.1.1, and 5.1.1.5

Table E-1 Summary of Responses to Federal Information Requirements		
Federal Information Requirements	**Proponent's Response**	**Section Reference**
	proposed construction mitigation. It should also be noted that the City has committed to a tree replacement strategy that will include a replacement ratio of 2:1. This will result in an overall net gain for the project. This commitment does not preclude additional mitigation and/or compensation that will be negotiated with specific agencies related to land transfers or permits. With the implementation of the proposed mitigation measures outlined in Sections 5.1.1.1 and 5.1.1.5 no significant adverse environmental effects are anticipated.	
Wildlife and Migratory Birds	An overview of wildlife and migratory birds known to exist within the study area is provided in Section 4.1.4. Section 4.1.3 provides additional details regarding existing habitat. Mitigation for common/not at risk species is primarily focused on mitigation of potential adverse effects to wildlife habitat. The mitigation measures recommended for the protection of 'designated natural areas' (Section 5.1.1.1), vegetation communities (Section 5.1.1.5), fisheries and aquatic habitat (Section 5.1.1.2) and surface and groundwater (Section 5.1.1.3) are applicable to the protection of wildlife and their habitat. As noted in Section 5.1.1.1, all wildlife encountered during construction activities will be protected and all active nests of migratory birds will be protected. With the implementation of the proposed mitigation measures outlined in Sections 5.1.1.1, 5.1.1.2, 5.1.1.3, and 5.1.1.5 no significant adverse environmental effects are anticipated.	4.1.3, 4.1.4, 5.1.1.1, 5.1.1.2, 5.1.1.3, and 5.1.1.5
OPERATION / MAINTENANCE		
Air Quality	An overview of ambient air quality is provided in Section 4.1.5. The project is not anticipated to result in significant adverse environmental effects either locally or regionally during the operations phase, as the preferred technology is electric LRT. It is anticipated that the project will likely have local and regional air quality benefits during the operations phase, as it will eliminate the use of diesel O-Train vehicles along the existing rail corridor, reduce the number of diesel buses required to provide the same service of the LRT and reduce the dependency of automobile use within the City of Ottawa.	4.1.5 and 5.1.1.7
Archaeology and History	An overview of existing and potential archaeological resources and known cultural resources is provided in Section 4.2.6. As discussed in Section 5.2.1.8, no significant adverse environmental effects are anticipated during the operational phase of the project as no additional land will be affected. An overview of known existing and potential heritage resources (cultural landscape and built heritage features) is provided in Section 4.2.6. As discussed in Section 5.2.1.9, with the implementation of proposed construction mitigation measures no significant adverse environmental effects are anticipated during the operational phase.	4.2.6, 5.1.2.8, and 5.1.2.9
Central	An overview and description of the Central Experimental Farm (including the Dominion Arboretum) is provided	4.2.3 and

Table E-1 Summary of Responses to Federal Information Requirements		
Federal Information Requirements	**Proponent's Response**	**Section Reference**
Experimental Farm	in Section 4.2.3. With the implementation of proposed construction mitigation measures (Section 5.1.2.2) no significant adverse environmental effects to Central Experimental Farm are anticipated during the operational phase.	5.1.2.2
Contaminated Sites and Waste Management	Areas of actual and potential site contamination are discussed in Section 4.2.7 with additional details provided in Appendix G. There is potential for impacts to contaminated sites during construction and potential for waste impacts to land during construction. Section 5.1.2.10 outlines proposed mitigation measures including proper storage and handling of potentially harmful products and chemicals, and proper containment and handling of wastes during operation and maintenance. With the implementation of the mitigation measures outlined in Section 5.1.2.10 no significant adverse environmental effects are anticipated.	4.2.7 and 5.1.2.10
Fish and Fish Habitat	Section 4.1.1 provides a summary of the existing aquatic habitat and potential sensitivities at each of the twenty-seven potential watercourse crossings located along the study corridor. Additional details are provided in the Natural Environment Report (Appendix A). Potential effects during the operational and maintenance phase relate primarily to increased stormwater runoff. As discussed in Section 5.1.1.2, stormwater runoff is not anticipated to result in any significant adverse environmental effects as runoff will be mitigated by the implementation of the stormwater management measures identified in Section 5.1.1.4. Compensation Plans and formal authorization under the Fisheries Act will be obtained during Detail Design. It is anticipated that there will be a benefit to fish habitat as the compensation plans required for Authorization under the Fisheries Act will result in a net gain in fish habitat.	4.1.1, 5.1.1.2, 5.1.1.4 and Appendix A
Health and Wellbeing	Potential adverse effects to health and wellbeing (including but not limited to air, noise and safety) are discussed in Section 5.1.2.5. The greatest potential effect to human health wellbeing is pedestrian and traveller safety. With the implementation of mitigation measures noted in Section 5.1.2.5 no adverse environmental effects are anticipated. With the implementation of proposed mitigation measures, including those identified for air quality (Section 5.1.1.7) and noise (Section 5.1.2.6), this project will not result in significant adverse environmental effects to human health and will likely result in benefits to air quality and assist the City of Ottawa in meeting the growth objectives set out in their Official Plan. The Official Plan sets out a growth management strategy emphasizing urban intensification and increased mixed-use development centred on rapid transit as the preferred mode of travel. This means that more new residences will be built close to, or using, existing city infrastructure such as water, sewer and power lines, making growth more affordable for taxpayers. It also means that residents will increasingly be able to live, work, play and shop all within their own communities, reducing the need to get in a car and travel and instead encouraging healthier choices such as walking, cycling or use of transit to reach those destinations.	5.1.1.7, 5.1.2.5 and 5.1.2.6

Table E-1 Summary of Responses to Federal Information Requirements

Federal Information Requirements	Proponent's Response	Section Reference
Land Use	Existing and future land uses are described in Sections 4.2.1 and 4.2.2 with additional details provided in Appendix C. Potential effects during the operational phase include Station and Park and Ride security, aesthetic impacts, community safety and increased traffic on-route to Park and Ride lots. As noted in Sections 5.1.2.6 and 5.1.2.7 no significant noise and vibration effects are anticipated. Proposed operational mitigation is discussed in detail in Section 5.1.2.1. The proposed mitigation encompasses mitigation for security around Stations and Park and Ride lots, aesthetics, noise, vibration, safety around tracks, prevention of unauthorized access, and mitigation for increased traffic around the Park and Ride lots. With the implementation of the proposed mitigation measures no significant adverse environmental effects are anticipated during the operational phase. In fact, the residual effects of this project will result in benefits to surrounding land uses as it will assist the City of Ottawa in meeting the growth objectives set out in their Official Plan.	4.2.1, 4.2.2, 5.1.2.1, 5.1.2.6 and 5.1.2.7
Noise and Vibration	Existing and future noise and vibration are discussed in Sections 5.1.2.6 and 5.1.2.7. Additional details are provided in the noise impact assessment (Appendix D), vibrations impact assessment (Appendix E) and the National Arts Centre vibrations impact assessment (Appendix F). With the implementation of proposed mitigation measures no significant adverse environmental effects are anticipated. Noise impacts resulting from the operation of the proposed LRT system are generally not significant and, as discussed in Section 5.1.2.6, mitigation is not warranted. As outlined in Section 5.1.2.7, vibration guidelines are predicted to be met at all receptors (with the exception of the NAC). With the implementation of construction mitigation measures, no operational vibration mitigation measures are required.	5.1.2.6.1, 5.1.2.7, Appendix D, Appendix E and Appendix F
Rail Rolling Stock Accessibility	The recommended North-South Corridor LRT facility will be fully accessible to the disabled following all of the City of Ottawa's present transit accessibility standards and all pertinent legislation. It should be noted that the City's standards are consistent with the CTA's " Code of Practice: Removing Communications Barriers for Travellers with Disabilities" and "Guide to Removing Communication Barriers for Travelers with Disabilities". Specific accessibility requirements (e.g. low-floor vehicles with roll-on/roll-off capability) will be addressed during the design and construction stage of the project. Safety is an important component of the LRT operations and can be addressed in the final design and operations of the system. These measures may include:	5.1.2.15

Table E-1 Summary of Responses to Federal Information Requirements		
Federal Information Requirements	**Proponent's Response**	**Section Reference**
	• Security cameras on vehicles, at stations and parking lots; • Telephones at parking lots and stations; • Panic buttons at stations; • Lighting for traffic and pedestrians; • Safety through design; • Fencing at parking lots and near residential areas; • Controlled access across the tracks; • Roving security patrols; • Signals at rail crossings; • Involvement of special interest groups during design; and • High maintenance standards to retain secure sites. With the implementation of the proposed design, no significant adverse environmental effects are anticipated as the LRT system will be designed to ensure full accessibility of the system in accordance with City of Ottawa policy and all pertinent legislation (e.g. Accessibility for Ontarians with Disabilities Act).	
Rideau Canal	An overview and description of the Rideau Canal is provided in Section 4.2.4 with additional details regarding recreational uses provided in Section 4.2.5. Components of the natural environment within and surrounding the Rideau Canal are described in Sections 5.1.1.2 and 5.1.1.5. With the implementation of the proposed mitigation measures outlined in Sections 5.1.1.2, 5.1.1.5, 5.1.2.3 and 5.1.2.4 no significant adverse environmental effects are anticipated.	4.2.4, 4.2.5, 5.1.1.2, 5.1.1.5, 5.1.2.3 and 5.1.2.4
Species of Special Concern	Section 4.1.4 provides an overview of species at risk and significant habitat within the study area. The standard mitigation measures recommended for the protection of 'designated natural areas' (Section 5.1.1.1), vegetation communities (Section 5.1.1.5) and fisheries and aquatic habitat (Section 5.1.1.2) are applicable to the protection of potential habitat for rare species and species at risk. Some additional species specific measures are noted in Table 5.1.1.6-1. The greatest potential for operation and maintenance effects to species of special concern is in wetland habitats due to the potential for water quality effects. Specifically, runoff from storm events, which has the potential to carry contaminants into surrounding wetland habitats, could degrade these areas over time and reduce the habitat quality for rare species. Section 5.1.1.4 outlines mitigation of potential adverse runoff effects via stormwater management. With the implementation of the proposed mitigation measures outlined in Sections 5.1.1.1, 5.1.1.2, 5.1.1.4, 5.1.1.5 and 5.1.1.6 no significant adverse environmental effects are anticipated.	4.1.4, 5.1.1.1, 5.1.1.2, 5.1.1.4, 5.1.1.5 and 5.1.1.6

Table E-1 Summary of Responses to Federal Information Requirements		
Federal Information Requirements	**Proponent's Response**	**Section Reference**
Surface and Ground Water	Potential operational and maintenance effects to groundwater features are limited to effects associated with stormwater run-off. Mitigation for these potential effects is discussed in Section 5.1.1.4 and includes stormwater management facility design. Section 5.2 provides an overview of potential accidents and malfunctions (e.g. spills) and associated precautions and mitigation measures during operation. Sample O-Train operational procedures for spill response and dangerous goods are provided in Appendix H.	5.1.1.3, 5.1.1.4, 5.2 and Appendix H
Transportation	The existing transit network, roadway network and future roadway expansions are discussed in Section 4.2.8. Potential operational effects to traffic can be mitigated by reducing the number of buses by taking advantage of the available LRT capacity, retaining all current turning movements, proper design of bus and LRT platforms and development of safety protocols for the operational phase. NRC-CSTT access effects re discussed in Section 5.1.2.14, mitigation includes separation of tracks and coordination of maintenance. The recommended plan identifies the relocation of the existing NRC-CSTT access siding track to the west of the twin-track Light Rail Transit line. Although the recommended plan identifies a third track as the preferred solution, the City of Ottawa will consider other options during the detailed design stage of the project implementation process that may provide a more cost-effective means of serving the NRC-CSTT facility. These options may include using a portion of the LRT track where technically feasible. With the implementation of the proposed operational mitigation measures no significant adverse environmental effects are anticipated.	4.2.8, 5.1.2.13 and 5.1.2.14
Vegetation and Wetlands	An overview of existing vegetation and wetlands is provided in Section 4.1.3. Standard construction mitigation techniques are recommended to ensure that vegetation communities and their associated wildlife habitat are protected to the extent possible during operation/maintenance. The greatest potential adverse effect from operational and maintenance activities are to adjacent designated natural areas that include wetland components and/or watercourses. Potential water quality-related effects will be mitigated by the development of stormwater management facilities as identified in Section 5.1.1.4. Potential adverse effects to 'non-designated' vegetation communities and proposed operational mitigation are outlined in Table 5.1.1.5-1. Table 5.1.1.1-1 outlines the potential adverse effects to designated natural features and proposed mitigation. It should also be noted that the City has committed to a tree replacement strategy that will include a replacement ratio of 2:1. This will result in an overall net gain for the project. This commitment does not preclude additional mitigation and/or compensation that will be negotiated with specific agencies related to land transfers or permits.	4.1.3., 5.1.1.1, 5.1.1.4 and 5.1.1.5

Table E-1 Summary of Responses to Federal Information Requirements		
Federal Information Requirements	**Proponent's Response**	**Section Reference**
	With the implementation of the proposed mitigation measures outlined in Sections 5.1.1.1, 5.1.1.4 and 5.1.1.5 no significant adverse environmental effects are anticipated.	
Wildlife and Migratory Birds	An overview of wildlife and migratory birds known to exist within the study area is provided in Section 4.1.4. Section 4.1.3 provides additional details regarding existing habitat. Mitigation for common/not at risk species is primarily focused on mitigation of potential adverse effects to wildlife habitat. The mitigation measures recommended for the protection of 'designated natural areas' (Section 5.1.1.1), vegetation communities (Section 5.1.1.5), fisheries and aquatic habitat (Section 5.1.1.2) and stormwater management (Section 5.1.1.4) are applicable to the protection of wildlife and their habitat. As discussed in Section 5.1.1.1, although there is some localized potential for wildlife disturbance in adjacent natural areas due to increased noise levels, these effects are also anticipated to be minor. Where the O-Train currently operates, wildlife will have already habituated to this minor disturbance. Furthermore, in general noise levels will be mitigated to the extent possible through design, and relative to other transportation facilities are of much reduced frequency and intensity generally. Operation of the LRT is anticipated to have minimal effects on wildlife. There will likely be some direct mortality; however, it is not anticipated to be significant. Train frequency will be many times less than the frequency of vehicular traffic on roadways within the same vicinity therefore it is anticipated that direct mortality from trains will be only a small proportion of total transit-related mortality. In fact, the total transit-related wildlife mortality may decrease if the number of cars on the roads is reduced through LRT ridership. With the implementation of the proposed mitigation measures outlined in Sections 5.1.1.1, 5.1.1.2, 5.1.1.4, and 5.1.1.5 no significant adverse environmental effects are anticipated.	4.1.3, 4.1.4, 5.1.1.1, 5.1.1.2, 5.1.1.4, and 5.1.1.5

1.0 Introduction

1.1 Project Overview

In April 2004, the City of Ottawa initiated an Environmental Assessment (EA) study for the North-South Corridor Light Rail Transit (LRT) Project to address existing and future transportation demand between the rapidly growing communities in the south and downtown Ottawa, as well as points in between, including the Macdonald-Cartier International Airport. The EA process engaged residents and businesses to assist in examining a wide range of alternatives, identifying both construction and operational effects and mitigation measures on all aspects of the environment (i.e. natural, socio-economic, cultural and transportation) leading toward the identification of a Recommended Plan for the undertaking.

The original study limits extended from the Rideau Centre to the proposed Limebank Station in Riverside South. On May 14, 2004, a joint Federal and Provincial funding announcement led to the extension of this project and EA study limits to include the future link to the Barrhaven Town Centre on the west side of the Rideau River.

This Screening Report was prepared to assist Federal Responsible Authorities in undertaking their review under the *Canadian Environmental Assessment Act (CEAA)* and documents the proposed project and summarizes all stages of the planning process leading to the development of the final recommended plan for the North-South Corridor LRT Project. The planning process is fully documented in the Ontario EA Report submitted to the Ontario Ministry of the Environment in September 2005. The scope of project and impact assessment reflects the details of the project known at the completion of functional design as of September 2005. The factors examined as part of the impact assessment were developed to address the information requirements outlined in the Final CEAA Scoping Document (Appendix L) prepared by the Federal Environmental Assessment Team received in September 2005. Additional details on the environmental assessment methodology are included in Section 2.2.

The planning process to select a preferred alternative was undertaken in accordance with the requirements of the Ontario Environmental Assessment Act and the approved EA Terms of Reference (ToR) for this project. The EA ToR was approved by the Ontario Minister of the Environment on September 15, 2004 and outlined a planning process to identify the need and generate and evaluate alternatives in order to identify a preferred alternative. Key to this EA was the analysis of various alternative corridors and alignments including the identification of all potential environmental effects and proposed measures to mitigate potential adverse effects.

The purpose of the Undertaking as it is defined in the approved Terms of Reference is:

- To respond to growth pressures by providing improved transportation in the study area; and
- To continue making Ottawa a liveable and economically viable city by providing a valuable tool for structuring and achieving land use, environmental and social objectives.

Significant growth is expected to occur in the greater Ottawa area over the next 20 years. The forecasted levels of population and employment translate into higher levels of peak period person trips loading the current transportation network.

Based on the transportation, land use and growth issues discussed in this report, the following summarizes the problems and opportunities being addressed by this study:

- Planned population growth of 75% and a 50% increase in employment will result in significant travel demand increases throughout the corridor.
- The existing transportation infrastructure will be unable to accommodate this anticipated growth.
- The growing communities of Riverside South and Barrhaven/South Nepean will experience substantial growth, with the combined addition of 115,000 residents over the planning period.
- The City of Ottawa's Official Plan outlines a growth management strategy to accommodate this growth based on the vision of sustaining the natural environment, optimizing economic vitality and ensuring healthy communities.
- To accomplish this, the City of Ottawa's Official Plan emphasizes urban intensification and increased mixed-use development centered on rapid transit as a means to address travel demand and to discourage the use of single occupancy vehicles for peak period travel.
- To realize this vision the City of Ottawa has established policies to support the following:
    a. Increase the overall peak hour transit modal share from 17% to 30%.
    b. Introduce high quality rapid-transit service at an early stage in the development of new urban communities in order to influence travel behaviour and encourage and promote alternative modes of transportation to reduce the dependency of residents on private automobile use.

This project is the critical first step towards implementing Light Rail Transit as part of the overall expansion of the City of Ottawa's rapid transit network, which is a fundamental requirement of the City of Ottawa's Official Plan (OP) and Transportation Master Plan (TMP). It delivers on several key Smart-Growth objectives, including providing high-quality rapid transit services *early* in the development of major growth areas, thereby setting the stage for attaining the City of Ottawa's long-range objectives of increasing the share of peak-hour travel from 17% transit ridership now to 30% transit ridership by 2021.

The North-South Light Rail Transit Corridor is expected to deliver a number of benefits, including:

- environmental benefits: cleaner air by reducing greenhouse gas emissions from the burning of fossil fuels through the replacement of current diesel technology with electric power, as well as by the proven success of Light Rail in converting more residents from using cars to choosing transit;
- reduced traffic congestion: reducing the number of cars on parallel roads, increasing the current reductions of over 600 fewer cars on Bronson Avenue and other roads as a result of the O-Train Pilot Project, and enhance transit service to a number of federal properties including: Confederation Heights, 870 Carling, Booth Street Complex, Plouffe Park and other federal properties in the core area;
- social benefits: connecting communities and fostering travel and participation between communities, as well as offering more housing options for the City of Ottawa's university students along the Light Rail line;

- economic benefits: providing new opportunities for residents and visitors to access downtown businesses, shops and entertainment districts, especially on weekends and in off-peak hours; enabling some residents to reduce expenses related to the number of family vehicles owned; providing increased commuter choice and flexibility; financial savings for both employee and employer; better linkages between federal employment notes, and enabling the City of Ottawa to achieve significant cost efficiencies in the operational costs of transit services delivery.

The recommended Corridor plan consists of 31 km of twin-track electrically powered Light Rail Transit service running from its southern terminus (end point) in the future Barrhaven Town Centre to the Rideau Centre, and includes a link to the Macdonald-Cartier International Airport. By 2021, a projected ridership of 60,000 to 70,000 people per weekday will be served on the North-South Light Rail Transit line, accessed at up to thirty-four different station locations. Four new Park & Ride lots, with a potential total collective capacity of over 7000 parking spots, have been planned at Leitrim, Bowesville, River Road and Woodroffe stations.

The selected route is centred on the expansion of the existing O-Train Pilot Project (former CP Ellwood) corridor, with a southern and western extension through Riverside South to Barrhaven Town Centre, and an eastern extension through LeBreton Flats, up the escarpment sharing the bus transit lanes along Albert and Slater Streets to a terminus at the Rideau Centre on the Mackenzie King Bridge. Alignments and station locations through Barrhaven and Riverside South were determined through separate community planning processes, with refinements made through the EA. The alignment through LeBreton Flats was developed in close cooperation with the National Capital Commission.

Figure 1.1-1 below provides a general overview of the project. A more detailed description of the Project is included in Chapter 3. Functional Design Plates are included in the Appendix package for reference.

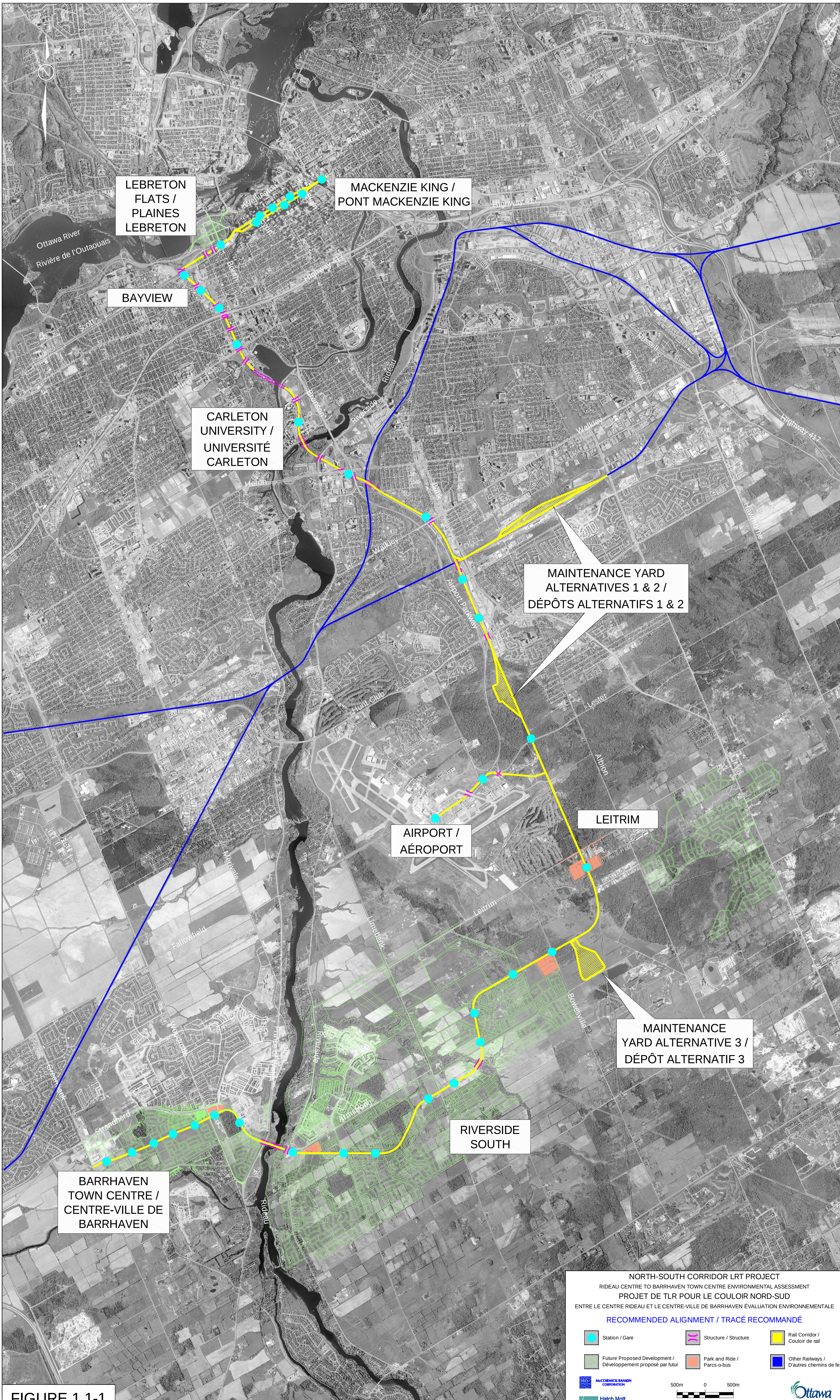

LEBRETON FLATS / PLAINES LEBRETON
MACKENZIE KING / PONT MACKENZIE KING
BAYVIEW
CARLETON UNIVERSITY / UNIVERSITÉ CARLETON
MAINTENANCE YARD ALTERNATIVES 1 & 2 / DÉPÔTS ALTERNATIFS 1 & 2
AIRPORT / AÉROPORT
LEITRIM
MAINTENANCE YARD ALTERNATIVE 3 / DÉPÔT ALTERNATIF 3
RIVERSIDE SOUTH
BARRHAVEN TOWN CENTRE / CENTRE-VILLE DE BARRHAVEN
Ottawa River
Rivière de l'Outaouais
Highway 417
Rideau
Walkley
Airport Parkway
Hunt Club
Albion
Lester
Leitrim
Limebank
Bowesville
Riverside
Fallowfield
Woodroffe
Greenbank
NORTH-SOUTH CORRIDOR LRT PROJECT
RIDEAU CENTRE TO BARRHAVEN TOWN CENTRE ENVIRONMENTAL ASSESSMENT
PROJET DE TLR POUR LE COULOIR NORD-SUD
ENTRE LE CENTRE RIDEAU ET LE CENTRE-VILLE DE BARRHAVEN ÉVALUATION ENVIRONNEMENTALE
RECOMMENDED ALIGNMENT / TRACÉ RECOMMANDÉ
Station / Gare
Structure / Structure
Rail Corridor / Couloir de rail
Future Proposed Development / Développement proposé par futur
Park and Ride / Parcs-o-bus
Other Railways / D'autres chemins de fer
McCORMICK RANKIN CORPORATION
Hatch Mott MacDonald
500m 0 500m
August / Août 2005
Ottawa
Photography: Year 2002

FIGURE 1.1-1

1.2 Project Justification

The following Alternatives to the Undertaking were examined to address the purpose of the undertaking and problems identified in Section 1.1:

- Do Nothing;
- Expand Arterial Roadway Network;
- Expand Rapid Transit Services Outside the Corridor;
- Expand Rapid Transit Services Within the Corridor; and
- Combination of Expansion of Rapid Transit and Arterial Road Networks.

These five alternatives were evaluated based on four categories: Transportation System; Natural Environment; Policy and Planning; and Socio-Economic Environment. Within each category, criteria were developed that reflected the need and provided meaningful comparisons of the alternatives.

In summary, the evaluation identified that:

- A Do Nothing alternative does not support the significant growth in travel demand anticipated in the study area and would result in severe roadway congestion and congestion-related pollution.
- The Expand Arterial Roadway Network alternative would require 14 additional roadway lanes to address the need, which cannot be physically accommodated without significant adverse social and environmental effects.
- Expanding Rapid Transit Facilities Outside the Corridor does not address the transportation problem within the Study Corridor, and does not provide the level of service and connections required to serve the growing communities and employment areas in the Corridor.
- Expanding Rapid Transit Facilities Within the Corridor does not completely address the travel demand and development needs in the Corridor. While providing strong environmental benefits through reduced motor vehicle use, it also results in significant residual congestion on the roadways in the south end of the City of Ottawa.
- The Combination of Expansion of Rapid Transit and Arterial Road Network in the south end of the City of Ottawa provides for a balanced transportation system that fully meets forecasted travel demands in the Study Corridor.

The evaluation identified that a transit-only option will accommodate a large proportion of the transportation demand but not provide for full mobility, since transit alone cannot serve all trips or all destinations. Therefore the recommended solution is a combination of expansion of rapid transit service combined with limited additions to the arterial road system in the south end of the City of Ottawa. The North-South Corridor LRT Project is the rapid transit component of this alternative.

Alternative Methods for carrying out the undertaking were examined for the various component of the undertaking. The evaluation of the various components examined the advantages and disadvantages of the alternatives on the Natural, Social, Economic and Cultural Environments. The following outline the components examined:

- Alternative Technologies –LRT vs. Bus Rapid Transit (BRT);
- Alignment Alternatives – Downtown Corridor, Hunt Club Corridor, Airport Corridor, Leitrim/Armstrong Corridor; and
- Supporting Infrastructure – Alternative LRT stations.

An electrically powered rail-based system that takes advantage of the existing O-Train rail infrastructure was recommended, capitalizing on the potential cost savings and reduction in environmental effects by using an existing rail corridor. Alternative corridors north and south of the current O-Train corridor were considered to provide service to the downtown and South Urban Community.

Albert and Slater Streets were identified as the preferred alternative in the Downtown because they currently serve as the main transit corridor in the downtown area, are central to the transit market served, have the best rail geometric characteristics, and minimized adverse effects to existing businesses and traffic operations.

Through the southern portion of the study area, the preferred alternative best serves the future development of these communities, maximizes the use of the existing rail corridor and minimizes adverse effects to environmental features.

A detailed documentation of the alternatives considered and the evaluation is included in the *North-South Corridor Light Rail Transit (LRT) Project Environmental Assessment Report* (September 2005) submitted to the Ontario Ministry of the Environment.

2.0 Federal Environmental Assessment Process

2.1 Federal Triggers

In accordance with the *Canadian Environmental Assessment Act* (CEAA), the federal government is required to ensure that an environmental assessment is conducted before a federal authority performs one or more of the following CEAA triggers with respect to a project:

- is the proponent of a project;
- grants money or any other form of financial assistance to the project;
- leases, sells or disposes of land to enable a project to be carried out; or
- exercises a regulatory duty in relation to a project, such as issuing a permit or license that is included in the Law list prescribed by the regulations to the Act.

In accordance with CEAA, a screening is required for the proposed project. The Canadian Environmental Assessment Agency (Agency) is acting as the federal environmental assessment coordinator for the screening. The potential federal triggers are outlined in Table 2.1-1.

Table 2.1-1 Summary of the Potential Federal Triggers
Federal Responsible Authorities
Transport Canada – funding, land, approval under subsection 5(1) under the *Navigable Waters Protection Act* and potential *Railway Safety Act* approval under subsection 10(1)
Infrastructure Canada – funding
Fisheries and Oceans Canada – potential *Fisheries Act* authorization under subsections 35(2) and 37(2)
Public Works and Government Services Canada - land
Canadian Transportation Agency – *Canada Transportation Act* approvals and authorizations under subsections 98(2), 99(3) and 101(3)
Parks Canada – land and *Department of Transport Act*: *Historic Canals Regulations* permit under subsection 14(2)
Agriculture and Agri-Foods Canada – land
Federal Authorities
Environment Canada
Health Canada
Other Federal Involvement
National Capital Commission

Appendix I outlines the federal land required by the project as identified at the end of the functional design completed in September 2005. Additional details of potential land requirements for construction staging areas and construction accesses are included in Section 5.1.2.18.

2.2 Environmental Assessment Methodology

The impact assessment process was designed to meet the information requirements outlined in the Final CEAA Scoping Document (Appendix L) prepared by the Federal Environmental Assessment Team received in September 2005. The potential environmental effects outlined in this report are based on the details of the project as identified at the end a Functional Design Stage (September 2005). Potential effects as a result of known design changes since that time have also been included in this report. It should be noted that potential construction staging areas and construction accesses are currently being identified. A preliminary description of these areas is included in Section 5.1.2.18 of this report. It is recognized that detailed impact assessment has not occurred on these sites. However the City is committed to providing the necessary details on the potential effects and proposed mitigation measures as design progresses.

It is recognized that as the project proceeds through the design process additional details relating to construction staging and mitigation will be developed. The overall objective of undertaking the Federal Review at this stage of planning and design is to coordinate Federal and Provincial EA Requirements in accordance with *Canada-Ontario Agreement on Environmental Assessment Cooperation* and to allow the Responsible Authorities an opportunity to undertake a review of the project early enough in the planning process. As such it is not possible to provide final details of all the mitigation measures and all the potential effects as detail design and detailed construction staging has not been developed.

A Project Environmental Management Plan (PEMP) included in Chapter 9 of this Report outlines the process that the City of Ottawa will follow as design proceeds to ensure that the mitigation commitments outlined in this document are realized during the design and construction stages. It is also recognized that additional details will be provided at the time specific permits and approvals are sought.

The potential effects to valued ecosystem and social components identified in Chapter 5 focuses on the following key steps:

- determine whether or not there are environmental effects and, if so, whether they are adverse;
- determine whether adverse effects are significant; and
- determine whether significant adverse environmental effects are likely based on probability of occurrence and scientific certainty.

Chapter 5 was organized based on the factor areas identified in the Final CEAA Scoping Document (Appendix L) prepared by the Federal Environmental Assessment Team. It is recognized that some features have potential effects on various factor areas and therefore potential effects to some specific features may be documented in more than one section. An example of this would be a specific watercourse that may have potential effects to fisheries and aquatic habitat. These effects are documented in the fisheries section. In addition there may be potential effects to navigation which are documented in the navigation section. The rationale for structuring the report and assessment section in this manner was to mirror the information requirements outlined in the scoping document (Appendix L).

Each section includes documentation of potential effects, proposed mitigation and the significance of the potential effect. The following issues were considered when determining the significance of the potential effect:

- Direction – measure of relative effect, i.e. positive or negative;
- Geographic extent / location – spatial area affected by a project – local, regional, national, global
- Frequency – measure of repetitions -one time, recurring
- Duration – measure of the length of time a potential effect could last, i.e. short-term, long-term;
- Magnitude – potential severity of the effect; based on relationship to a regulation or guidelines or accepted industry standards;
- Occurrence – measure of likelihood of the effect;
- Reversibility/Mitigation – the potential for recovery and ability to avoid effect or reduce time to recover;
- Ecological – measure of the ecological impact of the effect with consideration of the relative ecological importance of the environmental component;
- Confidence – level of confidence in prediction of effect;
- Residual Effects – measure of overall effect with consideration of reversibility/mitigation;
- Cumulative Effects – measure of the net environmental effects associated with the project in combination of the environmental effects of other past, present or future projects or activities; and
- Significance – overall impact significance of the potential residual environmental effects.

3.0 Scope of the Project

3.1 Project Components Description

Under CEAA, “Scope of the Project” refers to those components of the proposal that should be considered part of the project for the purposes of the assessment.

The “Scope of the Project” is partially determined by the federal triggers. For this project the Responsible Authorities have indicated that the “Scope of the Project” includes all aspects of the project related to the construction, operation, maintenance, improvements and decommissioning phases of Ottawa’s North-South Corridor LRT Project. Issues associated with accidents and malfunctions will also be considered.

Table 3.1-1 summarizes the various activities by project phase.

Table 3.1-1 Summary of Activities by Project Phase

Project Phase	Project Activity	Related activities
Construction	31km of twin-track from the Rideau Centre to Barrhaven Town Centre • Construction of new track from the Rideau Centre to Bronson Avenue within existing roads and on a new alignment to Bayview Station • Twinning and upgrading of existing track from to Bayview Station to south of Leitrim Road • Construction of new track from south of Leitrim Road to Barrhaven Town Centre on a new alignment (exclusive right-of-way) • Construction of new track into the Macdonald-Cartier International Airport on a new alignment	Site excavation and grading, drainage, blasting, rock drilling, street construction, overhead electrical installation, track laying, signal installation, purchase of electric LRT vehicles, channel realignment, sediment and erosion control measures, stormwater management facilities, security features, installation of lights and communication systems, transportation and storage of construction materials and equipment, vegetation/habitat restoration

Table 3.1-1 Summary of Activities by Project Phase		
Project Phase	**Project Activity**	**Related activities**
	35 Stations • 9 existing stations that require upgrading modifications	Grading, drainage, blasting, rock drilling, street construction, replacement of platforms and shelters to accommodate twin track, reconfigure accessibility, pedestrian access, and installation of lights and communication systems
	• 24 new stations, not necessarily all developed during initial construction	Site excavation and grading, drainage, blasting, rock drilling, street construction, installation of platforms and shelters, building erection, security features, installation of lights and communication systems
	• 2 new stations for Airport link	Integration with Airport Terminal and future development site
	• 17 traction-power substations	Excavation, grading and small building construction including electrical power supply and underground electrical conduits. Installation of electrical equipment, including transformers, rectifiers, circuit breakers and control systems within the building
	• 22 new structures including: ○ Temporary Structures ○ Final Structures ○ Dow's Lake Tunnel	Site excavation and grading, drainage, blasting, rock drilling, street construction, bridges, retaining walls, extension/construction of culverts
	• 14 existing structures that require minor modifications	Slope restraining and grading, vibration dampening
	Maintenance & Storage Facility • 3 identified alternative sites	Site excavation and grading, drainage, overhead electrical installation, track laying, maintenance buildings, associated road access and parking lot, security features, installation of lights and communication systems

Table 3.1-1 Summary of Activities by Project Phase		
Project Phase	**Project Activity**	**Related activities**
	Parking Facilities • 4 new parking facilities located at Woodroffe, River Road, Bowesville, and Leitrim with a total ultimate capacity of 7000 cars.	Site excavation and grading, drainage, street construction, building erection, security features, installation of lights and communication systems
Operation, Maintenance and Improvement	• Service and Alignment	Repair or replacement of tunnel, bridge structures, culverts, track, rail grinding, Security issues, recovery from system accidents or malfunctions, landscaping, fencing, signs, illumination
	• Vehicles	Daily maintenance of vehicles, cleaning, graffiti removal, garbage collection
	• Parking facilities	Repair or repaving of Park and Ride Lots, winter snow clearance, limited salt application to Park and Ride Lots and crossroad locations, landscaping, fencing, signs, illumination, graffiti removal, garbage collection
	• Stations	Winter snow clearance, maintenance / rehabilitation of building and infrastructure, landscaping, fencing, signs, salting, illumination, graffiti removal, and garbage collection
	• Structures	Building and infrastructure maintenance / rehabilitation
	• Utilities	Storm drainage system repairs, drainage structure maintenance / clean out
	• Maintenance Facilities	Spill retention, maintenance of landscaping, fencing, signs, illumination, and repair or replacement of paving and track
Decommissioning	Decommissioning is not applicable to the City of Ottawa's North-South Corridor LRT given that the facility is part of the City of Ottawa's long-term transportation vision and is considered permanent within the planning horizon (lifespan of the facilities). However, decommissioning of any project elements, if required, will be undertaken in accordance with applicable environmental regulations in place at that point in time.	

3.1.1 Detailed Project Description

Please refer to Figure 1.1-1 (Section 1.1) for a general overview of the project

The southern terminus of the completed Light Rail Transit facility will be at Barrhaven Town Centre, southeast of the Strandherd Drive/Greenbank Road intersection, where there will be a future interchange station with the proposed extension of the Southwest Transitway. From here, the line runs easterly at grade, within the median of the future Chapman Mills Drive through South Nepean, crossing Woodroffe Avenue at grade to reach Woodroffe Station. There are four proposed stations within this stretch of the Light Rail Transit line, situated at the intersections of the future Longfields, Claridge, Beatrice and Newland streets.

The first Park & Ride lot is located at the Woodroffe Station with accommodation for approximately 825 vehicles in the northeast quadrant of the Woodroffe Avenue and Strandherd Drive intersection.

East of Woodroffe Station, the line curves around to the north of the Nepean woods within an exclusive right of way, then swings south crossing under Cresthaven Drive where a station is located. As the line extends east from Cresthaven Station it rises above ground to cross over Prince of Wales Drive immediately south of the Strandherd Drive intersection. The Light Rail Transit line crosses the Rideau River on a separate structure adjacent to the proposed new Strandherd-Armstrong train/car bridge, passing under River Road immediately south of the Armstrong Road intersection on the east side of the river. Initially, the Light Rail Transit line will cross the river using two lanes of the eventual six-lane Strandherd-Armstrong Bridge.

East of River Road, the line rises out of the ground to meet at grade at River Road Station, where a 1,000 vehicle Park & Ride lot is located. From there, the line runs at-grade, swinging south through West Spratt Station and Shoreline Station to bypass the Astral Media communication towers and Armstrong South Woods. From there, the tracks head easterly within the median of a main street-type development – similar to Chapman Mills Drive in South Nepean – and continues east through the Riverside South community core to Main Station. East from Main Station an at-grade crossing takes the line across Limebank Road to Limebank Station, then extends east and north within an exclusive right of way to cross over Mosquito Creek. The line then crosses Earl Armstrong Road at grade, with a station located at the crossing. Property is to be protected for a potential future grade separation.

The line extends northeast of Earl Armstrong to East Spratt Station, then turns due east, heading to Business Park Station – the eastern-most station within the Riverside South community. On the east periphery of Riverside South lies Bowesville Station, which will exist to serve a Park & Ride lot accommodating up to 3,000 vehicles. The Light Rail Transit line continues easterly, still within an exclusive right-of-way, until it intersects with the City of Ottawa owned abandoned north-south Canadian Pacific Railway (CPR) – Prescott Subdivision.

From this point, the Light Rail Transit line turns northerly and operates exclusively within the former CPR right-of-way all the way to Bayview Station. The Leitrim Station is along this portion of the corridor approximately 350 m south of Leitrim Road, with accompanying 1,200 spot and 2,500 spot Park & Ride lots being located on both the east and west sides of the line respectively. The line then crosses Leitrim and Lester Roads at grade, with Lester Station located at the intersection to provide a location for passengers to transfer from the regular Light Rail Transit line to a Light Rail Transit or other transit service that will be serving the Airport. Lester Road will be widened to 4 lanes at the rail crossing.

Between Leitrim and Lester Roads, a 2.2 km. Airport link heads westerly to serve stations at a future development site near Alert Road and at the Airport terminal. The twin-track link operates in an exclusive right-of-way and crosses under the Alert Road intersection and the Delta Taxiway.

From Lester Road, the line continues north to a new Light Rail Transit South Keys Station adjacent to the South Keys Transitway station, then to the existing O-Train Greenboro Station. This station is located south of the existing east-west freight railway tracks (CN Walkley Subdivision) and a potential future east-west Light Rail Transit line.

The recommended plan identifies the relocation of the existing NRC-CSTT access siding track to the west of the twin-track Light Rail Transit line. Although the recommended plan identifies a third track as the preferred solution, the City of Ottawa will consider other options during the detailed design stage of the project implementation process that may provide a more cost-effective means of serving the NRC-CSTT facility. These options may include using a portion of the LRT track where technically feasible.

A new structure will be built to carry the Light Rail Transit line over the existing east-west freight line to provide safe and reliable high-frequency Light Rail Transit service. From this grade separation, the existing track will be utilized and a new track will be constructed adjacent to it. The next station encountered is at Walkley Road.

Along this stretch, the Light Rail Transit line is located on the east side of the Southeast Transitway, turning easterly to pass under the railway south of Heron Road. It is at this location that another grade separation is required to permit the Light Rail Transit tracks to pass over the existing VIA Rail passenger railway tracks, as well as Sawmill Creek and the Southeast Transitway.

The Light Rail Transit line continues north of the grade separation to a reconstructed Confederation Station located immediately south of Heron Road. The Light Rail line then continues northerly towards Carleton University. Widening of the existing single-track bridge over the Rideau River, immediately south of the Carleton University campus, is required to accommodate twin tracks. Just north of the river, a new Carleton Station will be situated to tie into future university development plans.

The existing O-Train passes under Dow's Lake in a single-box railway tunnel. For the double-track Light Rail Transit line, a second single-track tunnel will be constructed parallel to and west of the present tunnel. Minor work will be carried out to embankments and retaining walls under the structures for Beech Street, Young Street Pedestrian Crossing, Gladstone Avenue and Somerset Street to accommodate the double tracking. The existing station at Carling will be modified to accommodate the twin-track Light Rail Transit line, and new stations will be located just south of Gladstone Avenue and Somerset Street.

The tracks continue north to Bayview Station, located just south of the existing Scott Street Bridge providing direct pedestrian access to integrate all surrounding development areas. The tracks then turn easterly, running on either side of the Transitway within a new right-of-way through LeBreton Flats. A crossover track will be located in this area to allow operation flexibility. LeBreton Station will be a combined Light Rail Transit and Bus Rapid Transit (BRT) facility located at Booth Street. The corridor crosses under Booth Street to provide integration between the Light Rail Transit, Transitway and bus services serving Gatineau across the Chaudière Bridge.

From LeBreton Flats, the tracks rise up the escarpment on a 5% grade and connect to the west end of Albert and Slater Streets. Both Light Rail Transit and bus rapid transit service will operate in the second lane out from the curb on the right hand side each of Slater (eastbound) and Albert (westbound) Streets. With the tracks running in a straight line, the Light Rail Transit platforms extend from the curb for passenger boarding, whereas the buses move into the curb to pick up passengers and allow Light Rail vehicles to pass. Three Light Rail Transit platforms are located on each of Albert and Slater Streets between Bay Street and Elgin Street, alternating with bus stations on every second block. All existing accesses will be maintained as well as almost all (92%) of parking, loading and taxi access.

The tracks then converge on the western approach to the Mackenzie King Bridge where the line terminates at the Rideau Centre at Mackenzie King Station. A crossover track will be located at the western approach to Mackenzie King station, and tail track will extend beyond the station platform for operational reasons.

Functional Design Plans of the project are included in the Appendix package. Additional details of potential land requirements for construction staging areas and construction accesses are included in Section 5.1.2.18.

3.1.2 Station Locations

Potential station locations were identified in a variety of ways. Within Barrhaven and Riverside South, station locations were identified as part of the development of community plans. Other locations were identified in previous studies. It is assumed that all stations could potentially be constructed; however, their timing will depend on a combination of project phasing and local development requirements.

The following 35 stations will form this project. They include 24 new stations and 9 existing, as well as 2 new for the Airport link.

1. Rideau Centre (existing)
2. Downtown 1 – between Metcalfe and O'Connor (new)
3. Downtown 2 – between Bank and Kent (new)
4. Downtown 3 – between Lyon and Bay (new)
5. LeBreton (existing)
6. Bayview (existing)
7. Somerset (new)
8. Gladstone (existing)
9. Carling (existing)
10. Carleton (existing)
11. Confederation (existing)
12. Walkley (existing)
13. Greenboro (existing)
14. South Keys (new)
15. Lester (new)
16. Leitrim (new)
17. Bowesville (new)
18. Business Park (new)
19. East Spratt (new)
20. Earl Armstrong (new)
21. Limebank (new)
22. Main Street (new)
23. Shoreline (new)
24. West Spratt (new)
25. River Road (new)
26. Prince of Wales (new
27. Cresthaven (new)
28. Woodroffe (new)
29. Airport (new)
30. Airport hotel or Uplands/Lester/Alert intersection (new)
31. Barrhaven Town Center (new)
32. Longfields (new)
33. Claridge (new)
34. Beatrice (new)
35. Newland Drive (new)

In general, two basic station concepts have been developed with either centre island platforms or offset side platforms. Pedestrian access at all stations not associated with an overpass is at-grade. Stations at overpasses with transit service include elevators and stairs to take advantage of the transit transfer and to provide accessibility.

Platform lengths have been set at 60m to accommodate two trains at the stop. Platform widths through the Southern community centres vary between 3.5m to 6m reflecting projected use, available lands, and integration with adjacent buildings. Side platforms between LeBreton station and Bowesville have been assumed to be 6m wide platforms. All the platform lengths and widths must be reviewed with the operating authority during the detail design.

Station Amenities

The design of the stations has not yet been finalized. This will be left to the detail design team. The EA has identified a preliminary list of amenities to be considered in the design process. This list is subject to further refinement during the design of each station.

Amenities proposed for consideration at the stations include but are not limited to:

- Waiting room / information centre
- Station building lighting
- Station building heating
- Shelters - open
- Shelters - enclosed
- Shelter heading
- Platform lighting
- Bicycle racks
- Bicycle lockers
- Elevators
- Escalators
- Stairwells
- Emergency telephones
- Public address system
- CCTV cameras
- Fire protection system
- Sprinklers/fire suppression system
- Access control
- Mirror for operator to watch platform
- Platform edge markings
- No-trespassing signs
- Fencing
- General train safety signs
- Emergency cart storage
- Signals room
- CCTV panel
- Radio tower
- Ticket vending machine
- Ticket sales office
- Electronic passenger information
- Next-train identification and countdown
- Map cases
- Wayfinding signage
- Tactile signage
- Train direction signs
- Timetable distribution cabinet
- Benches
- Public telephones
- Garbage receptacles
- Recycling receptacles
- Platform landscaping

3.1.3 Park & Ride Facilities

The EA examined seven potential locations for Park & Ride lots within the study corridor to be added to the existing lot at Greenboro Station. The recommended plan identifies 4 new lots accommodating over 7,000 parking stalls identified in Table 3.1.2-1, below:

Table 3.1.3-1 Park and Ride Lots

Station	# of Spots	Access From
Woodroffe	825	Strandherd at the intersection of Crestway Dr.
River Road	1000	Earl Armstrong Rd. and new collector road
Leitrim – Phase 1 – Phase 2	1200 (potential for 1500-2000)	Leitrim Road
Bowesville	3000	Bowesville Rd. and Earl Armstrong Rd.
Total proposed	**7525 - 8025**	Note this excludes existing parking spots at Greenboro

The lot at Woodroffe Station would provide access to Light Rail Transit service for South Nepean residents as well as residents in Manotick, Kars, North Gower, Kemptville, and surrounding areas. The lot will have easy access via the two arterial roadways, provide a major customer drop-off ability, allow for connection with bus services using the arterial roads, and accommodate facilities for bus operators.

The lot at River Road Station intercepts commuters traveling from the south on River Road, and serves the western portion of the Riverside South community. The site is located east of River Road, and can be accessed from the first north-south collector road to the east of River Road, and directly from Earl Armstrong Road, at a future signalized access to the commercial property on the northeast corner of the River Road/Earl Armstrong intersection.

The lot at Bowesville Station is required in the longer term, at such point in time when both the Leitrim and/or River Road lots reach their capacity. It will serve the eastern portion of the Riverside South community as well as rural areas to the south. In addition, the facility will be close to the Rideau Carleton Raceway Slots and the possible future site of the Central Canada Exhibition, and could serve as a staging location for shuttle services between the Light Rail Transit service and these activity centres.

The lot at Leitrim Road will be constructed in two phases as demand warrants. The first phase will be located on private property at the end of Quinn Road east of the rail line, accommodating approximately 1,200 vehicles. Expansion potential for as many as 1,500 to 2,000 vehicles is possible on Transport Canada property west of the rail line. The lot will provide access for residents in the Leitrim and Riverside South communities as well as the large rural commuter shed in the southeast area of Ottawa and the counties beyond. The east site is preferred over the west site for initial construction because it is closer to the Leitrim development and to Bank Street South, where most of the rural commuters that would use the facility will be coming from. With most traffic to the site coming from the east or southeast, the east site also has the advantage of avoiding a substantial increase in the amount of traffic at the Light Rail Transit/Leitrim Road crossing. The facility will provide access for passenger drop-off as well as stops for feeder bus routes serving the Leitrim development.

Amenities proposed for consideration at the Park and Ride lots include but are not limited to:

- Lot and walkway lighting
- Stormwater management
- Landscaping
- Bus lay up area
- Kiss and Ride
- Taxi area
- Accessibility Parking
- Emergency telephones
- Public address system
- CCTV cameras
- Public telephones
- Garbage receptacles
- Recycling receptacles

3.1.4 Structures

The North-South Corridor Light Rail Transit project requires construction of a number of new structures and upgrading or widening of a number of existing structures as presented in Table 3.1.4-1.

Table 3.1.4-1– Summary of New Structural Requirements

Structure Location	Need	Length[1]	Remarks
Cresthaven Road	Carry Cresthaven Road over LRT tracks	11 m clear span	New Underpass
Prince of Wales Drive (in South Nepean)	Carry LRT tracks over road	30 m single span	New bridge crossing (Ultimate)
Rideau Canal Crossing (Final Alignment Strandherd)*	Carry LRT tracks over Rideau Canal	3 span structure. Piers will not be in the water	New bridge crossing (Ultimate)
Strandherd / Armstrong Crossing (Interim Alignment)*	Carry LRT tracks over Rideau Canal	Structure without piers in the water	2 lanes of new 6-lane roadway crossing utilized to carry LRT tracks over river (Interim)
River Road Underpass	Carry River Road over LRT tracks	11 m clear span	New Underpass (Ultimate)
Mosquito Creek	Carry LRT tracks over Mosquito Creek	4 span continuous structure with spans of 17/22.5/22.5/17 m	New bridge crossing
Hunt Club Road	Carry LRT tracks over Hunt Club Road	4 span continuous structure with spans of 13/18/18/13 m	New bridge crossing
Walkley Diamond Grade Separation	Carry LRT tracks over Transitway and OCR freight tracks	2 single span (25 m and 15 m) structures and associated 2x300 m lengths of retaining walls	New LRT tracks over Rail Grade separation and associated structural works

Table 3.1.4-1– Summary of New Structural Requirements			
Structure Location	**Need**	**Length[1]**	**Remarks**
Walkley Road Underpass	Carry Walkley Road over LRT tracks	7 m clear span structure	A new Underpass to be built beside existing to accommodate 2 tracks
Sawmill Creek	Carry LRT tracks over creek	A single 28 m span structure	A new structure as part of the Ellwood Diamond grade separation works
Southeast Transitway	Carry LRT tracks over Transitway	A three span continuous structure with 88 m overall length	Part of Ellwood Diamond grade separation works
Ellwood Diamond Grade Separation	Carry LRT tracks over Sawmill Creek, Transitway and VIA tracks	Single 15 m span bridge structure and associated 2x315 m lengths of retaining walls	New LRT tracks over VIA Rail tracks and associated structural works
Heron Road Underpass	Carry Heron Road over LRT tracks	7 m clear span structure	A new Underpass to be built beside existing to accommodate 2 tracks
Rideau River Crossing	Carry LRT tracks over Rideau river	To match existing span arrangement of 19/19/31/10 m single spans.	A new structure to twin the existing and accommodate the second track and pedestrian movement
Pedestrian underpass at Carleton University	Carry LRT over pedestrian pathway	5 m wide pedestrian underpass, 10 m long	Widen existing underpass to accommodate pedestrian movement across campus
Pedestrian underpass at Carleton Station	Carry LRT over pedestrian pathway	6m x 3m pedestrian underpass, 18 m long	New underpass to accommodate pedestrian movement across campus and to the platforms
Dow's Lake Tunnel	Carry LRT under Dow's Lake and Dominion Arboretum	550m of single track tunnel	New structure to twin the existing tunnel

Table 3.1.4-1– Summary of New Structural Requirements			
Structure Location	**Need**	**Length[1]**	**Remarks**
Booth Street Structure	Carry Booth Street over LRT	Heritage style structure over Transitway, LRT and open aqueduct	A new structure to accommodate transfers to local bus network
Cliff Street Access	Carry LRT and Bus Rapid Transit over access road	Two structures	New structures over access road to the Cliff Street parking lot and the ‘tail race’
Mackenzie King Bridge	Four existing structures	Total of 590 m in length	Local stiffening required to accommodate LRT
Airport Spur Alert Road Underpass	Carry LRT under Alert Road	Single Structure	New structure under Alert Road
Delta Taxiway	Carry LRT under taxiway	New single spur	Under taxiway at airport

Note: [1] All span lengths are approximate and subject to Detail Design.
* Design of Rideau Canal crossing structure to be to subject to the approval of the NCC and Parks Canada. Design elements will be incorporated to reflect future world heritage site designation of the Rideau Canal system.

In addition to new structures, several existing structures will require minor modifications to accommodate the twinning of the LRT track. These modifications include grading, ditching and slope restraints. Table 3.1.4-2 illustrates the modification required.

Table 3.1.4-2 – Summary of Modifications to Existing Structures	
Structure Location	**Need**
Bronson Avenue	Slope grading to accommodate second track
Riverside Drive	Slope restraining and grading to accommodate second track
Pedestrian underpass at Carleton University	Widen existing underpass to accommodate pedestrian movement across campus
University Drive	Slope restraining and grading to accommodate second track
Prince of Wales (north)	No work required, twin tracks fit without walkway
Carling Avenue	No work required, twin tracks fit without walkway
Beech Street	No work required, twin tracks fit without walkway
Young Street Pedestrian overpass	No work required, twin tracks fit without walkway
Highway 417	Slope restraining and grading to accommodate second track

Table 3.1.4-2 – Summary of Modifications to Existing Structures	
Structure Location	**Need**
Gladstone	No work required, twin tracks
Somerset	No work required, twin tracks fit with walkway
Wellington Street	No work required, twin tracks fit with walkway
East West Transitway	No work required, twin tracks fit with walkway
Mackenzie King Bridge	Local deck repairs required to dampen vibration on NAC structure and stiffening required on other structures to support LRT.

3.1.5 Rail Crossings

The Light Rail Transit line crosses two heavy rail lines at the Ellwood Diamond (VIA Rail) and at the Walkley Diamond (Ottawa Central Railway). In order to ensure reliable three minute service headways (or less in the future) on the proposed Light Rail Transit service, it is necessary to grade separate these two rail/rail crossings. The proposed bridges would have the Light Rail Transit tracks pass over the railway tracks. This work will also require the reconstruction of the Sawmill Creek Structure and two Transitway structures.

3.1.6 Rideau River/Canal Crossings

The Light Rail Transit corridor crosses the Rideau River/Canal at three locations. Initially the southern crossing, linking Barrhaven to Riverside South, will utilize 2 lanes of the proposed 6-lane Strandherd-Armstrong Road Bridge, with the Light Rail Transit tracks running at grade through the approaching roadway intersections on the western (Prince of Wales) and eastern (River Road) ends of the bridge. At some point in the future, if and when local traffic demand warrants the use of the full six lanes of the bridge, these intersections will operate at capacity, making the running of high-frequency Light Rail Transit operations through them unreliable. When this happens, the Light Rail Transit line will be grade separated through the two intersections, and cross the Rideau River on a separate Light Rail Transit-only structure constructed south of the road bridge. The Light Rail Transit line will cross over Prince of Wales Drive and under River Road. Both bridges will be subject to federal design approval (Parks Canada) and will be designed in consultation with Parks Canada and NCC and in accordance with the Strandherd-Armstrong Bridge Aesthetic Guidelines (du Toit Allsopp Hillier, November 2005 [a copy is provide in Appendix K]).

The second crossing of the Rideau River connects Vincent Massey Park to the south of the Carleton University campus at the existing railway bridge. This structure will be twinned to the west to accommodate the second rail line, with the possibility of a pedestrian accommodation. This bridge will be designed sympathetic to the existing structure to mitigate adverse heritage effects. This crossing is not part of the Rideau Canal system.

The final crossing, at the Rideau Canal in downtown Ottawa, will be on the existing Mackenzie King Bridge. There will be no additional widening of this bridge required.

3.1.7 Dow's Lake Tunnel

The existing tunnel under Dow's Lake will be twinned, with the proposed location to be immediately to the west of the current location. Construction of the tunnel will use a "cut and cover" method under the Dominion Arboretum lands, Dow's Lake and Colonel By Drive. Construction timing will be restricted to winter operations to minimize adverse effects on boating operations on the Rideau Canal. A number of plantings on Arboretum grounds will be affected by the tunnel construction. In order to ascertain the type of mitigation that would be required, the actual alignment was staked out on the surface to facilitate the Arboretum staff review. A detailed response has been received that includes a list of trees that have to be removed and others that would be transplanted. Some of these trees are donor trees and will require careful consideration and treatment during construction. A detailed construction and mitigation plan will be developed for approval before construction can proceed. Arboretum staff suggested construction of the new tunnel to the east of the existing tunnel to minimize disruption to the sensitive root zones of their plantings. This alternative was considered but not recommended. Moving the tunnel to the east side of the existing tunnel would result in encroachment on the Department of National Defence's Canadian Forces Reserve Base. This would result in the removal of a row of parking which is already at a premium on the site and has the potential to impact on future redevelopment. As well, this would require the demolition and replacement of the existing tunnel ventilation facility, which would cost in excess of $1,000,000. With the east side closer to Dow's Lake, possible damage to the shoreline area would result. A new twin-track tunnel on a separate alignment was also considered. It was not recommended because the existing structure is still in good condition with considerable serviceable life remaining. Finding a new alignment on either side of the existing tunnel without incurring significant effects to affected lands is not possible.

With continuing dialogue and input from Arboretum staff, proper mitigation of the proposed tunnel construction will be developed to ensure protection and restoration of the Arboretum lands to the greatest extent possible.

3.1.8 Booth Street Bridge

The Light Rail Transit line will cross under Booth Street where a new bridge will be built. The bridge structure will incorporate LeBreton Station, and crosses over the open aqueduct and future Ottawa Street. In visual terms, the structure is to complement the surrounding urban design, being respectful of the existing heritage and consistent with the development design themes for LeBreton Flats. A functional design of this bridge has received past preliminary approval from the NCC. However, the final design will still be subject to NCC approval. The NCC has provided design Guidelines to the City (a copy is provided in Appendix K).

3.1.9 Power Supply

Power will be supplied to the system through approximately 17 traction-power substations (TPSS) located at strategic locations along the Light Rail Transit line. Primary power will come from Hydro Ottawa. To ensure the system can continue to operate even if a power source fails, every TPSS will receive its power from a different circuit than the adjacent TPSS. As well, each TPSS is sized to assume the load should an adjacent TPSS source fail. It is recommended that the substations be the prefabricated type. The substations include all the equipment necessary to transform and rectify the primary AC three-phase power to DC traction power for supplying the Light Rail Transit vehicles. The recommended plan identifies typical and proposed TPSS locations and shall seek approval for all property parcels required for each TPSS. Traction power will be supplied to the vehicles via overhead contact wires supported by poles. Outside of the downtown, a single pole line running between the tracks with cantilever arms will support the wires over each track. Within the downtown, a variety of methods will be used to suspend the overhead wires, including: single poles with cantilever arms (to be incorporated with street lighting); transverse wires attached to poles on each side of the street (which may incorporate street lighting or traffic signals); and in some instances, transverse wires (not electrically charged) attached to adjacent building faces. Specified locations and numbers of substations may be modified as detail design and implementation proceeds.

3.1.10 Signalling and Communication System

A basic signalling system functions to safely separate trains from each other. This includes both a separation between following trains and the protection of specific paths through junctions and crossovers. Additional functions may be added to the basic system such as automatic train stops. These apply the brakes should a train run through a stop signal. Speed control can also be added, usually to protect approaches to junctions (turnouts), sharp curves between stations, and approaches to terminal stations where track ends.

A Light Rail Transit signalling system can enhance the safety of the movement of Light Rail Vehicles (LRV) and improve the overall efficiency of operations. Safety protection features include control of track switches, control of bi-directional LRV operation, providing a safe distance between operating LRVs, and grade crossing warning. Efficiency features include headway reduction, operating speed increase, operating time decrease for delays normally caused by weather, management of Light Rail Transit timetables, and recovery of operations.

A traditional signalling system is being recommended for the North-South Light Rail Transit. It is further recommended that the signalling system and equipment be standardized as much as technically possible. This would reduce overall training and project costs, standby parts inventories and skills required by maintenance forces.

A range of communication system options can be adopted individually or combined with the signalling system on site or in a Control Office to form a safe, efficient and smoothly operational modern Light Rail Transit system. These include:

- Radio system to supply wireless communications throughout the Light Rail Transit network for operation, maintenance and emergency services activities;
- Customer Communications System to link numerous elements of the operations. They can be in the form of train communications, Public Address system, Intercom System, and security/maintenance radios;
- Passenger Information System (PINS) to provide messages in the station area when a train is approaching a station, arriving at the platform, and leaving the station. Non-revenue or out-of-service trains will display “out of service” messages through the PINS system;
- Public Address (PA) system to provide audio information over speakers;
- Telephone system to provide private communications;
- Emergency ‘panic button’ system to call for security services;
- Closed-circuit television (CCTV) system for security purposes; and
- Supervisory Control and Data Acquisition (SCADA) system to monitor and control other system.

A fibre-optic communications backbone is a recommended requirement in support of the above listed systems. The recommended plan incorporates sufficient underground conduits running the full project length to accommodate signalling and communication system requirements.

Approval for the signalling and communication systems has not yet been sought. The specific design of the project signalling system will be up to the City of Ottawa's project implementation team and the eventual design-build contractor for the project.

3.1.11 Maintenance and Storage Facility

A maintenance and storage facility is required to support the operation of the Light Rail Transit system. As this project is the first component of a larger Light Rail Transit network comprised of many projects, the proposed facility will be sized to accommodate the following activities:

- Heavy maintenance for the full 2021 (105 vehicle) Light Rail Transit fleet (typically only one heavy maintenance shop is required for this size of network);
- Light maintenance and washing of the 2021 North-South Light Rail Transit line fleet;
- Storage for the 2021 North-South Light Rail Transit line fleet;
- Administration and driver facilities;
- Communication and control facilities; and
- Employee parking.

The EA examined the following four potential sites for the location this facility. Conceptual layouts were developed for each of the sites for the purpose of comparison. Each site was examined from the standpoint of efficiency of Light Rail Transit operations, site servicing, compatibility with surrounding lands and environmental effects. It is recognized that these concepts will be further developed and refined as design progresses. The analysis follows:

1. *Existing CP Walkley Facility*

The Walkley site would be a continuation of the existing land use. It is described as a 'single-ended' facility due to its location offset from the North-South line. There are operational concerns due to its single access point, its long narrow shape with insufficient width to provide a continuous loop to turn trains around, and the fact that no direct access to the southbound Light Rail Transit tracks is available due to the presence of the existing east-west freight rail line. There are environmental concerns regarding the presence of ground contamination resulting from the historical operations of the facility by CP Rail. The site can be serviced from surrounding lands.

2. *City of Ottawa lands east of the Airport Parkway, south of Hunt Club Road – Lester Facility*

The Lester site is adjacent to the Airport Parkway and provides direct access to both northbound and southbound tracks and would lie predominantly on City-owned land. The conceptual design identifies a need for a small triangle of Transport Canada land; however, this requirement may be eliminated through detail design. The site would be accessed from the Airport Parkway, and services would come from the Hunt Club Road area. The site is located within an area used by local residents for recreational activities. The NRC-CSTT access siding would have to either go around the outside of the facility or cross the facility access tracks.

3. *Transport Canada Lands south of Leitrim Road outside the bend from the existing rail corridor towards Riverside South – Bowesville Facility*

The Bowesville site is on Transport Canada lands 'outside the curve' and would be a 'single-ended' facility; however, with access to both north and southbound tracks operations, and sufficient width a continuous loop to turn trains around, would not be constrained in the manner of the Walkley site. Access to the site would be from Earl Armstrong Road and site servicing would be available from nearby.

4. *Transport Canada Lands south of Leitrim Road inside the bend from the existing rail corridor towards Riverside South*

This site located on Transport Canada lands 'inside the curve' was rejected due to environmental considerations. It is situated on lands formerly operated as a municipal and DND landfill. There is a long history of a known contaminated groundwater plume emanating from this site, and an area-wide risk assessment identified a number of concerns. Transport Canada operates a ground water pump-and-treat facility on site, removing groundwater from a number of shallow and deep extraction wells to be treated on site and then returned into the ground through a series of recharge wells. The constraint of locating a facility amidst an operating treatment facility, while maintaining the series of existing extraction and recharge wells, made this site undesirable.

The first three sites are being identified in the recommended plan to be carried forward for approval, although only one site will actually be constructed. The City shall undertake a separate process for the selection of the final location for the facility. This process shall be as follows:

- Set up of a Public Working Group;
- Undertake a technical assessment of each of the three eligible sites;
- Consult with the public and agencies;
- Select a Preferred site;
- Public information meeting;
- Assess mitigation measures; and
- Consideration by Committee followed by Council approval.

A report detailing the process carried out, the consultation undertaken and commitments made for the selection of the final location of the maintenance and storage facility shall be prepared. The report and the recommendations contained therein shall be subject to the approval of City Council.

This CEAA Screening Report outlines the potential adverse environmental effects with all three sites and proposed mitigation measures (Section 5.1.2.16). When a preferred site is selected, the Federal Team will have the opportunity to review and comment on any potential adverse environmental effects and proposed mitigation measures.

3.1.12 Utility Impacts

There are a number of existing underground and overhead utilities within the recommended Light Rail Transit Corridor that are impacted by the project. These were identified and assessed based on reviews of available utility base mapping and as-built information provided by the City of Ottawa, as well as follow-up meetings with the utility companies affected. All known utility features have been compiled onto a composite utility base plan that was used during the Study.

In addition, the EA study team has made three separate presentations to the Ottawa Utility Coordinating Committee (UCC) to provide updated information on the progress of the study and proposed alignment information.
The following utilities have been contacted over the course of the study and have confirmed the location of existing plant, identified potential conflicts and provided preliminary relocation cost estimates (where applicable):

- Hydro Ottawa
- Hydro One
- Bell Canada
- Enbridge Consumers Gas
- Rogers
- Allstream
- Sprint (Call-Net)
- Level 3 Communications
- 360º Networks (Group Telecom/Bell)
- PWGSC (Steam Plant)
- Trans-Northern Pipelines Inc.

There has also been on-going co-ordination with City of Ottawa utilities (sewer, water, street lighting and traffic signals), including the proposed high and low-pressure water main (Lines ‘A’, ‘B’ and ‘C’) replacement projects. The City of Ottawa has carried out closed-circuit television (CCTV) inspection of all existing sewers along Albert and Slater Streets (including cross-streets) to assess the need to rehabilitate or reconstruct any existing storm, sanitary or combined sewers.

The majority of notable utility conflicts occur in the downtown Corridor (Bronson to Elgin) with some relocation work required along the existing O-Train corridor. There are only minor conflicts along the corridor south of Leitrim through the proposed Riverside South Community and into South Nepean related to existing storm and sanitary sewer and water main crossings.

A brief description of the major utility conflicts identified to date follows:

Downtown Corridor (Bronson to Elgin)

- **Hydro Ottawa** – there are existing hydro duct banks running the full length of both Albert and Slater Streets as well as an overhead line on Albert Street between Bronson Avenue and Lyon. Hydro has identified that relocation work including maintenance hole rebuilds and duct bank relocation on Slater Street between Metcalfe and Elgin and Albert Street between Bank and Elgin is required, with an estimated cost of $13.4M.
- **Hydro One** – three existing direct buried conduits (depth of 6-7 feet) are located under the proposed Light Rail Transit line on Slater between Metcalfe and Elgin. The potential impact of Light Rail Transit on the conduits is to be confirmed.
- **Bell Canada** – has an extensive network of existing underground utility duct banks running under both Albert and Slater Streets. This network is fed from a major central switching facility located on the south side of Albert St. between Bank and O’Connor, and under CRTC regulations contains telecommunications plant from all major carrier corporations. There are minor impacts to Bell plant along Albert Street between O’Connor and Elgin Streets. The existing underground plant along the full length of Slater Street are in direct conflict with the proposed Light Rail Transit line and must be relocated, including new feeds to all buildings. A large co-ordination effort will be required to construct a new duct bank, maintain the existing service and re-feed all of the buildings. A $30M preliminary estimate for relocations in

these areas has been provided by Bell (subject to completion of a design feasibility study to be completed by end of 2005).

- **Enbridge Consumers Gas** – existing gas mains are present all along Albert and Slater Streets and several cross streets. Enbridge Consumers Gas has provided an estimate of $600,000 to relocate the gas mains and crossings that are in conflict with the proposed Light Rail Transit line.
- **Rogers Cable**– a preliminary estimate of $250,000 has been provided to relocate maintenance holes and lower duct crossings under platforms and tracks and reconfigure aerial plant west of Bronson Avenue. This estimate does not include the cost of relocating Rogers cables either in Bell duct banks or on Hydro poles that are being relocated.
- **Combined sewers** – 140m of existing combined sewers on Albert Street and 125m of combined sewers on Slater Street (both near Bronson Avenue) require separation due to MOE regulations. Two new sewers (sanitary and storm) will replace the existing combined sewer. A new storm outlet must be located to the west of Bronson Avenue during detailed design.
- **Storm sewers** – Approximately 3.7km of existing storm sewer is present within the Light Rail Transit Corridor downtown. The results of the City's CCTV inspection indicate that most of the sewers show moderate structural deficiencies and would be candidates for rehabilitation beginning in about 5 years. A section of storm sewer on Slater west of Elgin is hydraulically deficient and should be upgraded.
- **Sanitary sewers** – There are no hydraulic constraints in the sanitary system with the Light Rail Transit Corridor downtown. It has been proposed to proactively replace all service laterals to each building. Approximately 53 storm and sanitary structures (maintenance holes and chambers) are directly impacted by the Light Rail Transit route through the downtown Corridor. Access structures will have to be re-built to provide access to the sewer network for future maintenance and rehabilitation requirements. The City has also proposed to proactively rehabilitate those sewers that have the shortest remaining life cycle and have the highest potential to impact Light Rail Transit service. A preliminary cost estimate of $5.3M has been provided to cover the entire related sewer works described above.
- **Water** – the existing water mains running under Albert and Slater Streets date from the late 1890s. The City's Water Services Branch has indicated that these mains would not survive major construction works, and that the Light Rail Transit project would provide them the opportunity to replace the existing water mains in conjunction with the reconstruction of the roadways. Two existing water mains on Slater Street would be consolidated and replaced by a single new water main, while the existing water main on Albert Street will be replaced with a new water main in the same location.
- **Traffic signals** – all downtown intersections along Albert and Slater Streets are to be re-built and a new communication duct bank (interconnect) is required along Albert Street to be located under sidewalk or shared within street lighting or the telecommunications duct.
- **Street lighting** – all existing street lighting along Albert and Slater Streets will be replaced. It is proposed to install new street lighting on the new traffic signal poles and catenary poles for the overhead power supply for the Light Rail Transit system.

Existing O-Train Corridor (Bayview to Leitrim)

- **Enbridge Gas** – an existing gas main on the Airport link near Thad Johnston and Alert roads will require relocation at an estimated cost of $64,000.

- **Telecommunications** – Sprint, Level 3 Communications and 360º Networks all have fibre-optic cables (long distance carriers) running along the existing O-Train Corridor between Bayview and Leitrim. Most of the cable is buried with some rigid duct banks running above ground at a number of structures. Level 3 Communications is located south of Walkley only and 360º Networks is located north of Walkley only. All three utilities have determined that their plant is in conflict with the proposed Light Rail Transit line and will require relocation to some degree. A "joint build" duct bank has been proposed to reduce the relocation costs and will be examined further by the utilities involved.
- **Trans-Northern Pipeline Inc. (TNPI)**- This is a buried pipeline that is crossed south of the Ottawa Macdonald Cartier International Airport between Bowesville Road and Limebank Road. TNPI has been contacted to determine any impacts or constraints regarding this crossing. No problems were identified but there are strict regulations regarding what can be constructed on top or adjacent to the pipeline; therefore, a guideline has been provided for construction in the vicinity of these pipelines.

3.1.13 NRC-CSTT Access Siding

The National Research Council – Centre for Surface Transportation Technology (NRC-CSTT) provides world class surface transportation development and testing services for the rail and road transport industries, defence departments and a wide range of private and public-sector vehicle and equipment manufacturers. Situated on a 51-acre campus southeast of the Ottawa Macdonald Cartier International Airport on Lester Road, the facility houses some of the most sophisticated and useful vehicle Research & Development and test facilities in the world. NRC-CSTT is a non-subsidized self-supporting business unit within the National Research Council.

A large number of client vehicles are delivered to NRC-CSTT for testing by rail transport, with access provided by the Ottawa Central Railway (OCR) through an agreement with CP Rail on a 4.1 km. siding track extending south of the Walkley Facility within the CP Ellwood corridor. A portion of this track is currently used by the O-Train Pilot Project. Prior to its purchase by the City, CP Rail maintained this rail siding specifically for NRC-CSTT access. NRC-CSTT also uses this siding to access sections of the OCR track between Pembroke and Montreal to conduct certain types of vehicle testing.

Historically, up to 20 access moves per year have been required, including both freight and Light Rail Transit type rail vehicles. Vehicle moves currently operate between 9 a.m. and 4 p.m. with the occasional move occurring between midnight and 5 a.m. After-hour moves are required for the movement of specialty and oversize vehicles. A Track Occupancy Permit, which requires 48-hour prior notice, must be obtained by the OCR from Capital Railway to provide the vehicle access move.

Rail access is critical to the business of the NRC-CSTT. The City of Ottawa will ensure the facility has access; however, the conversion of the current line to electric Light Rail Transit would precludes vehicle access moves to the NRC-CSTT on the Light Rail Transit line due to conflicts with the overhead power lines and narrow station platform clearance.

To mitigate this problem, the recommended plan identifies the relocation of the existing siding track to the west of the twin-track Light Rail Transit line. The existing rail corridor is sufficiently wide to accommodate this third track, and it would continue to cross Hunt Club road on the existing rail overpass structure. The City of Ottawa would retain ownership of this siding and enter into agreements with the OCR and NRC-CSTT to grant access rights.

Although the recommended plan identifies a third track as the preferred solution, the City of Ottawa will consider other options during the detailed design stage of the project implementation process that may provide a more cost-effective means of serving the NRC-CSTT facility. These options may include using a portion of the LRT track where technically feasible. If another option is selected, the Federal Team will have the opportunity to review and comment on any potential adverse environmental effects and proposed mitigation measures.

3.2 Scope of Assessment

The study area boundary for this project is defined as a broad band running from the Rideau Centre to Barrhaven Town Centre. The study area also includes an airport link and a new crossing of the Rideau River (Figure 3.2-1). Recognizable features within this study area include Downtown Ottawa, Rideau River and Rideau Canal, Carleton University, and the Macdonald-Cartier International Airport. The Albion Road (Leitrim) Wetland is the most significant natural area located within the study area.

The study area is a broad band covering three areas. In the downtown section it runs east-west from Bayview to the vicinity of the Rideau Centre. Then it runs north-south parallel to, and extending to either side of, the existing railway alignment that extends from Bayview past Highway 417, through Carleton University, across the Rideau Canal and Rideau River and south along the eastern limits of the airport. The south portion of the study area then diverges from the exiting railway alignment just south of Leitrim Road, to traverse a presently ‘Greenfield’ area. This portion of the study area runs in a generally east-west direction generally defined by the Riverside South Secondary Plan to another crossing of the Rideau River into the Barrhaven Town Centre.

The scope of factors to be considered for this project included changes to both the biophysical and socio-economic environment potentially caused by the project as described in the scope of the project. Although the study area is a broad band, the scope of factors considered was not limited to features directly or entirely within the study area. It was recognized that many significant environmental features extend outside the study area proper. In those cases, impacts to the entire feature were considered. For example, the Albion Road (Leitrim) Wetland was considered as a complete feature, rather than considering only the portions of the wetland within the study area.

The environmental factors considered in the assessment were identified by the Federal Environmental Assessment Team in the Final Scoping Document (Appendix L) received in September 2005. These factors include:

Biophysical Environment

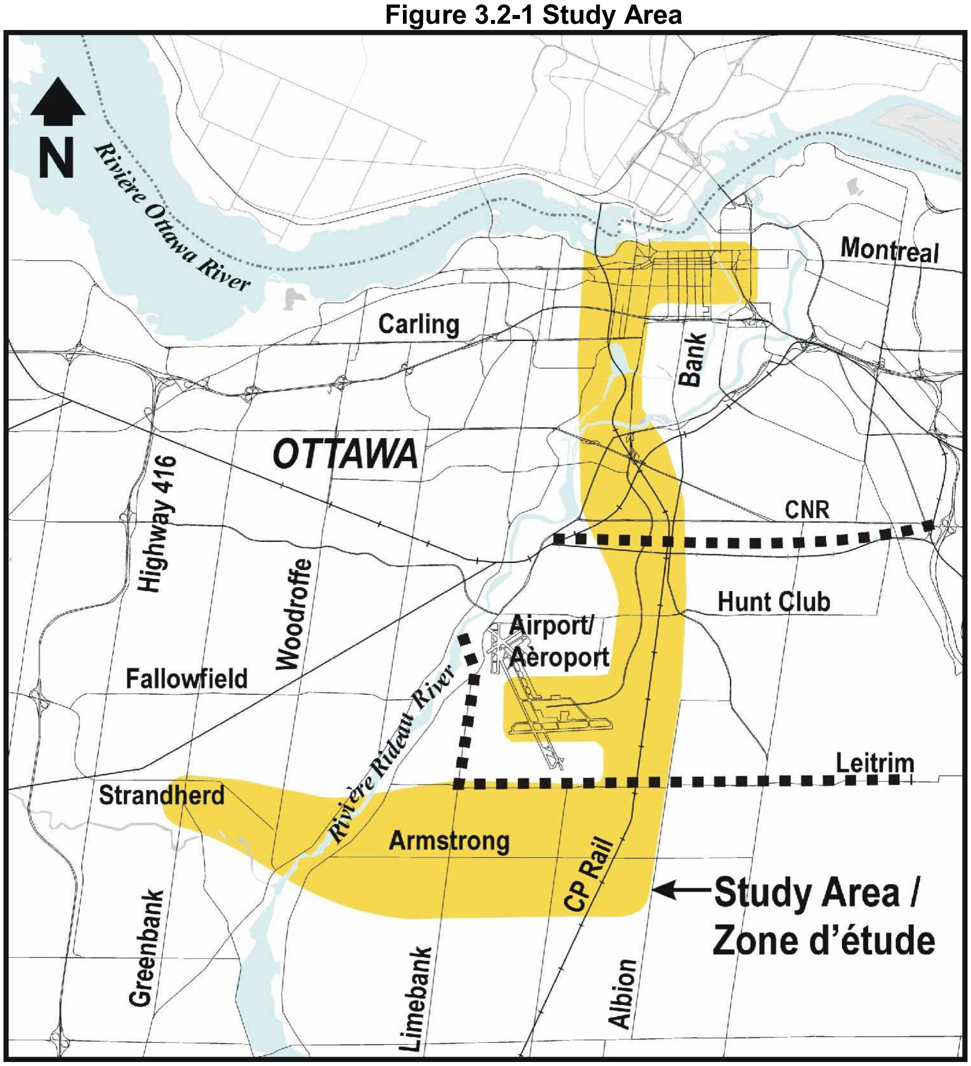
- Fish and Fish Habitat
- Surface and Ground Water
- Vegetation and Wetlands
- Wildlife and Migratory Birds
- Species at Risk
- Air Quality

Socio-Economic Environment

- Landuse
- Central Experimental Farm
- Rideau Canal
- Health and Wellbeing
- Noise and Vibration
- Archaeology, History and Palaeontology
- Contaminated Sites
- Waste Management
- Transportation
- Rail Rolling Stock Accessibility
- Recreation

Additional details on Environmental Assessment Methodology are included in Section 2.2 and Chapter 5.

Figure 3.2-1 Study Area



4.0 Description of Existing Environment

Overview

The study area defined for this project is a broad band running from the Rideau Centre to Barrhaven Town Centre (as outlined on Figures 4.1.1-1a through 4.1.1-1c). The study area also includes an airport link and a new crossing of the Rideau Canal. Major features within this study area include Downtown Ottawa, Rideau River and Rideau Canal, Carleton University, and the Ottawa Macdonald-Cartier International Airport (OMCIA). The Albion Road (Leitrim) Wetland is the most noteworthy natural area located within the study area.

The 'study corridor' generally refers to a much narrower corridor along either side of the preferred alignment, where field studies were focused. The width of this 'study corridor' may differ for the various disciplines, however for the natural environment portions of the biophysical environment, field investigations were generally limited to within approximately 50m of the existing railway right-of-way (ROW) on the twinned portions, and to a slightly broader corridor where the new alignment is proposed.

The City of Ottawa is home to three watersheds – the South Nation Watershed to the east, the Rideau River Watershed dominating the central portion of the City of Ottawa, and the Mississippi River Watershed to the west.

The City of Ottawa supports a network of other natural and semi-natural features including forests, wetlands, meadows, parks, and other areas of open space. The most publicly recognized feature of the greenspace network is the National Capital Commission (NCC) Greenbelt as it borders a large portion of the City of Ottawa's urban area.

The most noteworthy natural features located within the limits of the study area include the Rideau River/Canal, the NCC Greenbelt, the Albion Road (Leitrim) Wetland.

The entire study area consists of a wide range of land uses. Broadly speaking, the southern portion of the study area consists of, mixed density residential, developing communities, agricultural resource areas and open space. Institutional, employment, commercial and mixed density residential areas dominate the central and northern portions of the study area. Other significant features include the Ottawa MacDonald-Cartier International Airport.

The study area also encompasses the business centre of downtown Ottawa. The downtown is also home to Parliament Hill, a national symbol and familiar landmark, as well as local archives, museums, historical and archaeological sites, and culturally-rich communities.

The following sections provide more detailed information regarding the existing biophysical and socio-economic environment of the study corridor (Sections 4.1 and 4.2, respectively). Chapter 5 outlines the potential adverse environmental effects and proposed mitigation measures associated with the project and should be referred to for a detailed assessment of potential adverse effects.

4.1 Description of Biophysical Environment

4.1.1 Fish and Fish Habitat

A total of twenty-seven potential watercourse crossings are located along the study corridor. This section documents habitat conditions and any observations of fish. In addition, existing fisheries information collected from agencies are incorporated in the descriptions. Potential issues, sensitivities, constraints and opportunities are also noted based on the information collected to date. Additional details are included in the Natural Environment Report (Appendix A).

Approach

Agencies including the Kempville District MNR, Rideau Valley Conservation Authority (RVCA) and the City of Ottawa were contacted to obtain all relevant background fisheries and aquatic habitat information on the watercourses within the project limits. Topographic maps, drainage maps, aerial photography and plans showing the crossing locations were utilized to name and document the flow direction and connectivity of the watercourses to known fisheries (e.g. Rideau River/Canal).

Field surveys, by an Ecoplans Limited fisheries biologist, were conducted on September 7, 8 and 10, 2004 and on June 12 to 14, 2005. General aquatic habitat data (as described below) were collected in the vicinity of the project, and the various watercourse reaches were photographed.

Habitat data collection encompassed the following fisheries and aquatic habitat parameters:

- morphology and flow (including riffles, pools, depth, width, permanence)
- cover opportunities (i.e. woody debris, undercut banks, boulders), substrate type, bank character (i.e. height and erosion), and aquatic and riparian vegetation
- physical barriers to fish movement
- potential ‘critical’ or specialized habitats including possible spawning areas, good nursery cover, holding habitat (deeper refuge pools)
- water quality indicators, any potential pollutant point sources and other disturbances
- any evidence of groundwater discharge, and
- potential habitat enhancement opportunities.

Existing Watercourse Crossings

The main watercourses that traverse the study corridor are the Rideau River and Canal, Sawmill Creek, Mosquito Creek and the Jock River. These watercourses are part of the Lower Rideau River Watershed, which represents approximately one fifth of the total drainage area for the entire Rideau River Watershed (*Lower Rideau River Watershed Strategy, Phase 1*; Robinson Consultants Inc., 2003).

Sawmill Creek, Mosquito Creek and the Jock River are all tributaries of the Rideau River/Canal which outlets into the Ottawa River immediately north of the study limits. The Rideau Canal is a series of locks and reaches that provide a navigational link from Ottawa to Kingston. The Rideau Canal is a National Historic Site of Canada, designated Canadian Heritage River and is a candidate site for World Heritage status. Parks Canada currently has jurisdiction of the

Rideau Canal from Ottawa to Kingston, which includes the Rideau River upstream of Hog's Back.

The twenty-seven watercourse crossings along the study corridor that were assessed during the 2004 and inventories comprise a total of 15 different watercourses, within the five main watercourse systems (Figure 4.1.1-1a, 4.1.1-1b, 4.1.1-1c). That is, the study corridor crosses most of the watercourses more than once, as listed below:

- The Rideau Canal is crossed three times (Crossings 1, 2, and 17) and the Rideau River is crossed once (Crossing 3);
- The LRT corridor crosses two tributaries of the Rideau Canal (Crossing 16 and 17a);
- Sawmill Creek (Crossings 4, 5 and 5a) is crossed three times and three small tributaries of Sawmill Creek (Crossings 9 and 10) are crossed once;
- Cahill Drain (Crossings 6, 7 and 8), a tributary of Sawmill Creek, is crossed three times;
- Mosquito Creek (Crossing 12) is crossed once and seven of its tributaries are crossed (Crossings 11, 11a, 11b, 11c, 13, 14 and 15); and
- The LRT corridor also crosses five tributaries of the Jock River (Crossings 18, 18a, 18b, 19 and 19a).

The characteristics of the existing aquatic habitat conditions collected at each of the above crossings are detailed in the table found in Appendix I (of Appendix A [the Natural Environment Report]). Fisheries information is also noted on the table for those watercourses where it is available or where field observations were made. This information is summarized below in relation to the significance and sensitivities of the fish habitat and fisheries associated with the various watercourse crossings.

Summary of Fisheries and Aquatic Habitat Significance and Sensitivities

(Note: please refer to Appendix I of Appendix A [Natural Environment Report] for detailed fisheries and aquatic habitat information at all watercourse crossings)

Most of the watercourses along the study corridor (with the exception of Crossings 17a, 18, 18a, 18b, 19 and 19a) have been described as permanent watercourses and classified as warmwater fish habitat by the MNR and RVCA. Crossings 17a, 18, 18a, 18b, 19 and 19a (Tributaries of the Rideau Canal and Jock River) are intermittent systems that are also classified as warmwater fish habitat by MNR and RVCA. Crossing #13 (Tributary of Mosquito Creek) is intermittent in the vicinity of the crossing and then permanent approximately 200m downstream. One of the watercourses (Cahill Drain) also appears to exhibit coldwater attributes (e.g. potential groundwater discharge; sculpin species present) as described by Jennifer Lamoureux of RVCA. Also, a section of Sawmill Creek (at Crossing #5 and 5a) is classified as coolwater fish habitat as shown in the *Sawmill Creek Subwatershed Study Update* (CH2M Hill, 2003), and also provides habitat for sculpin species.

No Species at Risk Act (SARA) listed species (Extirpated, Threatened or Endangered) or SARA species of Special Concern were identified within the study limits. Nor were any provincially significant/rare species identified by MNR (COSSARO or S1-3). This determination was based on a review of the SAR and MNR NHIC databases and the species lists and information provided by the agencies and City of Ottawa and in other background documents (see Appendix A for complete list of background information sources and species lists for the Rideau River and Rideau Canal).

The Rideau River supports a diverse and important warmwater sportfish community with several top level predator species, including Walleye (*Stizostedion vireum vitreum*), Muskellunge (*Esox masquinongy*), Northern Pike (*Esox lucius*), Smallmouth Bass (*Micropterus dolomieu*), and Largemouth Bass (*M. salmoides*), as well as a number of panfish, coarse fish, and bait and forage fish species.

Within the Rideau River, several areas of specialized habitat were identified during the background information inventory. Specifically, nursery areas were identified by the City of Ottawa in the vicinity of the study corridor crossing of the Rideau River. At Crossing #3, Rock Bass and Yellow Perch nursery habitat sites were identified along the south shore downstream of the proposed crossing. Furthermore, morphology and substrate conditions in the vicinity of Crossing #3 of the Rideau River are comprised of rapids with coarse substrates (e.g. rubble). These conditions may provide spawning habitat for species such Walleye, and sucker and redhorse species.

The Rideau Canal is connected to the Rideau River and Ottawa River. It was constructed as a navigational link around Rideau Falls. At Crossing #1 (downtown Ottawa) the Rideau Canal starts to drop approximately 60m in elevation through a series of gated locks over a length of approximately 375m. At Crossing #2 the Rideau Canal widens out (approximately 90m) into Dow's Lake which is located immediately downstream. At Crossing #17, the Canal is wide (approximately 80m), slow moving with flat morphology.

The Rideau Canal flows through a gated lock system, which may limit fish movement to some extent. However, there is evidence that fish move through the locks, passing through the sluices when they are open. The Museum of Nature provided a general list of fish species that have been found in the Rideau Canal. This list closely resembles the species assemblage of the Rideau River, including top level predators such as Walleye, Muskellunge, Northern Pike, Smallmouth Bass, and Largemouth Bass, as well as a number of panfish, coarse fish and bait or forage fish species. American Eel (*Anguilla rostrata*) was also observed in the lock system within downtown Ottawa in the fall of 2005 (Parks Canada pers. comm.). This species is currently receiving protection interest given its rapid decline in population. Species lists are provided as appendices to the Natural Environment report in Appendix A.

Within the Rideau Canal, several areas of specialized habitat were identified during the background information inventory. Specifically, Smallmouth Bass, Yellow Perch and Logperch nursery habitat sites were identified by the City of Ottawa approximately 300m downstream of Crossing #17. Also at crossing #17, Northern Pike spawning habitat was identified along the west bank, approximately 160m upstream of the crossing (MNR NRVIS data).

Within the study corridor, two tributaries of the Rideau Canal are crossed. Crossing #16 is an agricultural field swale. Crossing #17a relies on road drainage upstream of the Prince of Wales Drive (due to a barrier further upstream) and is swale like downstream of the road. Emergent vegetation that could provide potential Northern Pike spawning habitat is present in both systems however, volume and flow duration may not be sufficient to support spawning and successful emergence and dispersion of pike.

Substrates along the reaches of Sawmill Creek in the vicinity of Crossings 4 and 5, are relatively more diverse and include a mix of coarse materials. Riffle morphology is also present at Crossing #4. The coarse substrates persist downstream of the middle crossing, Crossing #5, and become finer upstream through Crossing 5a where the morphology is 'flat'. At the tributary crossings of Sawmill Creek (Crossings 9 and 10), substrates are fine and morphology is flat.

Walleye and Northern Pike are currently prevented from migrating from the Rideau River upstream along Sawmill Creek to the vicinity of the corridor by a culvert barrier near the confluence, removal of which would enable access from the river to Sawmill Creek. Sculpin species, indicative of groundwater discharge, were recorded in Sawmill Creek (near Crossings #4 and #5), as well as its tributaries (near Crossings #9 and #10). The fish community is otherwise comprised of a small number of common, tolerant baitfish species.

At the Cahill Drain Crossings (#6, 7, and 8), which is also a tributary of Sawmill Creek, substrates include a mix of rubble, gravel and sand. Morphology is dominated by ‘flats’, with pools and some riffles. The Cahill Drain (which is also a tributary of Sawmill Creek) supports a similar fish community to Sawmill Creek, generally comprised of a small number of tolerant common species with sculpin species.

At the Mosquito Creek crossing (#12), substrates are sand dominant (with some boulders, muck, silt and clay) and morphology is flat. The tributaries of Mosquito Creek that are crossed by the LRT study corridor (Crossings 11, 11a, 11b, 11c, 13, 14, and 15) are all small agricultural drainage ditches that were all dry at the time of the surveys. Substrates at all the tributary crossings are comprised of muck and clay, and morphology appears flat. Mosquito Creek supports a more diverse warm water fishery according to the background database, including Northern Pike, although the species are common and generally tolerant in the vicinity of the study corridor (Niblett, 1991). Tolerant baitfish species have been found in the vicinity of the tributary crossings at Crossing #14 and approximately 500m downstream of the Crossing #15 in 1991 by Niblett Environmental Associates.

There is potential Northern Pike spawning habitat (emergent vegetation) in the vicinity of the study corridor at the Mosquito Creek tributary crossings 11, 11a, 11b, 11c, 13 and 14; however, volume and flow duration may not be sufficient to support spawning and successful emergence and dispersion of pike. Niblett (1991) states pike are not expected to spawn in Mosquito Creek due to the lack of spawning substrate (emergent vegetation) and low water levels. At Crossing # 12 in the main Mosquito Creek, spawning habitat for White Sucker was identified in a riffle located approximately 250m downstream of the crossing location.

The tributaries of the Jock River that are crossed (Crossing 18, 18a, 18b, 19 and 19b) are all small intermittent agricultural drainage ditches that were all dry (with the exception of Crossing #19) at the time of the surveys. Substrates in the vicinity of these crossings are comprised of muck and clay, and morphology appears flat. The tributary associated with Crossing #18a has been removed with recent construction in the area.

Emergent vegetation that could provide potential Northern Pike spawning habitat is also present in the vicinity of the Jock River tributary crossing areas noted above; however, volume and flow duration may not be sufficient to support spawning and successful emergence and dispersion of pike. As outlined subsequently in Table 5.1.1.2-1, additional in-season assessment is required to confirm whether sufficient flow volumes and duration are present to support successful spawning, emergence and dispersion.

4.1.2 Surface and Ground Water

The proposed LRT alignment is in part located within existing infrastructure (city streets, railway embankment), the LeBreton Flats redevelopment area, the new development areas of Riverside South, and the suburban areas of Chapman Mills, Davidson Heights, and Barrhaven.

Major outlets for runoff from the LRT are the Ottawa River, the Rideau River, Sawmill Creek, Hunt Club Creek, Mosquito Creek, the Jock River, and Findlay Creek (South Nation River) as described in Section 4.1.1.

The primary source of freshwater supply for much of urban Ottawa comes from the Ottawa River and major tributaries, whereas in the rural areas, potable freshwater is obtained from bedrock and overburden aquifers (via water wells). Groundwater can be found as shallow as 0.5 to 2.0 metres below grade in the area north of Macdonald-Cartier International Airport, though all of this area is municipally serviced for potable water. For much of the area south of the airport (south of Leitrim Road) groundwater can be found at approximately 2.0 metres below grade. The direction of shallow groundwater flow is approximately west to east, though surface water features will influence the direction of groundwater movement on a local scale. The overburden geology in the south section of study area consists mostly of deposits of clay and silt interspersed with pockets and/or buried lenses of sand and gravel. Clays and silts have low permeability and will restrict the movement of groundwater, whereas sands and gravels have a high permeability and can result in groundwater flow of several metres a day. Since the overburden thickness throughout much of the preferred LRT corridor ranges from 10-25 metres, there is the potential that several overburden aquifers may be found in one location at different depths. This will likely occur in areas of topographic highs (i.e. groundwater recharge zones) corresponding to the following locations: Barrhaven Town Centre and the High Road area. Other small-scale areas of groundwater recharge may include: Claridge; Beatrice; and Newland. Groundwater is typically discharged to topographic lows such as steams, lakes and rivers. Areas within the preferred LRT corridor where groundwater discharge may be encountered include the following: Rideau River; Mosquito Creek; and the area south of Bronson Avenue (creek). It is important to note that variations in overburden geology and permeability will likely occur on a localized scale.

4.1.3 Vegetation and Wetlands

4.1.3.1 'Designated' Natural Areas

There is a considerable amount of existing information describing the natural areas located within and in the vicinity of the general study area. The majority of the remnant natural features have been assessed and identified or 'designated' at some level.

In addition to a small number of larger, more significant natural areas identified by MNR (e.g. Life Science Areas of Natural and Scientific Interest, Provincially Significant Wetlands), there are a number of regionally and locally designated areas within Ottawa and its surroundings. A number of regional and city-wide studies have been undertaken to identify and document remaining natural areas. Many of these areas are small in size; however their significance at the local landscape level is increased by the generally limited presence of large, extensive and intact natural areas in the region. The various studies have resulted in several sites having multiple names and designations, leading to some confusion. For clarity, all data associated with a particular site has been combined in the site descriptions provided below.

It is also noted that the Rideau Canal is a National Historic Site of Canada. It is also designated as a Canadian Heritage River and nominated for World Heritage Designation. A Management Plan has been developed for the Rideau Canal by Parks Canada in order to manage, protect and ensure the long term integrity of the Canal. The Rideau Canal

Management Plan provides the following details regarding the importance of the natural heritage features of the Rideau Canal Corridor:

> *Many of the natural features of the Canal - the wetlands and the identified lakes - are known to have a direct connection to the construction of the Canal. In addition, there are extensive ecosystem features - lands, waters, plants and animals - under the jurisdiction of the Rideau Canal that are valued because they comprise an important component of the Canal's history and landscape and as such are considered a vital heritage resource that must be respected and safeguarded.*

In the case of the Rideau Canal, the designated place (i.e. the place designated as a national historic site) consists of the lands and waters under the jurisdiction of Parks Canada including the bed of the Rideau Canal to the high water mark between the Ottawa River and the harbour in Kingston.

Additional details on the Rideau Canal are provided in Sections 4.1.1 (Fish and Fish Habitat), 4.2.4 (Rideau Canal) and 4.2.5 (Recreation) of this Report.

The various designated areas are described below and mapped on the natural environmental features map presented in Figures 4.1.1-1a, 4.1.1-1b and 4.1.1-1c. The mapping identifies all of the local and regional names and designations for those features, where relevant. It also highlights the major designated natural areas that are found outside the study area. While these areas are mapped to provide landscape context, they are not discussed in the text. Finally, there are a few Urban Natural Areas designated by the City of Ottawa that fall within the study area and are mapped on Figures 4.1.1-1a, 4.1.1-1b and 4.1.1-1c, but are not discussed in the text. These sites fall within two categories: 1) those that require a full evaluation and 2) those that require an ecological condition check. There is no data available from the City of Ottawa for either site category. However, one site, 'South of Leitrim, north of Quinn' has been included below since this site is directly adjacent to the proposed railway.

Areas of Natural and Scientific Interest

Areas of Natural and Scientific Interest (ANSIs) are areas designated by the Ministry of Natural Resources for their representative earth science and life science values. ANSIs are defined as "areas of land and water containing natural landscapes and features which have been identified as having values related to protection, natural heritage, scientific study or education" (Brunton, 1992, p.47). ANSIs may vary in level of significance [MNR designates ANSIs as Provincially or Regionally significant]. The most significant of these make the greatest contribution to the Ontario Ministry of Natural Resource's Protection Objective.

The three Earth Science and two Life Science ANSIs that are located within the study area (or in the immediate vicinity of the study area) are listed and described briefly below. Locations of these designated areas are presented in Figure 4.1.1-1a, 4.1.1-1b and 4.1.1-1c.

ecoplans Limited	Date: March 2006	Project No. 04-2824	Figure 4.1.1 - 1a Natural Environment Features	0 500 1,000 m 1:40,000 N

ecoplans Limited

Date:	Project No.	
March 2006	04-2824	

Figure 4.1.1 - 1b Natural Environment Features

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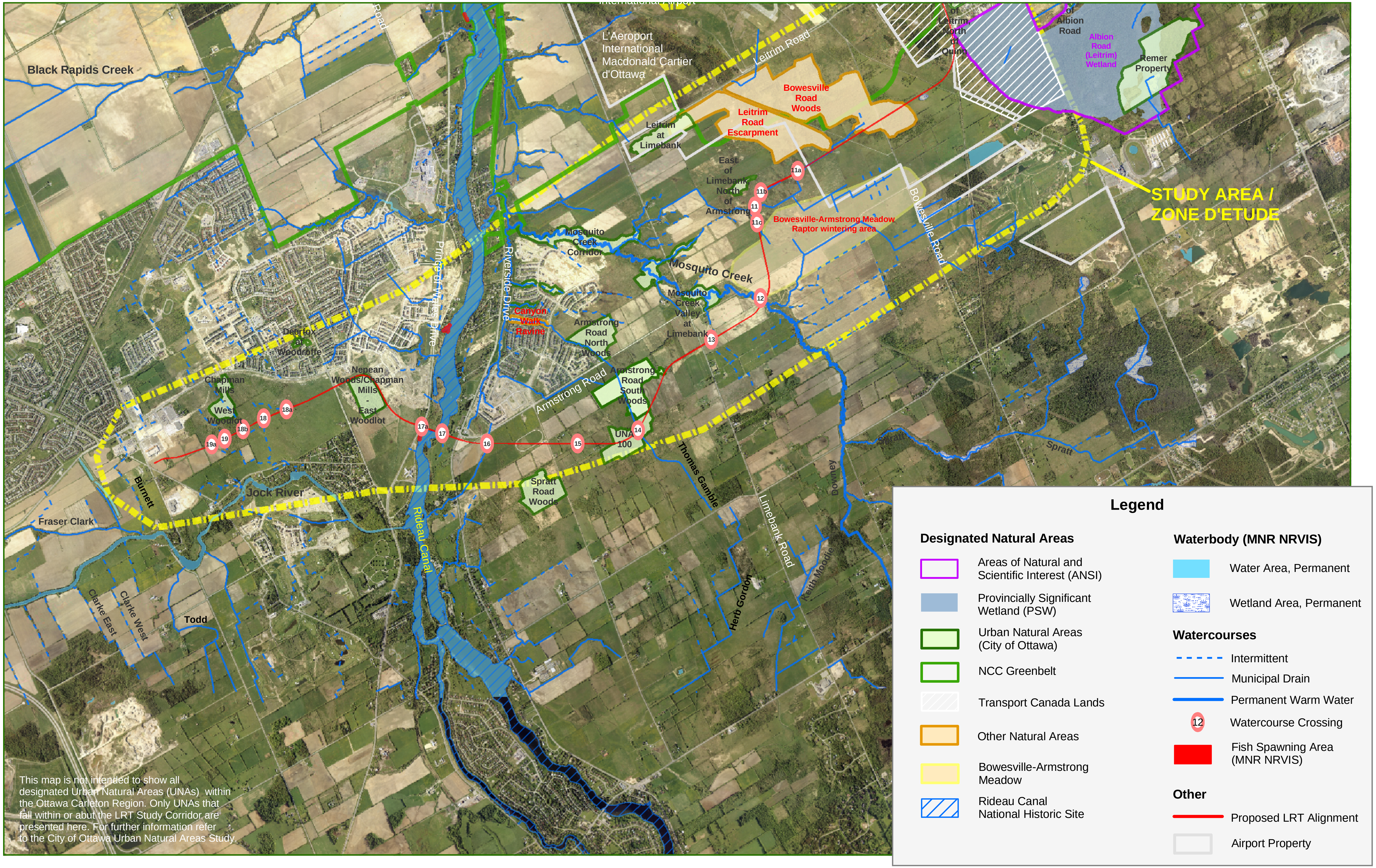


ecoplans limited

Date:	Project No.	
March 2006	04-2824	**Figure 4.1.1 - 1c Natural Environment Features**

Earth Science

Three Provincially Significant Earth Science ANSIs are identified on the NHIC website and in the NRVIS digital database. Each of these three sites occur within the study area boundaries, or in close proximity to the study area. Details on the representative features of these sites were provided by the Planning and Research Section of Ontario Parks, Ontario Ministry of Natural Resources.

Hog's Back Falls (Provincially Significant ANSI)

Hog's Back Falls ANSI is located just west of the study area. This site represents structural deformation of lower Ordovician rocks of the Ottawa and Rockcliffe Formations. One main northwest striking fault passes through the falls and divides the Ottawa Formation (on the east) from the Rockcliffe Formation (on the west). Several other faults are also present in the area along with additional features such as folded shale and sandstone units, calcite growths and asymmetrical ripple marks indicating the action of currents (Billings, 1975a).

Sawmill Creek Shales ANSI (Provincially Significant ANSI)

Sawmill Creek Shales ANSI is located just north of the study area but within the Sawmill Creek corridor. This site represents a very good exposure of Billings Formation Shales. Black friable shales are exposed as a vertical face and can be seen from Sawmill Creek, immediately east of Billings Bridge. The exposure is maintained through natural erosion which occurs at the bend in the creek. Sawmill Creek Shales represent the best exposure of this type of formation within the City of Ottawa (Billings, 1975b).

Kippewa Drive ANSI (Provincially Significant ANSI)

Kippewa Drive ANSI is located on the north side of Kippewa Drive, northeast of Dows Lake and at the edge of the study area boundary. This site represents Eastview limestone and contains a few fossils (brachiopods and bryozoans). This is one of only a few exposures/outcrops of Eastview limestone in the region and in the City of Ottawa (Billings, 1975c).

Life Science

The study area encompasses a portion of the Provincially Significant Life Science Albion Road (Leitrim) Wetland ANSI, which is also a Provincially Significant Wetland (PSW). The Regionally Significant Pine Grove Forest Reserve ANSI is located just to the east of the study area. These sites are identified on the NHIC website and within NRVIS digital data. Details on their representative features are primarily found in the Site District Report for Site District 6E-12 (Brunton, 1992).

Albion Road (Leitrim) Wetland ANSI (Provincially Significant ANSI; PSW; NESS ID No. 100 – MODERATE)

As noted, this natural area has been designated by MNR as a Provincially Significant ANSI, and has also been evaluated as a PSW. Approximately one third of the 250 hectare (ha) Albion Road Wetland ANSI/PSW natural area falls within the study area, with the remaining area located to the east. The site occurs on a layer of marine clay that is contained within a basin located below a sand ridge (to the southwest). Deep groundwater sources flowing into the wetland from the west and south sustain the wetland vegetation.

The area is described as a rich coniferous / mixed swamp / fen forest complex occurring over peat of variable depth (Organic Deposit landform). Dominant species include Black Spruce (*Picea mariana*) and Tamarack (*Larix laricina*), with Red Maple, Black Ash, White Elm (*Ulmus americana*) and Silver Maple as associates. A mature White Cedar (*Thuja occidentalis*) forest that is supported by significant groundwater discharge and harbours rare flora, straddles Blais Road near the southwest portion of the site. The most significant portion of the Albion Road Wetland ANSI however, is the Valarian Fen, a peatland glade complex at the northeast corner of the site. This community is apparently unique in the site district and also supports provincially and regionally significant flora (Brunton, 1992; Brownell and Blaney, 1997).

Pine Grove Forest Reserve ANSI (Regionally Significant ANSI; NESS ID No. 102 – MODERATE)

The Pine Grove Forest Reserve ANSI is located east of the study area, but warrants mention due to its size and significance within the National Capital Commission (NCC) Greenbelt and the broader landscape. This regionally significant ANSI is approximately 250 hectares of crown land located on Sand Plain landform. It is dominated by young, deciduous and mixed early successional forests of White Pine, Trembling Aspen (*Populus tremuloides*), Red Maple, White Birch (*Betula papyrifera*) and Green Ash (*Fraxinus pennsylvanica*). Situated on low lying land with a high water table, this ANSI also supports wetland components.

Although the area has experienced significant disturbance, it still supports a number of unusual wetland habitats and rare flora, most notably a small fen on a thin peat deposit, one provincially rare orchid and several regionally significant vascular plants. There is also a small area of late successional upland deciduous forest which represents an uncommon sand-based landform-vegetation complex in Site District 6E-12 (Brunton, 1992; Brownell and Blaney, 1997; Mosquin and Gillett, 1985).

Evaluated Wetlands

Albion Road (Leitrim) Wetland (Provincially Significant ANSI; PSW; NESS ID No. 100 - MODERATE)

The Leitrim Wetland /Albion Road Wetland is the only evaluated wetland in the vicinity of the study area. As noted above, this wetland is classified as provincially significant and includes coniferous swamp, mixed swamp and fen communities. More details are provided under the ANSI description above.

Ottawa-Carleton Natural Areas

Although there were a number of sources that identified remnant natural areas within the Ottawa region, prior to the natural area evaluations undertaken in 1995 by Geomatics International and the Regional Municipality of Ottawa-Carleton (RMOC), data had not been collected in a systematic way and field information was incomplete. Brownell and Larson (1995) conducted a review of natural areas evaluation techniques and developed an initial method to evaluate natural areas in more detail. This review is referred to as the Natural Environment Systems Strategy (NESS).

Following this review, Brownell and Blaney (1997) conducted reconnaissance-level assessments involving limited field work but a systematic review of all existing information to compile summary sheets documenting the characteristics of the various natural areas. A follow-up report called Candidate Natural Area Evaluation (RMOC, 1997) summarized the findings of their evaluation.

Candidate sites were evaluated using eight criteria and were given a significance level (none, low, moderate or high) based on these criteria.

Further to this work, the City of Ottawa conducted a Natural and Open Spaces Study (NOSS) in 1998; this study was limited to the urban zone, north of the Greenbelt. As noted, there is also an ongoing study being undertaken by the City of Ottawa to identify Urban Natural Areas (UNAs) and summarize their associated natural features (2004). These UNAs are assigned environmental ratings of high, moderate or low, based on nine criteria. (Note: The NESS and UNA ratings may not coincide due to differing study contexts. The NESS study included the entire former Region of Ottawa-Carleton [including both urban and rural areas] whereas the UNA study only included the new City of Ottawa urban areas. Therefore small, urban forests that may be considered low significance when compared to the large, natural areas outside of the city may be considered high significance within the urban limits).

In addition, the National Capital Commission has identified a Greenbelt around the City of Ottawa, which incorporates core natural areas, natural area buffers and natural area links. Cultivated and rural areas are also an important part of the greenbelt as these areas help to maintain and provide opportunities for future connections. This zone has been excluded from the City of Ottawa's UNA Study, but does contain some of the largest natural habitats within the study area.

The natural areas assessed within the above mentioned reports that are relevant to the LRT study area, are described briefly below. As noted, due to the multiple assessments of some of these areas, they often have more than one name, and designation and/or 'site code'. All relevant names, designations and codes are noted below and in Figure 4.1.1-1a, 4.1.1-1b and 4.1.1-1c. The site descriptions are presented as they occur generally from north to south along and in the immediate vicinity of the general study area. Many of the natural areas are not located within or immediately adjacent to the specific study corridor.

<u>LeBreton Flats</u> (NOSS ID No. 1320)

LeBreton Flats is located north of Scott Street, west of Commissioner Street, south of the Ottawa River Parkway and east of the Transitway, adjacent to the downtown area of the City of Ottawa. The master plan for LeBreton Flats includes 24 ha (60 acres) of park and festival space, 6 ha (14 acres) of federal cultural institutional use, and 22 ha (54 acres) of high density mixed residential, office and retail development. The site already includes the new Canadian War Museum and most of the planned park and festival space. The site includes areas of mown grass and open fields with some deciduous and coniferous trees. There are no significant species or habitats in this area, however it is recognized as an important greenspace and recreational area within the downtown core (Environmental Management Branch, 1998a).

<u>Dominion Arboretum</u> (NOSS ID No. 1101, UNA No. 133)

The Dominion Arboretum is located along the Rideau Canal on the Central Experimental Farm lands. It consists of planted deciduous and coniferous trees and shrubs, many of which were established approximately 100 years ago. In addition, there are more recently planted trees and shrubs which together include over 2400 species and varieties. Many of these planted species and varieties represent the only occurrence of their kind in Ottawa, and in some cases, Canada. Despite the great diversity of planted trees, the ground flora is primarily manicured lawn, which is routinely cut (Environmental Management Branch, 1998a).

<u>Carleton University Woodlot</u> (NOSS ID No. 1702)

This small, 2.5 hectare woodlot on the campus of Carleton University is classified as a Fresh-Moist Aspen-Poplar Deciduous Forest. It is found primarily along a small ravine, with the tableland portion of the site planted with ornamental trees. Floral diversity is generally low, however one regionally significant shrub is found on site (Environmental Management Branch, 1998a).

Vincent Massey Woods/Park (ESA, NOSS ID No. 2704; UNA No. 136 – HIGH; NESS ID No. 107 - LOW)

Vincent Massey Woods is located within the larger Vincent Massey Park area along the eastern shore of the Rideau River between Heron Road and Bronson Avenue. It is owned by the National Capital Commission and is described as an upland/wetland complex along steeply sloping Rideau River shore. The 16.2 ha of natural habitat are not large enough to support true 'interior forest' habitat. Despite the small size and high levels of disturbance (selective thinning, invasive species, railway tracks, bicycle trails and walking paths), this natural area has a high native floral diversity (213 species) and high native flora 'Co-efficient of Conservation' rating. Dominant habitat types include upland deciduous woods, upland mixed woods, thicket and treed swamp, upland scrubland, marsh and floodplain deciduous woods.

Several of the vegetation communities are significant in the region. In particular the 'Sugar Maple – Black Cherry (*Prunus serotina*) with Red Oak on clay-based riparian substrates' is considered a rare landform/vegetation combination within the City of Ottawa. Similarly, the 'Buttonbush (*Cephalanthus occidentalis*)-Silver Maple-Red Maple-Green Ash swamp on alluvial soils', as well as the 'Crack Willow (*Salix fragilis*) - Eastern Cottonwood (*Populus detoides*)-Dogwood (*Cornus spp.*) floodplain deciduous woods' are considered rare. This site also contains records of provincially, regionally and locally significant flora as well as exceptionally large specimen trees (including White Pine, Sugar Maple, Red Oak, Green Ash and Black Cherry). Butternut trees (federally and provincially endangered and listed on Schedule 1 of the Species at Risk Act [SARA]) are also found in the Vincent Massey Woods/Park.

A total of 55 wildlife species have been observed and/or reported in this area. The majority of these species are typical for the vegetation communities present on site, and also include many migrant birds, particularly passerines and waterfowl (Dickson and Darbyshire, 1979; Brunton, 1993; Brownell and Blaney, 1997; Environmental Management Branch, 1998a; City of Ottawa, 2004).

Hog's Back Woods (UNA No. 134 – MODERATE)

This natural area (11.8 ha) is located on the Rideau Canal just west of Hog's Back Woods East (UNA No. 139). The site consists of a disturbed wooded valley and inland river islands that are located within the transformed recreational parkland of Prince of Wales Falls and Confederation Heights. Generally, the area is disturbed and fragmented by human influences (tree removal, formal and informal pathways and residential lawn encroachment) except for the river islands which have not been heavily influenced and are in a relatively 'pristine' condition. The river islands are dominated by mature deciduous swamps of Black Willow (*Salix nigra*) and Eastern Cottonwood with associated Red-osier Dogwood (*Cornus stolonifera*) thickets. The valley slopes are comprised of young to sub-mature upland deciduous forests dominated by White Elm, Sugar Maple, Green Ash, and Trembling Aspen, over a dense buckthorn understory. There are no regionally rare or uncommon plant species reported for the area. Recommendations by the City of Ottawa focus on maintaining the riparian ecological conditions on the islands and maintaining valley slope forest communities to aid in slope stability and hence, shoreline protection (City of Ottawa, 2004).

Hog’s Back Woods East (UNA No. 139 – MODERATE)

Hog’s Back Woods East is located approximately 200m east of the Rideau Canal within the vicinity of UNA No. 134 (Hog’s Back Woods) and southwest of UNA No. 136 (Vincent Massey Park). The City of Ottawa (2004) describes the 4.6 ha, NCC owned property as a young to submature upland deciduous forest dominated by Green Ash and White Elm with the higher northeast section of the property consisting of a mature deciduous forest (Sugar Maple, White Ash and White Elm). The City of Ottawa also notes that there is no interior habitat, no significant flora or fauna and extensive invasive shrub development within the site. Hogs Back Woods East provides slope stabilization and is an ‘inland’ component of the Rideau River Wildlife Corridor (City of Ottawa, 2004).

Mid-Sawmill Creek Corridor (NOSS ID No. 3102; UNA No. 142 – MODERATE)

The Mid-Sawmill Creek Corridor extends upstream (southward) from its confluence with the Rideau River to the intersection of Cahill Drive at Plant Drive. The site is described generally as a “linear woodland and wetland complex in a steep-sided clay ravine along Sawmill Creek in Heron Park, Ottawa” (City of Ottawa, 2004, p.1). More specifically it is a linear, 19.9 ha complex of sub-mature to mature deciduous swamp, mature upland deciduous forest, young upland deciduous forest and sub-mature upland coniferous forest. Common tree species include Crack Willow, Bur Oak, Manitoba Maple (*Acer negundo*), White Elm, White Ash, Black Cherry, American Basswood, Sugar Maple, American Beech and Eastern White Cedar.

The site has a moderate ‘Co-efficient of Conservation’ rating, with 185 native vascular plants noted for the site. The site is disturbed by major road crossings (Heron Road, Walkley Road and the Airport Parkway), informal and formal pathways, forest clearing and adjacent influences from residential development. Despite these impacts, the site supports a regionally uncommon plant and provides a locally important wildlife corridor between the NCC Greenbelt and the Rideau River (Environmental Management Branch, 1998a; City of Ottawa, 2004).

CNR Line (NOSS ID No. 2901, UNA No. 143 - MODERATE)

This natural area is described generally as a “low, scrubby woodland and wetland complex in Riverside Park, Ottawa” (City of Ottawa, 2004, p.1). More specifically it is a young, 30.6 ha deciduous forest, deciduous swamp and thicket swamp complex regenerating from agricultural pasture. There are also areas of wet meadow and marsh habitats. The site has a low native flora ‘Co-efficient of Conservation’ rating and does not support a high native flora diversity or records of significant species. The site is crossed by the railway and a high voltage transmission line. There is residential development to the north and south and major arterial roads to the east and west (Environmental Management Branch, 1998a; City of Ottawa, 2004).

McCarthy Woods (and Southern Corridor) (ESA, NOSS ID No. 2904, UNA No. 144 – HIGH; NESS ID No. 106 - LOW)

McCarthy Woods is described as a “large, mature deciduous forest and associated regenerating thickets and fields in Riverside Park” (Environmental Management Branch, 1998a, p.1). It is a 78.2 ha site that supports about 19 hectares of ‘interior’ habitat that is considered the “largest reasonably natural deciduous forest in Ottawa” (Brunton, 1993, p. 85). It occurs on shallow to deep till and sandy-till over limestone bedrock.

The dominant vegetation type is submature to mature Sugar Maple deciduous forest with Ironwood (*Ostrya virginiana*), Bitternut Hickory, American Beech and Red Oak in drier areas and American Basswood, Eastern Hemlock (*Tsuga canadensis*), Blue-beech (*Carpinus caroliniana ssp. virginiana*), Striped Maple (*Acer pensylvanicum*) and Yellow Birch in more moist sites. A young to submature upland mixed forest (Eastern White Cedar, Trembling Aspen, White Elm) also occurs in low-lying areas in the southwest portion of the site. The site supports a diverse native flora (204 species) and a high native flora 'Co-efficient of Conservation' rating. As well, two regionally rare and five regionally uncommon vascular plants have been recorded on site. Disturbance through informal path development, the railway line, undergrowth thinning, and invasive species has had a limited impact on the site. Regeneration of adjacent abandoned agricultural fields will eventually provide added forest cover and increase the overall habitat quality. The once common till-based forest habitat is now considered rare in Ottawa (Brunton, 1993; Brownell and Blaney, 1997; City of Ottawa, 2004).

<u>Johnston Street West</u> (NOSS ID No. 3442, UNA No. 186 – LOW)

This area, located south of the existing railway facility (Walkley Facility), is identified as a young deciduous swamp thicket (Glossy Buckthorn [*Rhamnus frangula*], White Elm, Balsam Poplar [*Populus balsamifera ssp balsamifera*], Green Ash and Gray Birch [*Betula populifolia*]) with the westerly portion of the property containing a young to submature deciduous swamp forest over spring-flooded clay substrate (City of Ottawa, 2004). Owned by the National Capital Commission, the 5.9 ha site is heavily impacted by invasive species like Glossy Buckthorn, Purple Loosestrife (*Lythrum salicaria*) and Reed Canary Grass (*Phalaris arundinacea*). Industrial park development areas are located adjacent to the property with arterial roadways to the south. Despite its abundance of introduced species and overall disturbed nature, the site does provide some important functions including providing local storm water storage and enhancement as well as serving as a component of the east-west urban wildlife corridor. No regionally rare or uncommon vascular plants have been recorded on this site (City of Ottawa, 2004).

<u>Conroy Woods</u> (NOSS ID No. 3403, UNA No. 152 – LOW)

Conroy Woods is located immediately north of the existing rail facility, south of Walkley Road between Albion and Conroy Roads. It is described as a relatively extensive (10.9 ha) but disturbed upland deciduous forest. Dominant species include young Trembling Aspen, Balsam Poplar, White Elm and White Birch which are regenerating on former agricultural land. Several invasive species are noted as being present and causing severe impacts. Conroy Woods is a linear forest with no interior habitat or regionally significant species recorded (Environmental Management Branch, 1998a; City of Ottawa, 2004).

<u>Conroy Swamp/Greenboro Turtlehead Nature Area</u> (ESA, NOSS ID No. 3502, UNA No. 151 - HIGH)

Conroy Swamp is located south of an existing rail facility, south of Walkley Road and between Albion and Conroy Roads. Residential land use occurs to the south. The area is described as a forest and thicket swamp mosaic that has developed in a post-glacial drainage channel on Clay Plain, of approximately 28.2 ha in area (City of Ottawa 2004).

Communities include a young to mature hybrid maple (*Acer x freemanii*)-Silver Maple-Green Ash deciduous swamp (heavily infested with Buckthorn [*Rhamnus cathartica*]), a young thicket swamp (willow-Red-osier Dogwood-Buckthorn) and young upland forest (Large-tooth Aspen, American Basswood and Black Cherry). Despite extensive disturbance (forest clearing, altered drainage, invasive species and edge effects), a moderate diversity of native species as well as one regionally rare and five regionally uncommon plants persist. As well, the maple-ash swamp community is uncommon within the City of Ottawa (Dickson and Darbyshire, 1979; Brunton, 1993; Environmental Management Branch, 1998a; City of Ottawa, 2004).

Mountain Crescent Woods (NOSS ID No. 2907, UNA No. 149)

Mountain Crescent Woods is a small, 2.5 ha site located west of Bank Street and just north of Hunt Club Road. Sawmill Creek flows through this woodland and the area is considered part of the Sawmill Creek/Airport Parkway Greenway System Corridor (NOSS ID No. 5013). The area is described as a Dry-Fresh Poplar-Conifer Mixed Forest and an Organic Silver Maple Deciduous Swamp. This swamp community is considered rare within the City of Ottawa (Environmental Management Branch, 1998a).

National Capital Commission Greenbelt

The National Capital Commission Greenbelt was conceived in 1950 as a means to limit urban growth in the expanding Capital region, to protect scenic countryside areas and to provide a home for large institutions (e.g. Agriculture Canada, Natural Resources Canada research complexes, Department of National Defence installations). From 1958 through 1966, the Federal government proceeded to purchase the lands within the proposed greenbelt area, creating one of the most complete greenbelts in the world and the only one that is publicly owned in its entirety. The Greenbelt covers approximately 200 square kilometres and is dominated by natural areas and working farms but also accommodates recreational, residential, commercial and institutional uses.

Within the Greenbelt, lands have been given one of seven land designations within three categories that distribute land uses throughout the area. Natural environment designations include Core Natural Areas, Natural Buffers and Natural Area Links (NCC, 1996).

Airport Parkway Natural Area (NESS No. 105 - MODERATE)

The Airport Parkway Natural Area (part of the Greenbelt) is located 2 km southwest of Blossom Park, extending south from Hunt Club Road to Leitrim Road and east of Elizabeth Park to Highway 31, City of Gloucester. It is generally described as a poplar and Red Maple forest on acidic sand with some fairly large Red Maple and ash swamp communities. Eastern White Cedar mixed forest and swamp communities are also present. Most of this area is considered part of the Pine Grove Forest Reserve (the area of Pine Grove Forest that is not considered ANSI) and is owned by the National Capital Commission. Although highly fragmented, this area is considered an “important area for maintaining biodiversity, and productivity and hydrological functions” (Brownell and Blaney, 1997, p.242; Mosquin and Gillett, 1985; TSH, 2002).

Blossom Park Woods (no official designation)

Sometimes included within the larger Pine Grove Forest Reserve to the east, and located within the Airport Parkway Natural Area, Blossom Park Woods is located just east of the CNR railway line, north of Lester Road. This site is a mature upland/lowland forest complex on Sand Plain which is distinct in the surrounding young to mid-aged forest. Red Maple-Green Ash and Red Maple-American Beech-Eastern Hemlock forests dominate and support a rich ground flora including regionally significant species. Additional canopy species include Yellow Birch, Eastern White Cedar and Sugar Maple (Brunton, 1992; Dickson and Darbyshire, 1979; Mosquin and Gillett, 1985; CH2M HILL, 2003b).

Uplands Golf Course Woods (no official designation)

The forested area east of the Uplands Golf Course is a dense, submature Scots Pine (*Pinus sylvestris*) plantation with limited undergrowth. There is also a narrow deciduous forest dominated by Green Ash and Balsam Poplar located along the west side of the abandoned CNR railway. On the east side of the railway, the Scotch Pine plantation continues. There have been no significant species recorded for this area (Brunton, 2001; TSH, 2002).

South of Leitrim, North of Quinn (UNA No. 105)

South of Leitrim, North of Quinn is an 18.9 ha site for which there were no baseline data available from the City of Ottawa. Air photo interpretation and knowledge of the surrounding landscape suggests that the site primarily supports a lowland deciduous forest community likely comprised of species present in adjacent forested communities (e.g. poplars, White Birch, White Elm, Red Maple, Green Ash, Manitoba Maple etc.). A trail traverses the south-western section of the site and the forest is bordered to the north and south by residential and commercial/industrial land uses. This site will be further investigated at the detail design stage.

Transport Canada Lands – 'Environmental Restrictions'

Portions of the land owned by Transport Canada (and leased by the Macdonald-Cartier International Airport) have been identified as zoned "mixed-use commercial aviation/non-aviation with environmental restrictions". The area in question has a water table that is very close to the surface. Therefore, environmental restrictions referred to in the zoning order require that any developments be undertaken in a manner that ensures that all water is infiltrated back into the ground. Portions of these Transport Canada lands fall within other designated natural areas. For example, approximately half of the 135.5 hectares falls within the Provincially Significant Albion Road (Leitrim) Wetland. The remaining areas have not been identified through any other background studies as particularly significant and/or sensitive from a natural environmental perspective.

Field work undertaken by Ecoplans Limited in June, 2005 found that the area west of the railway right-of-way is a rolling upland mosaic of cultural meadow habitat, regenerating deciduous forest, mixed forest and pine plantations. The forested communities are primarily pioneer or young communities dominated by poplars, with Manitoba Maple, White Elm, Green Ash, Fire Cherry, Red Pine and Scotch Pine also observed. The pine plantations are Red Pine and Scotch Pine dominated and are the more mature forested communities on site.

Remer Property (UNA No. 184 – HIGH)

The Remer Property is a 41.6 hectare forested and open wetland complex that is part of the Albion Road (Leitrim) Wetland. The area is comprised of four communities. The first is described as a young to mature deciduous swamp dominated by Red Maple, Black Ash and White Elm. The second is an undisturbed sub-mature to mature mixed swamp dominated by Red Maple and Eastern White Cedar. The third is an undisturbed mature coniferous swamp dominated by Eastern White Cedar with Eastern Hemlock and Yellow Birch. Finally the fourth community is described as an undisturbed treed and open graminoid fen. Each of these communities occurs on organic substrates and has an exceptionally diverse and intact ground flora. This site also supports 10 regionally rare and 16 regionally uncommon vascular plants.

<u>Bowesville Road Woods</u> (no official designation)

Bowesville Road Woods is located south of the Macdonald-Cartier International Airport, along Bowesville Road. It is characterized by regenerating pastureland and scrubby woodland with 35-40 year old White Spruce (*Pinus glauca*), Red Pine and Scotch Pine south of Leitrim Road. The southern edge is regenerating pastureland with dense Gray Birch. There are no significant species recorded for this area (Brunton, 2001; TSH, 2002).

<u>Leitrim Road Escarpment</u> (no official designation)

The Leitrim Road Escarpment is located west of Bowesville Road Woods and extends in a northeast-southwest direction on both sides of Leitrim Road. It is generally described as an extensive willow thicket swamp and young to sub-mature Eastern White Cedar forest. Species present include Eastern White Cedar, Meadow Willow (*Salix petiolaris*), Pussy Willow (*Salix discolor*), Bebb's Willow (*Salix bebbiana*) and Balsam Poplar. The wetland communities occupy the clay-based plain at the base of the western slope of the sand-based escarpment (on which the airport is built) while the Eastern White Cedar forest dominates the slope of this feature. While these vegetation communities are common in the region, this site does support one regionally uncommon plant. The extensive vegetation communities also provide an important wildlife corridor and migrating woodland bird refuge (Brunton, 2001; TSH, 2002).

<u>Mosquito Creek Valley/Corridor</u> (UNA No. 101, 112, and 113)

Mosquito Creek Valley trends in a northwest and southeast direction and extends north and south of Armstrong Road as well as east and west of Limebank Road. This creek valley contains discontinuous remnant forests interrupted by regenerating agricultural land. Tree species are predominately Sugar Maple, American Basswood, American Beech, Eastern Hemlock, Red Oak and White Pine with White Elm, Green and White Ash along the creek bottom. These small, remnant forest habitats are highly disturbed by weedy shrubs and edge effects and there are no significant plant species on record. This valley has been divided into three separate units under the Urban Natural Areas Study by the City of Ottawa; however, there is no additional information available to date on these three units (Brunton, 2001; TSH, 2002).

<u>Canyon Walk Ravine</u> (no official designation)

Canyon Walk Ravine is located south of Mosquito Creek along an unnamed tributary of this creek. It is described as a severely disturbed remnant Sugar Maple, American Beech and Bur Oak forest. It also contains a narrow band of Green Ash and American Basswood as well as a substantial population of a regionally uncommon vascular plant. This ravine is considered important as a local wildlife corridor (Brunton, 2001; TSH, 2002).

<u>Armstrong Road North Woods</u> (NESS No. 125 – LOW, UNA No. 98)

Armstrong Road North Woods is located immediately north of Armstrong Road, 1.5 km east of the Rideau Canal. This site is a sub-mature to mature Red Maple/Silver Maple Mineral Deciduous Swamp (SWD3-3) with a 'strikingly high canopy' and vernal pools evident in the central portion of the site (Brunton, 2001). Bitternut Hickory, White Ash, White Birch and American Basswood are found on drier knolls. The site is 13.7 ha and occurs along a tributary to Mosquito Creek. It supports an intact native ground flora with two regionally significant and several regionally uncommon species noted. This site is part of an area within the RMOC that has been noted as habitat for wintering owls and hawks and contains area sensitive bird species.

Although the site is ranked as low significance by Brownell and Blaney (1997), Brunton (2001) notes that the NESS study did not involve original field work and likely under-rates the value of this site (Brunton, 2001; TSH, 2002; Brownell and Blaney, 1997; NEA, 2003).

<u>Armstrong Road South Woods</u> (NESS No. 124 – LOW, UNA No. 100)

Armstrong Road South Woods is located approximately 0.5km south of Armstrong Road and 1km east of Limebank Road. The City of Ottawa's UNA mapping connects the 'T' shaped Armstrong Road South Woods described by Brunton (2001) to a smaller forest to the south. This smaller forest is called Spratt Road East Woods by Brunton (2001) but is included here as part of Armstrong Road South Woods. Niblett Environmental Associates (2003) evaluated both the north 'T' shaped forest as well as the south sections and ranked only the northern 'T' shaped forest as significant (based on criteria related primarily to forest edge, structure, floristic diversity and presence of amphibian breeding pools). The core area of the woodlot is 22.8 ha with the additional southern section approximately 15.1 ha.

Although the western end of the 'T' has been described as a deciduous forest dominated by Sugar Maple, American Basswood, White Birch, White Ash and poplars with Butternut (*Juglans cinerea*), Manitoba Maple and Black Maple (*Acer saccharum ssp nigrum*) also observed, Brunton (2001) classified the entire forest as a Swamp Maple Mineral Deciduous Swamp (SWD3-3). Ecoplans Limited field investigations in 2005 confirmed this latter description. Bur Oak, Black Maple, White Elm, Yellow Birch, Green Ash and Black Ash are also locally common in the swamp with Butternut observed only rarely. Vernal pooling, important for amphibian breeding, is evident throughout the forest. This forest is also considered an area that supports wintering owls and hawks as well as area sensitive bird species. The north block of Armstrong Road South Woods also supports several regionally uncommon vascular plants (Brunton, 2001; TSH, 2002; Brownell and Blaney, 1997; NEA, 2003).

The disconnected southern section (i.e. Brunton's Spratt Road East Woods) is classified as a Swamp Maple Mineral Deciduous Swamp (SWD3-3) and is dominated by Sugar Maple, Silver Maple, American Basswood and White Elm. This forested swamp is surrounded by regenerating trees and shrubs, primarily shrub willow and Speckled Alder (*Alnus incana spp rugosa*). This characterization was confirmed in 2005 by Ecoplans Limited. This southern section of Armstrong Road South Woods is younger and has a higher degree of disturbance than the northern 'core' section and no significant flora or fauna were recorded within this woodlot (Brunton, 2001).

It should be noted that the Riverside South Community Design Plan (CDP) protects the more significant northern 'T' shaped forest while permits development on the less significant and disconnected southern section.

The land use planning process that resulted in the approval of the Riverside South Community Design Plan (CDP) in June 2005 included preparation of a series of supporting master studies including commercial space demand, transportation, water, sanitary sewer, storm water management and Significant Woodlot Study Update (Niblett 2005). Among other guidelines and legislated study approval processes, the supporting studies and CDP are consistent with the Natural Heritage conservation requirements of the Provincial Policy Statement and were carried out in accordance with the City of Ottawa Official Plan environmental protection policies. Also, representatives from the Rideau Valley Conservation Authority (RVCA), which by contract also represent matters of Provincial interest to MNR and which has the ability to recommend bump-up to DFO, were part of the study team for the CDP land use plan.

The Significant Woodlot Study Update recommended retention of the "T" shaped portion of the Armstrong South Woods. This woodlot area, which is designated in the Ottawa Official Plan as an Urban Natural Feature, was retained in the CDP design with the intent to protect it from development. The southerly "tail" to the "T" shaped woodlot was not identified as containing significant plant species and no threatened or endangered species were identified as being present by the RVCA. As a result, this part of the woodlot is to be developed in the future for housing, public roads and will contain the right-of-way for the LRT. Additional details on the land use planning process are included in Section 4.2.2 of this report.

Spratt Road Woods (NESS No. 123 – LOW, UNA No. 99)

This 15.4 ha forest is located southwest of Armstrong Road South Woods and south of the study area. Background information indicates that this area is a mixed-age hardwood forest dominated by Sugar Maple and Trembling Aspen with American Beech on drier knolls. Lower lying and vernal pooling areas with standing water support more moisture-tolerant species including Speckled Alder, White Elm, Black Ash and Green Ash in the canopy with Sensitive Fern and Wood Nettle and the dominant ground cover. This forest has a diverse understory and ground layer and supports regionally uncommon flora as well as area sensitive birds and vernal pools suitable for amphibian breeding. It is also recognized as a winter feeding and roosting area for raptors (> 9 species). A small area of shrub thicket with young Trembling Aspen, Silver Maple and White Elm also occurs to the southwest of the main Spratt Road Woods forest block (Brunton, 2001; Brownell and Blaney, 1997; NEA, 2003).

Chapman Mills Conservation Area

Chapman Mills Conservation Area is a 9.3 hectare area located north of Long Island lockstation on the Rideau Canal. The wetland area is federally protected habitat belonging to the Rideau Canal National Historic Site of Canada. The associated upland portions and parts of the wetland have been used to provide recreational opportunities for local residents. Vegetation communities associated with this site are described in Section 4.1.3.2 under the subsection titled ‘From the Rideau Canal West to Greenbank Road’.

Nepean Woods/Chapman Mills – East Woodlot (UNA No. 61)

Nepean Woods/Chapman Mills – East Woodlot is a 11.7 ha woodlot that is characterized as a mature upland deciduous forest dominated by Sugar Maple and American Beech with White Ash and American Basswood common associates and Ironwood frequent in the sub-canopy. This forest contains numerous specimen trees (> 1m DBH) and although previous reports indicate that it has been pastured in the recent past, there is little evidence of this now. There is currently a dense understory of hardwood regeneration. The northern end of this unit grades into a younger habitat that can be described as lowland hardwoods dominated by White Elm. This smaller community has experienced considerable die back and has a fairly open canopy. The northeast corner (beyond the core forested habitat) is a regenerating area with meadow marsh, swamp thicket and cultural meadow components. There were no previous records of significant species for this woodlot (McCormick Rankin, 1993); however a young Butternut tree was noted in the northeast corner of the site at the woodlot edge. Additional information on this site is not currently available from the City of Ottawa.

Chapman Mills – West Woodlot (UNA No. 60)

Chapman Mills – West Woodlot is found just south of Strandherd Road, between Greenbank Road and Woodroffe Avenue. It is an 8.1 ha mixed forest dominated by Eastern White Cedar with White Elm, Sugar Maple, White Birch, White Spruce and ash species as canopy associates. Some sections of this forest are clearly upland communities with Sugar Maple, Bitternut Hickory and American Beech in the canopy, while other sections support vernal pooling and obligate wetland species. There are no records of significant flora for the site (McCormick Rankin, 1993). Additional information on this site is not currently available from the City of Ottawa.

4.1.3.2 Vegetation and Flora

Background and Approach

Consistent with the data collection approach for the first phase of the project (i.e. generation and evaluation of alternatives), the vegetation and flora inventory focused on compiling and reviewing existing information within the study area, augmented with general field surveys in specific locations. Considerable existing information is available for many of the natural areas in the vicinity of the project. This background information review provided a context from which to assess specific areas within the study corridor as well as potential station location and maintenance facility alternatives.

Initial field surveys were conducted on September 10, 2004 with additional surveys carried out June 13, 14, 18 and 19, 2005 when the preferred alignment was known. This review focused on natural vegetation communities that had been previously highlighted through a review of air photos as well as specific areas that are traversed by the preferred alignment. The scope of the field work and terrestrial resources analyses included:

- Classifying or verifying previous classifications for vegetation communities, using the *Ecological Land Classification* (ELC) *System for Southern Ontario* (Lee et.al., 1998);

- Evaluating the sensitivity and significance of vegetation communities, using the "*Natural Heritage Resources of Ontario: Vegetation Communities of Southern Ontario*" (Bakowsky, 1996; NHIC website, 2004);

- Evaluating significance and sensitivity of flora recorded during field surveys, using Newmaster *et. al*. (1998) and the NHIC website (2004) for provincial and national significance, and Brunton (1998) for regional significance;

- Preparing a vascular plant species list (Appendix C of the Natural Environment Report [Appendix A]); and

- Taking representative site photographs, a selection of which is included in Appendix A of the Natural Environment Report (Appendix A).

The full Natural Environment Report is provided in Appendix A. The information provided in this section was extracted from the Natural Environment Report.

General Vegetation Overview

The study area includes natural, agricultural, urban, urban residential, rural residential, industrial and commercial land uses. As a result, vegetation is a mosaic of culturally influenced and remnant or naturally regenerating features. The seven key designated natural areas located immediately adjacent to or bisected by the study corridor are:

1) Vincent Massey Woods;
2) The Mid-Sawmill Creek Corridor;
3) The westerly forested portions of the Airport Parkway Natural Area (including Blossom Park Woods and all forested/wetland areas east of the airport);
4) Albion Road (Leitrim) Wetland;
5) Bowesville Road Woods (not officially designated);
6) Armstrong Road South Woods; and
7) Nepean Woods/Chapman Mills - East Woodlot.

LeBreton Flats and the Dominion Arboretum also lie along the proposed alignment but are both considered culturally influenced habitats with limited ecological value. Similarly, the Rideau Canal (a Canadian Heritage River and National Historic Site of Canada) will be crossed three times by the alignment, however since this designated area is more of a fisheries and aquatic habitat feature as opposed to an important feature from a vegetation perspective, it is discussed more fully in the Fish and Fish Habitat (4.1.1) and Rideau Canal subsections (4.2.4).

Aside from these key habitat areas, vegetation in the majority of the study corridor and vicinity, and specifically along the existing railway alignment, is typical of roadsides/railways, and is comprised of maintained areas (i.e. turfgrass and landscape plantings) and culturally influenced vegetation including old field, thicket or conifer plantations. The level of disturbance is generally high along the existing CNR railway alignment, as reflected by the high proportion and wide distribution of non-native, disturbance-tolerant and invasive species.

Through the south portion of the study area, the study corridor trends southwest through the rural agricultural area towards the new Riverside South Community. In this section, it traverses primarily agricultural fields and generally avoids remnant natural habitats (with the exception of Bowesville Road Woods and the southern end of Armstrong Road South Woods). The study corridor then swings north to cross the Rideau Canal at a 90 degree angle before turning west again at the northeast corner of Nepean Woods/Chapman Mills - East Woodlot and ending at Greenbank Road. The Rideau Canal (a Canadian Heritage River and National Historic Site of Canada) will be fully spanned by the Strandherd Armstrong Bridge (i.e. no instream works), therefore impacts to this important designated feature will be minimized, as discussed further in Section 5.1. Vegetation at this crossing location is discussed below in the final (fifth) sector description.

To facilitate the description of the vegetation communities traversed by the study corridor, the corridor has been divided into five general sectors based on homogeneity of surrounding habitat characteristics (e.g. urban, suburban, natural, agricultural) and consideration of logical 'dividing lines' (e.g. roads and/or natural features). The sectors are as follows:

1) Urban Sector from the Rideau Centre to Carleton University (existing alignment);
2) Suburban Sector from Carleton University to Hunt Club Road (existing alignment);
3) Greenbelt Sector from Hunt Club Road to the Albion Road Wetland (existing alignment);
4) Rural Agricultural Sector from west of the Albion Road Wetland to the Rideau Canal (proposed new alignment); and
5) From the Rideau Canal west to Greenbank Road (proposed new alignment)

The vegetation units within each of these sectors along and adjacent to the study corridor are described below moving from north to south. The airport link and maintenance facility alternatives have been discussed under separate sections.

LRT Study Corridor

1) Urban Sector from the Rideau Centre to Carleton University (existing alignment)

Consistent with the urban nature of this sector, the associated vegetation is dominated by either manicured or culturally influenced communities and as a result has very limited natural heritage value. Furthermore, the expansion of the railway line in this sector is limited by surrounding urban features, confining the logical limits of the assessment area to the immediate vicinity of the existing railway. The railway does however, run adjacent to a number of designated 'natural' areas beginning with LeBreton Flats (NOSS ID No. 1302) at the north end of the sector. Further south, the alignment abuts the Dominion Arboretum (NOSS ID No. 1101; UNA No. 133), followed by Carleton University Woodlot (NOSS ID No. 1702). These three designated areas are primarily culturally influenced communities with very limited natural heritage value.

Only one area supporting a semi-natural vegetation community was assessed in the field by Ecoplans Limited. This community is a disturbed woodland/hedgerow that borders both sides of the existing rail line just south of Dows Lake (Unit 1,). It occurs on an artificially steep slope where the railway tracks emerge from the tunnel under Dows Lake. The canopy is primarily composed of variable-aged trees including Manitoba Maple, Eastern Cottonwood and Trembling Aspen with scattered Large-tooth Aspen, American Basswood, Balsam Poplar, White Pine, White Ash and White Elm. The understory and ground layer are highly disturbed and are dominated by non-native species.

2) Suburban Sector from Carleton University to Hunt Club Road (existing alignment)

South of the Carleton University Campus, the study corridor follows the existing railway alignment which crosses the Rideau River and traverses Vincent Massey Woods (ESA; NOSS ID No. 2704; UNA No. 136 – HIGH; NESS ID No. 107 - LOW). Past Bronson Avenue, the alignment crosses Sawmill Creek and runs along the northeast edge of the Mid-Sawmill Creek Corridor (NOSS ID No. 3102; UNA No. 142 – MODERATE) for approximately 1.5 kilometres before crossing the creek again south of Walkley Road. An existing east-west spur traverses the CNR Line natural area (NOSS ID No. 2901; UNA No. 143 - MODERATE) and extends into McCarthy Woods (ESA; NOSS ID No. 2904; UNA No. 144 – HIGH; NESS ID No. 106 - LOW). Similar to the urban sector, the potential expansion through this sector is confined by the surrounding land use and potential adverse effects will be limited to habitat that is immediately adjacent to the existing railway. The field review was therefore scoped to review the natural and semi-natural communities within this immediately adjacent habitat.

The first area assessed was the forested habitat on the north and south sides of the existing railway alignment within Vincent Massey Woods (Unit 2). This area is described as a Dry-Fresh Sugar Maple – Black Cherry Deciduous Forest with American Basswood, Bur Oak and White Ash as canopy associates (Unit 2). The existing railway tracks and raised embankment have already had an adverse effect on the surrounding natural features. Vegetation within the ROW is dominated by non-native, invasive and disturbance-tolerant species which are invading the natural forest communities. However the habitat north of the railway appears to be less disturbed than the smaller forested area to the south of the tracks. Seepage was also observed at the base of the railway embankment on the north side of the tracks, and this groundwater likely contributes to the Buttonbush-Silver Maple-Red Maple-Green Ash swamp further north.

The Mid-Sawmill Creek Corridor is a linear woodland/wetland ravine complex that supports regionally significant flora. Only the specific crossing location within this natural area was reviewed by Ecoplans Limited. The area north of the crossing (Watercourse Crossing #4) is primarily a young lowland forest dominated by Manitoba Maple, with Green Ash, White Elm and Crack Willow as canopy associates. However, the area immediately surrounding the existing railway bridge is highly disturbed and dominated primarily by young Manitoba Maple, Staghorn Sumac thicket, Buckthorn and Riverbank Grape vines (Unit 3).

The remaining habitat within the Mid-Sawmill Creek Corridor was not assessed since southeast of Watercourse Crossing #4 the Transitway (2-lane road) is located between the railway tracks and Sawmill Creek, restricting any development closer to this natural feature. However, vegetation on the west side of the tracks, just north of Walkley Road was reviewed (Unit 4) and found to be a culturally influenced community dominated by old field species and scattered planted trees and shrubs (Unit 4,). Species observed include Norway Maple (*Acer platanoides*), White Ash, English Elm (*Ulmus procera*), Staghorn Sumac (*Rhus typhina*), Manitoba Maple, American Basswood, Silver Maple and Red Oak.

South of Walkley Road, the tracks traverse a primarily open area that is considered part of the Sawmill Creek/Airport Parkway Greenway System Corridor. This ‘open space’ area is dominated by grassed fields with some scattered trees and shrubs. Just north of the east-west railway spur the alignment crosses Sawmill Creek a second time. This area was reviewed in 2005 (Watercourse Crossing #5, Unit 5) and found to be highly disturbed with an open canopy comprised of young Manitoba Maple, White Elm, Crack Willow and Staghorn Sumac. The area also supported an abundance of non-native species including Buckthorn and Black Swallow-wort (Unit 5).

One small section of woodland extends close to the proposed Greenboro Station location. This small habitat patch (Unit 6,) was field assessed by Ecoplans Limited and was found to be a young, disturbed woodlot dominated by Manitoba Maple with White Elm, Trembling Aspen and Eastern White Cedar as occasional associates. Fairly mature Buckthorn shrubs are also common throughout.

Just east of this woodlot, the east-west railway spur traverses the CNR Line natural area. This area was reviewed by Ecoplans Limited (Unit 7) and found to be a young, patchy deciduous forest, and thicket swamp mosaic with areas of wet meadow and marsh habitats, particularly in pooling areas in the ditch alongside the existing railway embankment (Unit 7). This habitat is apparently regenerating from agricultural pasture.

Just east of the CNR Line is McCarthy Woods, a much larger and more mature deciduous forest. This forest is considered the largest reasonably natural deciduous forest in Ottawa. While McCarthy Woods is within the general study area, it is not close enough to the proposed alignment to warrant further review or assessment in the field.

North and south of the proposed Greenboro station, construction of an artificial 3-cell constructed wetland has been proposed in the area west of the existing railway tracks, to mitigate flooding, improve water quality, reduce downstream channel erosion and enhance the natural features and recreational opportunities in the Sawmill Creek Watershed. This project was initiated to address growing public concern about the state of the Sawmill Creek Watershed (CH2M HILL, 2003a). Given that this area is in the process of being significantly altered, this area was not assessed in the field. Reconnaissance field review in 2005 revealed that the first phase of the construction is underway.

On the east side of the railway alignment, just south of the constructed wetland, and immediately north of Hunt Club Road, another small, designated area occurs. This area, known as Mountain Crescent Woods (NOSS ID No. 2907, UNA No. 149), is a small, mixed forest/Silver Maple swamp complex with a vegetation community considered to be rare in Ottawa (the Silver Maple Swamp). Sawmill Creek also flows through this site. The area is surrounded by industrial and suburban development and was not assessed in the field due to the fact that it is located approximately 300m east of the existing alignment and will not be directly affected.

3) Greenbelt Sector from Hunt Club Road to the Albion Road Wetland (existing alignment)

The north boundary of the NCC Greenbelt is located just south of Hunt Club Road. This marks the beginning of the most naturalized sector of the study corridor. Ecoplans Limited field investigations focused on this sector where forested and regenerating habitats abut the existing railway alignment. A large portion of this sector is considered part of one or more designated natural areas. Albion Road (Leitrim) Wetland is the most significant natural feature of this sector and is designated as both an ANSI and PSW.

The study corridor traverses the NCC Greenbelt immediately east of the Macdonald-Cartier International Airport. The corridor traverses or abuts land designated (in the NCC Greenbelt Master Plan) as a 'Natural Area Link' as well as 'Rural Landscape Areas' and a Buildable Site Area (the airport). The existing track is designated an 'Infrastructure Corridor'. These designations reflect the fact that although this sector of the corridor is considered the most naturalized sector, it does not traverse or abut the more significant areas ('Core Natural Areas' and 'Natural Area Buffers') of the Greenbelt. Nevertheless, portions of this area are recognized within the City of Ottawa as important natural habitats.

North of Lester Road, the Airport Parkway Natural Area (NESS No. 105 - MODERATE) is located along both the west and east sides of the corridor. South of Lester Road, it is found only on the east side. This area is described by Brownell and Blaney (1997) as a Poplar and Red Maple forest with some fairly large Red Maple and ash swamp communities. Eastern White Cedar mixed forest and swamp communities are also present.

Field work by Ecoplans Limited focused on the portions of this natural area that occur immediately adjacent to the existing railway. Starting at the north end of the west side of the tracks, there is a Sugar Maple – Lowland Ash Deciduous Forest (Unit 8a) with a fern-rich ground layer adjacent to an area of pooling water (at Watercourse Crossing #8, a tributary to Sawmill Creek). Immediately south of this forest is an open habitat area (Unit 8b) classified as an Old Field Meadow (Unit 8b). This community is bordered by a shrub thicket which grades into a young poplar / Manitoba Maple hedgerow along the west side of the tracks. Further south, a young poplar-ash forest predominates and then grades into swamp thicket community at the junction with Lester Road (described in further detail below).

The median area between the tracks and the gravel laneway on the east side of the tracks (Unit 8c) was found to be a mix of Old Field Meadow and Cattail Mineral Shallow Marsh. Dominant species include cattails (*Typha sp.*), shrub willows and old field species including Queen Anne's Lace (*Daucus carota*), Canada Goldenrod (*Solidago canadensis*) and White Sweet Clover (*Melilotus alba*). Standing water in sections of this median area indicates that a high water table occurs here.

At the north end of the east side of the tracks (Unit 8d), the community can be described as a young White Cedar – Poplar Mixed Forest dominated by Eastern White Cedar, with Manitoba Maple, White Ash and Balsam Poplar also present. South of this young forest is a Sumac Cultural Thicket community (Unit 8e) that divides the younger forest from the adjacent unit (Unit 8f), which is the most mature and intact section of forest along the length of the study corridor. This Sugar Maple – Hemlock Mixed Forest is known as Blossom Park Woods. While Sugar

Maple and Eastern Hemlock dominate the canopy, Red Maple, Green Ash, Yellow Birch and American Beech are also important canopy associates. Vernal pooling was noted within this community and the area is known to support regionally rare flora.

At the intersection of the study corridor with Lester Road, each of the four quadrants was reviewed as a distinct unit to enable the review of each in relation to their suitability as a potential station location. Each of these quadrants has sections of wetland habitat associated with them, as well as small watercourse tributaries to Sawmill Creek. Each quadrant is described in brief, below. These descriptions focus on habitat areas beyond the railway tracks and associated gravel road, which support primarily non-native old field species.

The northwest quadrant (Unit 9a) was saturated and covered by standing water at the time of the field visit. While this high water level was likely related to the record-breaking rainfall of the previous day, the fact that the vegetation was dead implies that drainage to and / or from this area had already been altered. This area is classified as a Willow Mineral Thicket Swamp.

The northeast quadrant (Unit 9b) is described as a small, disturbed Mineral Deciduous Swamp and is dominated by Balsam Poplar, with Silver Maple and White Ash also observed. Small Reed Canary Grass Mineral Meadow Marsh inclusions are found in this unit where the canopy cover is sparse. Thicket Creeper (*Parthenocissus inserta*) and Riverbank Grape (*Vitis riparia*) vines were abundant in the understory. A small watercourse is also found in this unit (Watercourse Crossing #9) and drains towards Sawmill Creek.

The southwest quadrant (Unit 9c) is characterized as a Cattail Mineral Shallow Marsh with a young riparian forest surrounding the watercourse (Watercourse Crossing #10). The riparian forest is classified as a White Elm Lowland Deciduous Forest. This community type is characteristic of areas where flooding duration is short and often found on riverbanks and in floodplains. Species observed include Balsam Poplar, White Elm and Manitoba Maple with cattails dominating the shallow marsh habitat.

The southeast quadrant (Unit 9d) is also described as a White Elm Lowland Deciduous Forest. This area has a sparse canopy and a dense, tangled understory of vines, Buckthorn and Wild Red Raspberry (*Rubus idaeus ssp melanolasius*). Some limited wetland vegetation is found associated with the watercourse feature that traverses this quadrant (Watercourse Crossing #10).

As previously mentioned, the area between Lester Road and Leitrim Road and east of the railway alignment is considered part of the Airport Parkway Natural Area. However, part of this area is also mapped within the original Pine Grove Forest Reserve (Mosquin and Gillett, 1985). More recent MNR mapping for the much smaller Pine Grove ANSI has excluded the regenerating habitats closest to the railway. The ANSI incorporates only the more intact habitats east of the study corridor.

Field review in 2005 by Ecoplans Limited revealed that a large proportion of this forested habitat between Lester and Leitrim Roads, and east of the railway alignment, is a young to mid-aged mixed swamp. This dominant community (Unit 10a) is classified as a White Cedar – Hardwood Mixed Swamp with canopy trees including Green Ash, Red Maple, Balsam Poplar, White Birch, Trembling Aspen, Bitternut Hickory, Yellow Birch and Eastern White Cedar (dominant species and age varies). Eastern White Cedar dominates the sub-canopy throughout much of this community and the ground layer is fern-rich. Within the dominant community, pockets of Red Pine and European Larch Coniferous Plantations (Unit 10b,) as well as an upland Sugar Maple – White Ash Deciduous Forest (Unit 10c) were observed. Wet meadows and small cattail marshes have also been observed within this area (Mosquin and Gillett, 1985).

At Leitrim Road, the communities found east and west of the railway alignment on the north side of the road were assessed as potential station locations (Leitrim Station). Culturally influenced vegetation, dominated by old field species, surrounds the abandoned railway alignment and adjacent small gravel road. Beyond this old field habitat, coniferous plantations and early successional forests occur. These communities are described below in two sections, the east side and the west side of the study corridor. This area is known as part of the Uplands Golf Course Woods and has also been mapped as an 'environmentally sensitive area' by Transport Canada.

The east side of the alignment (Unit 11a) is a young to mid-aged Coniferous Cultural Plantation dominated by Scotch Pine and European Larch (*Larix deciduas*). The understory of this community is dominated by White Ash Saplings, Glossy Buckthorn and Alternate-leaf Dogwood (*Cornus alternifolia*). The ground layer is relatively sparse but supports Bracken Fern (*Pteridium aquilinum var latiusculum*), sedges (*Carex sp.*) and horsetail (*Equisetum sp.*) species.

The west side of the alignment is dominated by a pioneer to young Scotch Pine Coniferous Plantation (Unit 11b) with a narrow band of young Poplar Deciduous Forest dominated by Trembling Aspen, with Green Ash, Balsam Poplar, Red Maple and Manitoba Maple also observed. The understory of both communities includes Glossy Buckthorn, Alternate-leaf Dogwood, Thicket Creeper and Riverbank Grape. The Scotch Pine plantation has a ground layer dominated by old field species while Ostrich Fern (*Matteuccia struthiopteris var pensylvanica*), sedges and bedstraw (*Galium sp.*) species dominate in the deciduous forest community.

South of Leitrim Road and west of the railway right-of-way, there is a block of land owned by Transport Canada and mapped as 'environmentally sensitive area'. This area was reviewed in 2005 and found to be a rolling upland mosaic of old field habitat, regenerating deciduous forests, mixed forests and pine plantations. Four communities were classified within this area. The first is a young to mid-aged Poplar Mixed Forest (Unit 13a) dominated by Scotch Pine (suggesting a plantation history) with Large-tooth Aspen, Trembling Aspen and Red Pine also common. A mid-aged Red Pine Coniferous Plantation (Unit 13b) with small sections dominated by Scotch Pine, and two Poplar Deciduous Forests (Unit 13c and Unit 13d) were also noted. Cultural meadow habitat surrounds these forested communities and numerous ATV/mountain bike and pedestrian trails were noted throughout this area.

Finally, the Albion Road (Leitrim) Wetland occurs just south of the Greenbelt boundary, on the east side of the alignment. This wetland is both a provincially significant ANSI and provincially significant wetland (PSW) and is considered the most significant designated natural feature in the study area. Portions of this wetland, as well as land west of the railway right-of-way, have also been mapped as 'environmentally sensitive areas' by Transport Canada. It is described as a rich coniferous / mixed swamp / fen forest complex occurring over peat of variable depth. Dominant species include Black Spruce and Tamarack, with Red Maple, Black Ash, White Elm and Silver Maple as associates. An area of mature White Cedar, which is associated with an area of considerable groundwater discharge and harbours rare flora, straddles Blais Road near the southwest portion of the site. The most significant area however, is the Valarian Fen, a peatland glade complex at the northeast corner of the site, which supports provincially and regionally significant flora, and which is apparently unique in the site district (Brunton, 1992).

4) Rural Agricultural Sector from west of the Albion Road Wetland to the Rideau Canal (proposed new alignment)

Once the study corridor diverges from the existing railway alignment, the route runs primarily through a rural agricultural landscape towards the Rideau Canal. Much of this area is proposed for future suburban development, which will be serviced by the LRT route. There are a number of small natural or semi-natural habitat features within this sector.

Armstrong Road North Woods (NESS No. 125 – LOW, UNA No. 98) and Armstrong Road South Woods (NESS No. 124 – LOW, UNA no. 101) are located north and south of Armstrong Road between Spratt Road and Limebank Road. Spratt Road Woods (NESS No. 123 – LOW, UNA No. 99) is found west of Spratt Road, south of the proposed alignment. Several additional small features within the study area have been identified by the City of Ottawa in the ongoing UNA Study. However, due to the absence of information on site characteristics and their distance from the study corridor, these areas are not discussed within this section. Two additional natural features within this sector have not been identified in the UNA Study yet have been described within previous Consultant reports. These sites have been given names to identify them in other reports and to avoid confusion, these names have been maintained (Bowesville Road Woods and Leitrim Road Escarpment). These features are described below as they are encountered in an east to west direction.

Immediately following the diversion from the existing alignment, the study corridor crosses Bowesville Road and runs through the southernmost end of the Bowesville Road Woods. This area is described as regenerating pastureland and scrubby woodland with 35-40 year old White Spruce, Red Pine and Scotch Pine south of Leitrim Road. A portion of the area on either side of Bowesville Road in the vicinity of the Bowesville Station was assessed in the field. This area is described in more detail, below.

Both sides of Bowesville Road (Units 14a and 14b) can be described as Fresh-Moist Poplar Deciduous Forests that have undergone, and are still enduring, significant disturbance. Both sides of the road are currently pastured with cattle thereby reducing regeneration in the understory and severely limiting native flora health and diversity in the ground layer. Some pooling water was observed, indicating imperfect to poor local drainage characteristics.

The Leitrim Road Escarpment is located west of Bowesville Road Woods and extends in a northeast-southwest direction on both sides of Leitrim Road. It is generally described as an extensive willow thicket swamp and young to sub-mature Eastern White Cedar forest. Species present include Eastern White Cedar, Meadow Willow, Pussy Willow, Bebb’s Willow and Balsam Poplar. This vegetation is common in the area, and does not represent a significant vegetation feature (TSH, 2002). This feature is north of the LRT alignment.

Further west, the study corridor swings south and crosses Mosquito Creek to avoid Armstrong Road North Woods and the core area of the Armstrong Road South Woods. The Mosquito Creek Valley supports a scattered remnant forest that is interrupted by regenerating agricultural land and is not considered a significant vegetation feature (TSH, 2002).

The Armstrong Road North and South Woods are the most noteworthy natural features in this sector, especially considering the relative absence of mature forested habitat in the surrounding area. Both forest blocks have maple swamp and upland deciduous forest components as well as an intact native ground flora and regionally rare species. Armstrong Road North Woods is located at a distance from the study corridor and will not be affected by the railway. However the alignment crosses the south end of Armstrong Road South Woods. This area was reviewed by Ecoplans Limited in 2005 and is described as a Swamp Maple Mineral Deciduous Swamp (Unit 15b) dominated by Freeman’s Maple and Silver Maple, with White Elm also frequently observed. The area immediately south of the core ‘T’-shaped swamp is very young (pioneer) while further south and west the canopy becomes more mature (Unit 15b). It should be noted that the Riverside South Community Design Plan protects the more significant northern 'T' shaped forest while permitting development on the less significant and disconnected southern section (Unit 15b).

Although there are several small UNAs within this section of the study corridor, these are located at some distance from the proposed alignment and will not be directly affected by the project. Finally, Spratt Road Woods is located just south of the proposed alignment, with only the northeast corner of the feature within the study area boundaries. Similar to the Armstrong Road North and South Woods, this mature hardwood forest is considered relatively important, particularly because of the relative absence of similar forested habitat in this primarily agricultural area.

5) From the Rideau Canal West to Greenbank Road (proposed new alignment)

The vegetation surrounding the east side of the Rideau Canal crossing is restricted to a small, mid-aged White Cedar – Poplar Mixed forest on a fairly steep slope (Unit 16a). It is dominated by Eastern White Cedar, Cottonwood, Large-tooth Aspen and Trembling Aspen with Red Oak, Eastern Hemlock and ash trees observed occasionally. Manitoba Maple is locally dominant along forest edges and along the canal. The community is disturbed by the impacts associated with a hydro cut and residential homes. Only a narrow band of riparian wetland vegetation was observed in scattered locations along the shoreline. No instream aquatic vegetation, sensitive species or vegetation communities were noted at the crossing location (stream morphology and substrates are not conducive to the establishment of aquatic vegetation at this location). Furthermore, no SARA listed aquatic species have been noted at this location. Since the Canal will be fully spanned by the Strandherd Armstrong Bridge (i.e. no instream works), no adverse effects to instream vegetation or features are anticipated.

A small section of the Chapman Mills Conservation Area is found on the west side of the Rideau Canal crossing. This area is a mosaic of pioneer/young Ash Lowland Deciduous Forest and Old Field Meadow habitat surrounding a well-traveled pedestrian pathway (Unit 16b). A very small Green Ash Deciduous Swamp was also noted in a low-lying depression at the western side of the area. As above, no sensitive species or vegetation communities have been noted on this side of the crossing.

West of the Rideau Canal, the alignment swings northwest to avoid fragmenting the Chapman Mills – East Woodlot (UNA No. 61). This 6.5 hectare woodlot is a mature Sugar Maple – Beech Deciduous Forest (Unit 17a) with several specimen trees exceeding 1m in diameter at breast height (DBH). A smaller section of lowland hardwoods occurs at the north end of the unit, as well as a regenerating old field meadow/swamp thicket/meadow marsh mosaic at the northeast corner (Unit 17c). A young Butternut tree was recorded in this northeast corner.

West of Chapman Mills – East Woodlot, the landscape is primarily composed of active and abandoned agricultural fields with scattered hedgerows (dominated by American Basswood and Sugar Maple). Much of this area is currently undergoing residential and commercial development. Chapman Mills – West Woodlot (UNA No. 60) occurs north of the proposed alignment and is described as mosaic of White Cedar – Hardwood Mixed Forest and White Cedar – Hardwood Mineral Mixed Swamp (Unit 18a). The area immediately south of Chapman Mills – West Woodlot has been recently cleared of woody vegetation and is now primarily Old Field Meadow with small pockets of cattails in low-lying areas.

Airport Link

A short railway spur to the west of the study corridor is proposed to link the main route to the Macdonald-Cartier International Airport. This airport link generally traverses primarily developed lands that are surrounded by areas of culturally influenced vegetation (cultural meadow and thicket communities). Two small forested habitats occur within this area. The first is described as a pioneer Poplar Deciduous Forest dominated by Trembling Aspen (Unit 12a). The second is a disturbed community which alternates from being dominated by Cottonwood on drier knolls to being dominated by Crack Willow and White Elm in low lying depressions with standing water (Unit 12b). The NCC Greenbelt Master Plan has designated this area as a 'Buildable Site Area' and an 'Infrastructure Corridor' (NCC, 1996).

Proposed Maintenance Facility

Three alternative areas have been proposed as potential locations for a railway maintenance facility. Two of these alternatives are oriented parallel to the main study corridor with the third alternative being an east-west spur at the existing Walkley Rail Facility. Ecoplans Limited reviewed two of these sites in the spring of 2005 to characterize the natural features and to address the potential adverse effects of the proposed maintenance facility. The third site (Walkley Facility) is an existing rail facility and use of this existing facility will therefore have minimal additional direct effects on the natural environment. The vegetation features within and/or in the immediate vicinity of each alternative are briefly described below.

<u>Alternative 1 - Walkley Facility</u>

The majority of the Walkley Facility alternative is located at the site of the existing rail facility, south of Walkley Road, between Albion Road and Conroy Road. Three identified natural areas occur adjacent to this site. These include Johnston Street West (UNA No. 186), Conroy Woods (NOSS ID No. 3403, UNA No. 152 – LOW) and Conroy Swamp/Greenboro Turtlehead Natural Area (ESA, NOSS ID No. 3502, UNA No. 151 - HIGH). No other non-designated vegetation communities occur within or adjacent to this alternative.

Both Johnston Street West and Conroy Woods were evaluated in 2003 and given a 'low' environmental rating by the City of Ottawa (2004). Johnson Street West, located south of the rail facility, is a young thicket swamp/deciduous swamp mosaic that has been heavily impacted by invasive species. Conroy Woods, located north of the rail facility location, is a disturbed upland deciduous forest. Conroy Swamp/Greenboro Turtlehead Natural Area is also located south of the rail facility and was given a 'high' environmental rating by the City of Ottawa (2004). This natural area is described as a deciduous swamp/thicket swamp/deciduous forest mosaic that supports one regionally rare and several regionally uncommon vascular plants. The Conroy Swamp area is also recognized as an important natural area by the Fairlea Community Association. In an e-mail dated December 1st, 2004, a member of the Fairlea Community Association noted that the 'Turtlehead Trails' are part of a local 'recreational pathway' as well as part of a larger, conceptual linear greenspace system (Hawley, 2004). The area also represents one of the only remnant natural habitats in the local community and is therefore highly valued by local residents (Hawley, 2004).

<u>Alternative 2 – Lester Facility</u>

The maintenance facility alternative that occurs within the NCC Greenbelt area is located to the west of the existing railway alignment. This area is designated as a 'Rural Landscape Area' with the existing track designated an 'Infrastructure Corridor' and the Airport Lands designated

'Buildable Site Area'. These designations reflect the fact that even though this sector of the study corridor is considered the most 'naturalized' sector, the proposed maintenance facilities would not directly impact the more significant areas of the Greenbelt (i.e. Core Natural Areas, Natural Area Buffers and Natural Area Links). This area is also considered part of the Airport Natural Area (NESS No. 105 – MODERATE).

Portions of this area were reviewed by Ecoplans Limited in 2004 with an additional reconnaissance review in 2005. The north end of the site (the service road) traverses a regenerating pioneer forest habitat followed by a young to mid-aged maple – ash lowland deciduous forest (Unit 8a) with a fern-rich ground layer. Immediately south of this forest is a large open habitat area (Unit 8b) that is classified as an old field/cultural meadow. This community is bordered by a shrub thicket which grades into a young poplar / Manitoba Maple hedgerow along the west edge of the tracks. The southern half of the site is located within a young to mid-aged poplar deciduous forest (Unit 20) with the service road extending into a flooded willow thicket swamp (Unit 9a).

Alternative 3 - Bowesville Facility

The third maintenance facility alternative is located just west of the Albion Road (Leitrim) Wetland PSW where the study corridor swings westward. A small area of the proposed facility (the M-O-W Compound) would be located within the NCC Greenbelt boundaries, with the remaining area to the south and east. The Greenbelt section is designated 'Infrastructure Corridor' (NCC, 1996).

A reconnaissance review by Ecoplans Limited in 2005 revealed that this area is a rolling upland mosaic that includes old field habitat, regenerating deciduous forests, mixed forests and pine plantations (Unit 13a through 13d). The pine plantations and mixed forests are the more mature communities (young to mid-aged) while the deciduous forests are at an earlier successional stage. Numerous pedestrian/mountain bike/ATV trails were observed throughout this area.

Rare Flora and Vegetation Communities

The following points summarize the floral characteristics, including rare flora, and the rare vegetation communities recorded with the study corridor and vicinity:

- In total, 227 vascular plant species were recorded during Ecoplans Limited field surveys (the vascular plant species list is found in Appendix C of Appendix A [Natural Environment Report]). It should be noted that this inventory reflects the emphasis on surveying in the vicinity of the proposed alignment and station locations and does not include species previously recorded in the core sections of the adjacent designated natural areas. Additional species are undoubtedly found further from the alignment, especially in the larger natural areas.

- Of the 227 species recorded, 50 (~22%) are non-native and typical of old field and/or disturbed areas. These species are generally widespread and abundant in the study area.

- One Species at Risk, Butternut, was recorded in three locations \(Unit 2 [Vincent Massey Woods], Unit 15 [Armstrong Road South Woods] and Unit 17c [Chapman Mills - East Woodlot]). This tree species is listed as endangered, but not regulated in Ontario (Ontario Endangered Species Act does not apply). It is also Federally Endangered and is listed on Schedule 1 of the Species at Risk Act (SARA). (Note: This species is not at risk due to habitat loss, nor is it particularly rare, but rather is experiencing marked declines due to Butternut Canker. Butternut Canker is widespread, hyper-virulent and fatal (but infected trees can live for 20-40 years if otherwise healthy and able to “wall off” infected areas). Based on U.S. experience, a very small percentage of trees are resistant. The Canker vectors are rain, wind and insects. The canker can be difficult to detect – some trees will show obvious signs/stress while others seem to be vigorous. Typical symptoms are crown dieback, long linear fissures/cracks often with black discharge, epicormic branching, and loose/sunken areas of bark. Cankers tend to be concentrated on the underside of the branches).

- No other globally, nationally or provincially significant species were recorded during the field surveys.

- One regionally rare species, Foxtail Sedge (*Carex alopecoidea*), was recorded during Ecoplans Limited field surveys in Unit 3. Regional rarity was assessed using *Distributionally Significant Vascular Flora of the Region of Ottawa-Carleton* (Brunton, 1998).

- The Albion Road (Leitrim) Wetland (particularly in the Valarian Fen community in the northeast corner), Pine Grove Forest Reserve ANSI and Vincent Massey Woods each support provincially rare vascular plants, as well as regionally and locally rare species.

- Several of the natural areas support regionally rare or uncommon species (e.g. Pine Grove Forest Reserve ANSI, Albion Road (Leitrim) Wetland, Mid-Sawmill Creek Corridor, Carlton University Woodlot, Vincent Massey Woods, McCarthy Woods, Conroy Swamp/Greenboro Turtlehead Nature Area, Blossom Park Woods, Remer Property, Leitrim Road Escarpment, Canyon Walk Ravine, Armstrong Road North and South Woods, and Spratt Road Woods).

- The above-noted Valarian Fen, a peatland glade complex at the northeast corner of the Albion Road (Leitrim) Wetland, is apparently unique in the site district and supports provincially and regionally significant flora (Brunton, 1992; Brownell and Blaney, 1997).

- The Regionally Significant Pine Grove Reserve ANSI also supports a small fen component and other unusual wetland components.

- Vincent Massey Woods includes vegetation communities considered rare/significant in the region. In particular, the ‘Sugar Maple-Black Cherry with Red Oak on clay-based riparian substrates’ is considered a rare landform/vegetation combination within the City of Ottawa, and the ‘Buttonbush-Silver Maple-Red Maple-Green Ash swamp on alluvial soils’ and the ‘Crack Willow-Cottonwood-Dogwood floodplain deciduous woods’ are considered rare.

- The maple-ash swamp in the Conroy Swamp/Greenboro Turtlehead Nature Area and the organic Silver Maple Deciduous Swamp in the Mountain Crescent Woods are considered uncommon within the City of Ottawa.

- The once common till-based Sugar Maple Deciduous Forest habitats found in the McCarthy Woods are now considered rare in the City of Ottawa (Brunton 1993; Brownell and Blaney 1997; City of Ottawa 2004).

Sensitivities and Management Implications

In general, as noted previously, the vegetation occupying the majority of the study corridor that parallels the existing railway is typical of railway corridors and is comprised of maintained areas (i.e. turfgrass and landscape plantings) and culturally influenced vegetation including old field, thicket or conifer plantations. The level of disturbance is generally high, as reflected by the high proportion and wide distribution of non-native and invasive species. The vegetation communities and species located along and immediately adjacent to the majority of the railway alignment are therefore generally common, tolerant and not highly sensitive.

More specific sensitivities and management implications have been assessed in relation to designated natural areas and remnant natural habitats adjacent to the railway corridor and within the scoped study corridor. To maintain consistency, this discussion of vegetation communities has also been divided into the five sectors identified above as well as the Airport Link and Proposed Maintenance Facility alternatives.

<u>1) Urban Sector from the Rideau Centre to Carleton University (existing alignment)</u>

As discussed in the vegetation section above, consistent with the urban nature of this sector, the associated vegetation is dominated by either manicured or culturally influenced communities. As a result, these communities have very limited natural heritage value. Furthermore, the potential adverse effects associated with the expansion of the railway line in this sector will be confined to the habitat immediately adjacent to the existing alignment.

<u>2) Suburban Sector from Carleton University to Hunt Club Road (existing alignment)</u>

This sector is primarily suburban, with very limited natural habitat remaining adjacent to the alignment. Vincent Massey Woods, McCarthy Woods, the Sawmill Creek Corridor and Mountain Crescent Woods are the most significant natural features within the sector. Both Mountain Crescent Woods and McCarthy Woods are located at some distance from the study corridor and will not be directly affected.

Vincent Massey Woods is the most significant and sensitive feature within this sector with mid-aged forested habitat immediately adjacent to the existing railway alignment. Field review by Ecoplans in 2005 revealed that the area northeast of the railway embankment is more intact and sensitive than the area to the southwest. Impacts to the forest to the northeast should be minimized, wherever possible.

Sawmill Creek will be crossed twice by the alignment. The first crossing (Watercourse Crossing #4) is located within the Mid-Sawmill Creek Corridor natural area but vegetation immediately surrounding the existing railway alignment is discontinuous, young and disturbed. The second crossing (Watercourse Crossing #5) is located beyond the boundaries of the Mid-Sawmill Creek Corridor natural area and is also highly disturbed with no significant vegetation features noted.

The east-west railway spur traverses the CNR Line natural area along an existing railway alignment. Although this area includes wetland and forested habitats, they are young, regenerating communities that are already disturbed by the adjacent land uses and railway corridor. Therefore this area is not considered particularly sensitive.

<u>3) Greenbelt Sector from Hunt Club Road to the Albion Road Wetland (existing alignment)</u>

This sector is the most naturalized sector of the LRT study corridor. This section of the corridor traverses regenerating forested habitats, old fields, thickets and wetlands. However, much of the vegetation immediately adjacent to the existing alignment is culturally influenced and young, with relatively low sensitivity. The primary value of these habitats is in their connectivity to adjacent natural areas, and in their enhancement of the overall size of remnant habitat. They also provide some buffering capacity to adjacent lands.

The most sensitive natural feature of this sector is the Albion Road (Leitrim) Wetland, located immediately east of the existing alignment (note: only the extreme northwest tip of the wetland will experience slight edge intrusion from the new alignment). In general, wetland communities dependent on both groundwater and surface water are sensitive to land use changes that would affect either the quantity or quality of ground or surface water. Given the shallow rooted character of the trees within swamp communities, these features would also be particularly vulnerable to impacts associated with fragmentation/opening and creation of new edges (resulting from increased susceptibility to windthrow). Impacts to significant features within this natural area should be assessed and avoided, wherever possible.

As noted, the most significant portion of the Albion Road (Leitrim) Wetland is the Valarian Fen, a peatland glade complex at the northeast corner of the site that is unique in the site district and supports provincially and regionally significant flora (Brunton, 1992; Brownell and Blaney, 1997). While this area is removed from the corridor, the fen will be particularly sensitive to changes in water quality or quantity.

4) Rural Agricultural Sector from west of the Albion Road Wetland to the Rideau Canal (proposed new alignment)

This sector is primarily under agricultural land use with scattered regenerating pastureland and small remnant upland forest and forested swamp habitats. The key identified features in this sector include Bowesville Road Woods, Mosquito Creek Valley/Corridor, Armstrong Road North Woods, Armstrong Road South Woods and Spratt Road Woods.

The relative scarcity of forested habitat in the larger surrounding area increases the importance of the remnant forest features. Impacts to these features should be avoided, wherever possible. Mature forests are particularly sensitive to the creation of new edges which increase wind and light intrusion into the forest interior. Forested swamps (Armstrong Road North Woods and portions of Armstrong Road South Woods) are dependent on both groundwater and surface water, and are particularly sensitive to land use changes that would affect either the quantity or quality of ground or surface water.

5) From the Rideau Canal West to Greenbank Road (proposed new alignment)

This sector includes the Rideau Canal Crossing, a small deciduous forest (Nepean Woods/ Chapman Mills – East Woodlot) and a small mixed forest/mixed swamp mosaic (Chapman Mills – West Woodlot). The surrounding land is either under agricultural land use or is undergoing residential development.

The Rideau Canal Crossing location does not support any nearshore instream aquatic vegetation, sensitive species or vegetation communities (stream morphology and substrates are not conducive to the establishment of aquatic vegetation at this location). Furthermore, no SARA listed aquatic species have been noted at this location. Therefore this crossing location is not considered particularly sensitive from a vegetation perspective. Nevertheless, a full span bridge is proposed at this location. As such there will be no in water works.

The relative scarcity of forested habitat in the larger surrounding area increases the importance of the remnant forest features. Impacts to these features should be avoided, wherever possible. Mature forests (e.g. Nepean Woods/Chapman Mills – East Woodlot) are particularly sensitive to the creation of new edges which increase wind and light intrusion into the forest interior.

Airport Link

The land within the airport link study area are primarily culturally influenced and of minimal ecological value. This includes the two small, deciduous forest and disturbed deciduous swamp habitats which are considered common and tolerant communities. The Greenbelt Master Plan designations of 'Buildable Site Area and 'Infrastructure Corridor' reflect the fact that previous studies have also found this area to be of limited natural significance.

Proposed Maintenance Facility

Of the three alternatives proposed for the maintenance facility, Alternatives 2 (Lester Facility) and 3 (Bowesville Facility) appear to have the greatest potential for direct/footprint impacts on vegetation features and natural areas. Alternative 1 (Walkley Facility) occurs on an existing rail facility and therefore the direct impacts will be minimal. However this facility is bordered to the north and to the south by designated UNAs, one of which is listed as having a 'high' environmental rating. The sensitivities of each of these maintenance facility alternatives are outlined in brief below.

As noted, the majority of Alternative 1 (Walkley Facility) is located in an existing rail facility therefore direct impacts will be minimal. However there are three identified natural areas associated with it. Two of the identified features were given a 'low' environmental rating by the City of Ottawa (2004). However, the Conroy Swamp/Greenboro Turtlehead Natural Area was given a 'high' environmental rating. The wetland communities in this natural area are also dependent on both groundwater and surface water, and are particularly sensitive to land use changes that would affect either the quantity or quality of ground or surface water. Therefore, if Alternative 1 is selected, encroachment into Conroy Swamp/Greenboro Turtlehead Natural Area should be avoided. As well, careful design and management of drainage will also be required to protect the quality and quantity of both the groundwater and surface water regimes that support the wetlands.

While much of the vegetation within Alternative 2 is culturally influenced or young and is not of high ecological value, the southern portion of the site forested and is mapped as part of the Airport Parkway Natural Area. This forest is classified as a young to mid-aged poplar deciduous forest and contributes to local forest cover and wildlife habitat. As well, the alternative will encroach on small wetland communities at the north and south limits of the facility. If Alternative 2 is selected, efforts should be made to design the site to minimize direct impacts to the small wetland features if possible. Careful design and management of drainage will be required as well as edge management to better seal new forest edges.

Although this maintenance facility alternative is located within the NCC Greenbelt area, it is located within lands designated as a 'Rural Landscape Area' with the existing track designated an 'Infrastructure Corridor' and the Airport lands to the south designated as a 'Buildable Site Area'. These designations reflect the fact that the proposed maintenance facilities would not directly affect the more significant areas of the Greenbelt (i.e. Core Natural Areas, Natural Area Buffers and Natural Area Links).

Alternative 3 is located within a rolling upland mosaic of old field habitat, regenerating deciduous forests, mixed forests and pine plantations. These features are not considered of high ecological value yet contribute to local forest cover and wildlife habitat. Alternative 3 also has the potential to indirectly effect the adjacent Albion Road (Leitrim) Wetland PSW to the east. As noted, these wetland communities are sensitive to land use changes that could affect either the quantity or quality of ground or surface water. Provided there is no direct encroachment, the potential for indirect impacts to the wetland habitats through changes to the ground and surface water regimes can be managed with the implementation of mitigation measures.

4.1.4 Wildlife and Migratory Birds

Background and Approach

Again, consistent with the data collection approach for the first phase of the project (i.e. generation and evaluation of alternatives), the wildlife and habitat assessment for this stage of the project focused on compiling and reviewing existing information within the study area, augmented with general observations made during field surveys in specific locations. Specific wildlife surveys were not conducted; however incidental observations were noted while conducting vegetation and fisheries field work. Wildlife habitat was assessed generally based on the vegetation community characteristics in order to assess the types of wildlife that may utilize these features. Potential wildlife movement areas were also assessed generally based on background information, air photo interpretation and field surveys.

In addition to the data collected and summarized from background reports, the MNR was contacted to obtain Element Occurrence (EO) records of Species at Risk (SAR) and provincially rare species previously documented within the study area. Ecoplans Limited also considered potential habitat for SAR and rare species during their field surveys. A summary of the wildlife and wildlife habitat within the study area is presented below.

Overview

Typical of landscapes surrounding large urban centres of central and southern Ontario, the majority of the study corridor, and particularly the north portion, has been developed (urban or suburban) or is in agricultural use. In general, the suite of wildlife recorded by Ecoplans Limited within the study corridor is dominated by common, generalist species such as White-tailed Deer (*Odocoileus virginianus)*, Raccoon (*Procyon lotor)*, Striped Skunk (*Mephitis mephitis)*, and a variety of small passerines and hawks, tolerant of urban or semi-urban conditions. The observed species assemblage is consistent with the cultural habitat mosaic, proximity to commercial / industrial / residential development, anthropogenic history and moderate to high level of disturbance within the study corridor.

As described above in the vegetation section, the main habitat features along the study corridor are the scattered designated natural areas and remnant habitat patches within the NCC Greenbelt. In particular, the regenerating habitat within Greenbelt and the Bowesville Road Woods area as well as the Albion Road (Leitrim) Wetland PSW provide the greatest faunal diversity and abundance within the study corridor (CH2M HILL, 2003b; Brunton, 2001). These features are generally intact enough and of sufficient size to provide local habitat for a diversity of species.

A number of wildlife inventories have previously been conducted within the general study area. These include inventories associated with the Natural Open Spaces Study (NOSS) and Urban

Natural Areas Study (UNA), the Review and Assessment of Significant Natural Areas in Site District 6-12 (Brunton, 1992), and Biological Inventories of 23 Areas in the Ottawa Region (Dickson and Darbyshire, 1979). Additional wildlife information has been compiled in association with consultant reports in the general study area. For example, CH2M HILL (2003b) conducted wildlife inventories within the Sawmill Creek Subwatershed (encompassing the Sawmill Creek Natural Areas, Airport and NCC lands as well as McCarthy Woods, Blossom Park Woods and Greenbelt lands). In 2002 Totten Sims Hubicki reviewed natural areas near the Gloucester South Urban Centre and in 2003 Niblett Environmental Associates Inc. completed studies of significant woodlots within the Mosquito Creek Valley (including Bowesville Road Woods, the North and South Armstrong Road Woods and Spratt Road Woods).

These various studies were conducted over the years from 1979 to 2004. Combined, these studies recorded 111 bird species, 16 mammal species, 18 butterfly species and 15 species of amphibians and reptiles. This combined wildlife list, including species observed during Ecoplans Limited field inventories is presented in Appendix E of Appendix A (Natural Environment Report).

The following summary points provide an overview of wildlife species and habitat significance associated with the general study area:

- No endangered (END) wildlife was observed by Ecoplans Limited. Furthermore, according to the background information reviewed, no endangered wildlife has been recorded within the study corridor. This includes all endangered species as identified by the MNR (COSSARO), and SARA.

- No threatened (THR) wildlife was observed by Ecoplans Limited. However, according to the background information reviewed, one species listed by SARA as a federally threatened (THR) species (Blanding's Turtle, *Emydoidea blandingii)* has been recorded in the study corridor. *Blanding's Turtle is also a provincially threatened species designated by the MNR (COSSARO).* The records of this species are element occurrence (EO) records from the MNR, most of which are historical. Nevertheless, a letter provided by Shaun Thompson, MNR Kemptville District Ecologist, indicated that Blanding's Turtles are potentially still present in the study corridor. This species is discussed in the Species at Risk and Provincially Rare Species section below.

- No wildlife of special concern (SC) was observed by Ecoplans Limited. However, according to the background information reviewed, three species listed by SARA as federal species of special concern have been recorded within the study corridor. These species are also listed by the MNR (COSSARO) as special concern. These include the following species which are discussed in more detail in the Species at Risk and Provincially Rare Species section below:
  1) Short-eared Owl (*Asio flames)*;
  3) Red-shouldered Hawk (*Buteo lineatus); and*
  2) Monarch Butterfly (*Danaus plexippus*).

- No provincially rare wildlife (ranked S1 to S3) was recorded by Ecoplans Limited. However, according to the background information reviewed, three provincially rare species have been recorded within the general study area: Rough-legged Hawk (*Buteo lagopus,* S1 [very rare]), Black-crowned Night-heron (*Nycticorax nycticorax,* S3 [rare to uncommon]) and Eastern Red Damsel (*Amphiagrion saucium, S3 [rare to uncommon])*. Each of these species is discussed in the Species at Risk and Provincially Rare Species section below.

- While there were a number of additional element occurrences (EOs) on record for the vicinity of the study area, most of these were deemed to be either historical, extirpated, or of such low accuracy that they were of little value to the present study. A letter provided by Shaun Thompson, Kemptville District Ecologist, outlines this EO evaluation in more detail and is provided in Appendix F of Appendix A (Natural Environment Report). This letter did highlight the fact that information within the NHIC database is limited and there is always the possibility that other rare species still persist or have not yet been recorded in the area. It was recommended that habitat assessments regarding the potential for provincially rare flora and fauna be considered.

- Based on the background information review and Ecoplans Limited field inventories, the vast majority of the wildlife recorded in the study area and environs is classified as S5 (very common in Ontario), with a few S4 (common) and SE (non-native) species also noted.

- Fifty bird species considered of Conservation Priority in the Ottawa-Carleton Region have recorded within the greater study area.

- Twenty-two bird species considered 'area sensitive' (MNR, 2002) have been recorded within the greater study area. These species use the larger forested natural areas including the Armstrong Road North and South Woods, Spratt Road Woods and McCarthy Woods.

- Three species considered regionally or locally rare (Magnolia Warbler [*Dendroica magnolia*], Blue-headed Vireo [*Vireo solitarius*] and the Star-nosed Mole [*Condylura cristata*]) have been recorded in the greater study area (CH2M HILL 2003b).

- No specific amphibian surveys were conducted. However, the variety of small ephemeral or permanently pooled wetland habitats associated with some of the natural areas in the vicinity of the study area (i.e. Albion Road [Leitrim] Wetland, Sawmill Creek, Mosquito Creek, Rideau River) support potential amphibian habitat. In particular, the numerous wetland pockets and evidence of ephemeral pools within the Armstrong Road North and South Woods and Spratt Road Woods in the south portion of the study area provide potential amphibian breeding habitat (NEA, 2003).

- The area located between Mosquito Creek and Bowesville Road, known as the Bowesville-Armstrong Meadow, has been identified as providing wintering habitat for many raptors including Short-eared Owl, Rough-legged Hawk, American Kestrel, and Snowy Owl (*Nyctea scandiaca*) (NEA, 2003; Brunton, 2005 pers. comm.). This is based entirely on secondary source information and has not been field verified by Ecoplans Limited.

- The North and South Armstrong Road Woods are also identified as part of an area noted for wintering owls and hawks (TSH, 2002; Brownell and Blaney, 1997; NEA, 2003). Spratt Road Woods is also recognized as a winter feeding and roosting area for raptors; nine species have been recorded using these woods.

- A few potentially important local wildlife corridors have been identified in background reports. These include the natural areas along the Rideau River, Sawmill Creek, the Greenbelt region, Bowesville Road Woods, Mosquito Creek Valley, Leitrim Road

Escarpment and Armstrong Road North and South Woods (CH2M HILL 2003b; TSH, 2002; NEA, 2003; Brunton, 1993; Brunton, 2001; Geomatics, 1995). These are discussed in more detail the Wildlife Movement Opportunities section below and in the discussion of Wildlife Sensitivities and Management Implications.

Species at Risk and Provincially Rare Species

The following sections discuss documented SAR and provincially rare species from within the study area. As previously noted, although no SAR-specific surveys were conducted, Ecoplans Limited did consider *potential* habitat for SAR throughout the field investigations. Any *potential* habitat has been noted below, where appropriate (e.g. potential Blanding's Turtle habitat). Generally, the areas crossed by the proposed alignment are not high quality habitats that have high potential to support SAR (e.g. the majority of the alignment twins an existing rail facility, or traverses active agricultural land) therefore SAR-specific surveys were not deemed necessary. However, the proposed mitigation measures discussed in Chapter 5 do include some site specific measures to further assess and address potential adverse effects to SAR during detail design. Additional field work was conducted in May 2006 by Marshall, Macklin, Monahan (MMM). The results of this work are included later in this section.

Blanding's Turtle (THR)

There are a number of Blanding's Turtle records for the south end of Ottawa, dating back 50 years. However, specific records are either dated or lack sufficient detail to assess species presence on a record by record basis. The approach recommended by MNR was to assess this species according to suitable habitat presence/absence and to consider that where suitable habitat is located, there is potential for this species to be present.

Blanding's Turtle inhabit areas of shallow water, usually in large marshes or shallow lakes. They are often found wandering on land, but not usually very far from water except when nesting (MacCulloch, 2002). There are no large marshes or lakes within the immediate vicinity of the study corridor, limiting potential habitat for this species. There were, however, some areas of open water observed within the Greenbelt Sector of the study corridor, particularly surrounding Lester Road. This area may have the potential to serve as marginal habitat for Blanding's Turtle. The Albion Road (Leitrim) Wetland also has potential to serve as suitable habitat.

The relatively low density of their local populations and their life history strategies make Blanding's Turtle particularly vulnerable to increases in mortality, particularly adult mortality. Specifically, they have late sexual maturation and low reproductive frequency, increasing the importance of sustaining adults in the population. They are also quite mobile on land with females recorded to move up to 3km to reach suitable nesting habitat and males known to travel from 5km to 11.5 km to shift their home range.

Short-eared Owl (SC)

Short-eared Owls have been recorded from the Bowesville Road Woods and Bowesville-Armstrong Meadow area, with the most recent winter sighting in 2004 (Brunton, 2005 pers. comm.). The last record of a breeding pair was in 2000 (Brunton, pers. comm., 2005). This is based on background information and was not field-verified by Ecoplans Limited.

The Bowesville-Armstrong meadow area encompasses open spaces such as grasslands and agricultural fields, which are limited in the Ottawa-Carleton region (TSH, 2002, Brunton 2005, pers. comm.). This area is identified as providing wintering habitat for many species of raptors in addition to the Short-eared Owl (e.g. Rough-legged Hawk, American Kestrel, Snowy Owl) (NEA, 2003; Brunton, 2005 pers. comm.). The open vegetative habitat (tall grasses and undisturbed fields) provide excellent habitat for the production of rodents and small mammals such as meadow voles (*Microtus pennsylvanicus*), which are the primarily food source for large birds of prey. The presence of scattered individual hardwood trees also provides good hunting vantage points for this species (Brunton, 2001).

Short-eared Owls are highly migratory and nomadic, except in southern parts of their range, making them vulnerable to increases in mortality due to increases in residential development. Breeding habitat must have sufficient ground cover to conceal nests and nearby sources of small mammals for food. This owl has relatively small nesting territories and home ranges, varying from 15 to 200 ha. Due to its nomadic tendencies, mate and site fidelity are very low. Breeders tend to wander until they find areas with high densities of prey before settling to breed.

In winter, large numbers of these owls will over winter in areas with abundant food. In some communal winter roosts, up to 200 birds have been recorded (Cadman, 1994).

Current trends in urban expansion and intensive farming have contributed to this species decline over much of its range. Survey data shows a statistically significant 3.5% per year decline from 1966-2001 across the overall range and an even steeper decline of 11.4% per year in Canada (Cadman, 2004). Large-scale destruction of native habitat and natural succession has also contributed to increased vulnerability to predation and reduction of food sources.

<u>Red-Shouldered Hawk (SC)</u>

A Red-shouldered Hawk was observed in Blossom Park Woods in 1979 by Dickson and Darbyshire, however, no further details were provided.

Suitable habitat for Red-shouldered Hawks is described by Environment Canada (2003) as “deciduous or mixed wood forests containing shade-tolerant hardwood trees close to wetland areas”. Typically this species prefers large intact forested areas. Although Red-shouldered Hawks may persist in smaller woodlots (10 to 100 hectares), they do not compete well with other larger raptors (e.g. Red-tailed Hawks) (Environment Canada, 2003). This is particularly the case where their habitat encompasses open foraging areas. Their preferred prey is amphibians, hence the proximity to wetland areas. They construct large obvious stick nests, usually in the crotch of a large tree.

<u>Monarch Butterfly (SC)</u>

Monarchs have been recorded in the Greenbelt area within the central potion of the study *area*. However, there is potential for this species to be present wherever suitable meadow habitat occurs. In Canada breeding habitat is primarily in abandoned farmlands, along roadsides and wherever milkweeds *(Asclepias sp.)* and wildflowers (such as goldenrods, asters and Purple Loosestrife [*Lythrum salicaria*]*)* are present*.* The Monarch almost exclusively uses milkweeds for laying eggs and for food. The open old field/meadow habitats along the railway bed provides potential Monarch habitat*.*

The Monarch population is considered Special Concern in Ontario and Canada; however the primary threat to the Monarch is the destruction of their wintering sites in the highlands of Mexico. The reason for the Special Concern designation in Ontario is because Ontario constitutes a significant proportion of the Monarch's Canadian range and efforts are made to harmonize the national and provincial statuses for species with Canadian ranges largely confined or restricted to Ontario. Breeding areas in Ontario are also experiencing declines due to the use of herbicides (note: milkweeds are listed as noxious weeds), and natural succession of old field habitats.

Provincially Rare Species

Eastern Red Damsel (S3)

Eastern Red Damsel is a provincially rare species ranked S3 by the NHIC. There is only one record for the Eastern Red Damsel within the vicinity of the study area. This record, from 1999, was located in the Leitrim Fen (part of the Albion Road [Leitrim] Wetland).

Black-crowned Night-heron (S3)

Over the past decade populations of this species have increased following apparent pesticide-induced declines in the late-1960s and early-1970s. Current population trends show they are reasonably widespread and expanding their range in both eastern and Central Ontario (Austen, 1994). Black-crowned Night-herons are colonial nesters usually found in heronries with other species like Great Blue Herons and Double-crested Cormorants. In Ontario, Breeding occurs exclusively in the southern part of the province at relatively few sites and is at the northern edge of its range (OBBA, 2005); assigning it a provincial rating of rare to uncommon. With nesting occurring in sometimes large populations they may be susceptible to large-scale disturbances. In Ontario they prefer either sparsely or heavily treed islands; but will utilize wooded river banks, swamps and cattail marshes (Peck, 1983).

Rough-legged Hawk (S1)

Rough-legged Hawks are primarily found nesting in the Northern Arctic Tundra and can also be found inhabiting Southern Arctic Cliffs and along the Taiga Shield Rocky areas (Peck, 1983). They are short distance migrants and like many other migrating raptors over winter in southern parts of the province relying on open fields and abandoned agricultural lands where abundant rodent populations are vital for survival. Records of this species within the study area, specifically within Bowesville-Armstrong Meadow, (Brunton, 2001) are most likely migrant non-breeders as suitable nesting sites are nonexistent.

Wildlife Movement Opportunities

A combination of background information, field visits, air photo interpretation and professional judgement was utilized to develop the following assessment of wildlife movement opportunities. The discussion makes reference to the study corridor sectors (Sectors 1 through 5 that are described in the Vegetation and Flora section, Section 4.1.3.2).

In general, it can be assumed that wildlife habitat and wildlife movement opportunities are very limited within the Urban and Suburban sectors (Sectors 1 and 2). This is due to the fact that there are very few remaining vegetation features of notable size, limiting available habitat patches, and there are very few generally continuous features along which wildlife might move. The watercourse corridors are generally the only more or less continuous features, providing opportunity for movement of some species as well as local shelter opportunities in associated habitat patches.

For example, Vincent Massey Woods, the Arboretum and Carleton University Woodlot provide areas of shelter and habitat along the Rideau River and Rideau Canal waterways. In addition, Sawmill Creek and its associated riparian vegetation (e.g. the Mid-Sawmill Creek Corridor) potentially provide a north-south movement corridor and linkage to the Rideau River.

However, while these features may provide potential movement opportunities, it should be noted that the proposed LRT alignment follows an existing railway track through these sectors.

Any potential land-based east-west movements within Sector 2, between McCarthy Woods, the CNR Line and natural areas to the east (i.e. Johnston Street West, Conroy Woods and Conroy Swamp) are likely hindered to some degree by the existing north-south transportation corridors (i.e. the Airport Parkway and Bank Street). However, many birds may not find these features a barrier to movement and there is even evidence that White-tailed Deer move through the area (based on an Ecoplans Limited sighting of a deer near Watercourse Crossing # 5). Again, it should be noted that while these features may provide potential movement opportunities, the proposed LRT alignment follows an existing railway track through this area.

The Greenbelt sector (Sector 3) provides the largest, somewhat continuous and most intact habitat block within the study area. This sector includes the various blocks of the Airport Parkway Natural Area (including Blossom Park Woods and the Upland Golf Course Woods) which are largely connected to one another. The railway alignment currently cuts through the centre of this habitat block but does not pose a major barrier to movement presently. This natural area may also provide a connection to the Pine Grove Forest ANSI beyond the study area to the east (e.g. for larger-ranging mammals such as the White-tailed Deer and Coyote).

South of the Greenbelt in the Rural Agricultural Sector (Sector 4), wildlife movement is currently feasible between the Transport Canada Lands, the ‘South of Leitrim, North of Quinn’ UNA and the Albion Road (Leitrim) Wetland, as well as across open pasturelands to the Bowesville Road Woods and Leitrim Road Escarpment. The Bowesville Road Woods, Leitrim Road Escarpment and Mosquito Creek Valley natural areas are generally northwest-southeast trending features that provide wildlife movement opportunities throughout.

While movement is currently feasible between the Armstrong Road North and South Woods (across agricultural/pasture lands and across Armstrong Road), the approved land use plans for the Riverside South Community indicate that this area will be developed, thus restricting and/or altering future movement opportunities between these isolated woodlots.

The Rideau Canal in Sector 4 also provides a movement corridor and waterway linkage between habitat patches associated with the river, throughout the City of Ottawa.

West of the Rideau Canal (Sector 5), remnant habitat blocks are limited to isolated woodlots and there are no identifiable movement corridors between these patches.

Wildlife Sensitivities and Management Implications

The area south of the Macdonald-Cartier International Airport along Armstrong Road, known as the Bowesville-Armstrong Meadows, provides wintering habitat for a variety of raptor species There are records of Short-eared Owl (SC) and Rough-legged Hawks (S1), among others. The tall grasses and undisturbed fields provide excellent foraging habitat for raptors, in the summer as well as the winter, due to the abundance of rodents and other small mammals which are the primary prey items for large raptors. Although direct encroachment and removal of habitat is not desirable, the open character of the meadow habitats is not sensitive to fragmentation and the narrow LRT corridor should not constitute a significant adverse effect to the foraging raptors.

The North and South Armstrong Road Woods are also identified as part of an area noted for wintering owls and hawks (TSH, 2002; Brownell and Blaney, 1997; NEA, 2003). Spratt Road Woods is also recognized as winter feeding and roosting area for raptors; nine species have been recorded using these woods. Fragmentation could impact the forested habitat and affect the related cover and roosting functions.

A few potentially important local wildlife corridors have been identified in background reports and through the assessment of wildlife movement opportunities discussion above. These include the natural areas along the Rideau River and Rideau Canal (i.e. Vincent Massy Woods, the Arboretum, and Carleton University Woodlot), the north-south corridor along Sawmill Creek and the Mid-Sawmill Creek Corridor), the Greenbelt Region (including the Airport Parkway Natural Area, Blossom Park Woods and Upland Golf Course Woods), and the northwest-southeast trending corridors of the Bowesville Road Woods, Mosquito Creek Valley and Leitrim Road Escarpment.

In general, these local corridors are somewhat vulnerable to additional fragmentation, however, where the tracks already exist there will be very limited additional barrier effects beyond what currently exists. In particular, the crossings of the Rideau Canal and Rideau River in Sector 1 will be tunnelled and spanned, respectively (at the same locations as existing structures which currently allow for wildlife movement), resulting in negligible effects to wildlife movement. Similarly, Sawmill Creek will be spanned in the vicinity of an existing crossing which presently allows for limited wildlife movement. Wildlife movements will not be impeded at this crossing location. As well, the east-west movement opportunities within Sector 2 will remain unchanged.
The area of greatest sensitivity is the Greenbelt Sector (Sector 3) where the largest and most intact natural habitat areas are found. As previously mentioned, the existing railway alignment cuts through the centre of this habitat block, but does not pose a barrier to wildlife movement at the moment. Any security fencing required for community safety will need to consider the implications to wildlife movements in this sector. It should be noted that fencing less than 2.4m is generally permeable to White-tailed Deer (cited in Brudin 2003).

The Rural Agricultural Sector (Sector 4) is also sensitive to wildlife movement barriers as it currently accommodates broad-scale movements between and through large habitat patches and across the rural landscape generally. However, the Mosquito Creek Valley and the Rideau Canal provide the most distinct or defined ‘corridor’ features on the landscape. These features will be spanned by large bridges, and therefore wildlife movement will not be restricted.

Where the new rail alignment is constructed and where potential security fencing is proposed across potential wildlife movement corridors, impacts to wildlife movement will be considered and mitigated.

As described above, a number of rare species have been reported within the study area. The specific sensitivities in relation to the study area are summarized below.

Blanding’s Turtle (THR)

There are no large marshes or lakes within the immediate vicinity of the study corridor, limiting potential habitat for this species. There were, however, some areas of open water observed within the Greenbelt Sector of the study corridor, particularly surrounding Lester Road. This area may have the potential to serve as marginal habitat for Blanding's Turtle. The Albion Road (Leitrim) Wetland also has potential to serve as suitable habitat.

The high mobility of the Blanding's Turtle makes it vulnerable to a variety of development threats in addition to habitat removal, specifically roads. The narrow LRT and relatively low frequency of train versus car traffic makes it a desirable alternative to arterial roadways.

The introduction of nest predators, which occurs with fragmentation of intact forest / wetland mosaics, is also an important limiting factor for turtles, including Blanding's Turtles. However, the LRT in and of itself will not increase development and it will not remove the wetland areas that may provide habitat for this species.

Short-eared Owl (SC)

As described above, the Bowesville-Armstrong Meadow is considered a winter and summer foraging habitat for this species, as well as a variety of other raptors. The open nature of the vegetation system is not specifically sensitive to fragmentation, and the narrow LRT alignment should not have a significant effect on this foraging and nesting habitat, especially if encroachment due to construction work sites is kept to a minimum, thus keeping the habitat intact.

Red-Shouldered Hawk (SC)

Blossom Park Woods is a relatively small area (<25 hectares) surrounded by young, regenerating habitat and residential development to the east. There are no current EOs for the area and the status of the 1979 record is not clear. Given the current characteristics of the surrounding area and the lack of recent observations, it is highly unlikely that this species still persists within Blossom Park Woods or adjacent habitats. Furthermore, the nests of this species are conspicuous, and no large stick nests were recorded in the vicinity of the study corridor during the field surveys.

Monarch Butterfly (SC)

Suitable Breeding habitat for the Monarch is generally common and abundant within the immediate vicinity of the study corridor, and throughout much of the southern rural-agricultural portion of the study area. The meadow-old field habitats along the railway bed that support Milkweed provide suitable breeding and foraging habitat. The expansion of the LRT should not have a significant adverse effect of the habitat, and will in fact preserve this habitat type in the area, since the open meadow habitats will be maintained within the right-of-way.

Eastern Red Damsel (S3)

Presuming that the Albion Road (Leitrim) Wetland will not be affected by the LRT project, it is highly unlikely that the Eastern Red Damsel, if still present, will be impacted.

Black-crowned Night-heron (S3)

The occurrence of this species within McCarthy Woods was recorded by CH2M HILL during the Sawmill Creek Subwatershed Study Update in 2002. Suitable habitat is present with the study corridor and study area generally, in areas along the Ottawa River, the Rideau River/Canal and cattail marshes (Three Cell Wetland at Airport Rd) and stream corridors (Sawmill Creek, Mosquito Creek). However, the main banks and natural areas of the Rideau River/Canal are likely the preferred preference for nesting. The current proposed LRT route follows a pre-existing rail bed were habitat infringement on these associated habitats will be minimally impacted.

Rough-legged Hawk (S1)

In conjunction with sensitivities described above for the Short-eared Owl the Bowesville-Armstrong meadow also provides a winter foraging habitat for this species, as breeding habitat is not present. As noted above the LRT alignment should not have a significant affect on this foraging habitat.

Additional Field Work Completed in 2006

Additional field work to identify amphibian and reptile species were conducted in May 2006 by Marshall, Macklin, Monahan (MMM). The following outlines the results of this field work. Additional details on methodology, mapping and the results of future investigations will be provided to Environment Canada when available.

Amphibians

Seven species of amphibians have been designated as a Species at Risk in Ontario: Northern Cricket Frog (*Acris crepitans*), Jefferson Salamander (*Ambystoma jeffersonianum*), Small-mouthed Salamander (*Ambystoma texanum*), Tiger Salamander (*Ambystoma tigrinum*), Fowler's Toad (*Bufo fowleri*), Northern Dusky Salamander (*Desmognathus fuscus*), and Spring Salamander (*Gyrinophilus porphyriticus*). None of these species has been recorded in the City of Ottawa.

Five species of amphibians have been designated as a federal Species at Risk (SARA, Schedule 1): Jefferson Salamander, Small-mouthed Salamander, Tiger Salamander, Fowler's Toad, and Spring Salamander. None of these species has been recorded in the City of Ottawa.

Five species of amphibians have been designated as Not at Risk in Ontario and are not deemed to be protected species in Ontario: Four-toed Salamander (*Hemidactyllium scutatum*), Mud Puppy (*Necturus maculosus*), Northern Leopard Frog (*Rana pipiens*), Pickerel Frog (*Rana palustris*), and Western Chorus Frog (*Pseudacris triseriata*). Each of these species has been recorded in the City of Ottawa.

Armstrong South Woods

At Armstrong South Woods, breeding habitat is present in ephemeral pools for Northern Leopard Frog and Western Chorus Frog. Fourteen (14) ephemeral pools with standing water >25 cm deep were observed on 3 May 2006. Pools of this depth were considered to be the minimum depth necessary to permit metamorphosis. Four of the pools are located on or adjacent to the LRT alignment. Ephemeral pools <25 cm deep occupied approximately 25% to 50% of the forest floor in the vicinity of the alignment. These pools may provide breeding habitat for early-season transforming species such as Western Chorus Frog but not for late-season transforming species such as Northern Leopard Frog. Over-wintering habitat for Northern Leopard Frog (permanent waters) was confined to two municipal drains that lie to the south of the alignment at the south end of the woods. These drains are presently in flood condition owing to the presence of a beaver dam at their confluence. Three American Toads were heard calling from one of these drains during the survey period (2 pm to 6 pm).

The preferred habitat for Four-toed Salamander (woodland ponds, springs or creeks with mosses, rotting logs and overhanging grasses and sedges), Mudpuppy (permanent waters such as rivers, reservoirs, inland lakes), and Pickerel Frog (cool, clear waters, especially places where inlet streams and ground water discharge to bogs, marshes and weedy ponds), were not observed at Armstrong Woods.

Leitrim Wetland

The LRT alignment borders the wetland for approximately 50m to 60m. The vegetation that occurs on and adjacent to the right of way is Fresh-Moist Poplar Deciduous Forest (FOD8-1). No standing water was observed during the site visit conducted 2 May 2006. Based on this assessment, there is no breeding habitat for amphibians on or adjacent to the LRT alignment.

Reptiles

Seven species of reptiles in the Ottawa area have been designated as a Species at Risk in Ontario: Spiny Softshell (*Apalone spinifera*), Spotted Turtle (*Clemmys guttata*), Blanding's Turtle (*Emydoidea blandingii*), Wood Turtle (*Glyptemys insculpta*), Northern Map Turtle (*Graptemys geographica*), Milksnake (*Lampropeltis triangulum*), and Eastern Ribbonsnake (*Thamnophis sauritius*). One additional species has been designated as Not at Risk in Ontario: Common Watersnake (*Nerodia sipedon sipedon*).

Five species of reptiles in the Ottawa area have been designated as a federal Species at Risk: Spiny Softshell, Spotted Turtle, Northern Map Turtle, Milksnake and Eastern Ribbon Snake.

The recorded locations for four of the seven Species at Risk are remote from the LRT alignment: Wood Turtle (NW Ottawa), Northern Map Turtle (Ottawa River), Milksnake (NW and NE Ottawa), Eastern Ribbonsnake (west Ottawa). Three species have been recorded in the general vicinity of the LRT alignment: Spiny Softshell, Spotted Turtle and Blanding's Turtle.

Leitrim Wetland

At the Leitrim wetland, the LRT alignment borders the western limit of the Leitrim PSW for approximately 50m to 60m. The vegetation that occurs on and adjacent to the right of way is Fresh-Moist Poplar Deciduous Forest (FOD8-1). No standing water was observed during the site visit conducted 2 May 2006. Based on this assessment, there is no aquatic or wetland habitat for Spiny Softshell, Spotted Turtle, or Blanding's Turtle on or adjacent to the right of way.

The embankment of the rail bed may, however, provide marginal nesting habitat for Spotted Turtle and Blanding's Turtle. Accordingly, a late summer survey for turtle eggshells will be conducted along the portion of the LRT alignment that lies within 500 m of the wetland boundary. The survey area will include both forested and old field habitats.

Lester Wetland and Cahill Drain

The flooded thicket swamp that borders the LRT alignment northerly from Lester Road, and the impounded portion of the Cahill Drain that borders the LRT alignment south of Hunt Club Road, provide apparent habitat for Blanding's Turtle and Spotted Turtle. A field survey for basking turtles was conducted under ideal viewing conditions on 1 May 2006. Twelve Midland Painted Turtles were observed at the edge of the Lester wetland during the 5 hour survey. No species at risk were observed.

The embankment of the rail bed may, however, provide marginal nesting habitat for Spotted Turtle and Blanding's Turtle. Accordingly, a late summer survey for turtle eggshells will be conducted along the rail embankment and wetland edge to verify the presence/absence of nesting of Species at Risk.

4.1.5 Air Quality

This section provides and overview of the existing ambient air quality in the Study Corridor and surrounding areas.

The Ontario Ministry of the Environment (MOE) has developed Ambient Air Quality Criteria (AAQCs) for numerous contaminants, including those that are typically emitted from mobile sources and are known to have the potential to cause harmful effects on human health or cause degradation to the environment. AAQCs are established under Regulation 337 and represent desirable ambient contaminant levels.

An AAQC for oxides of nitrogen (NO_X) does not currently exist; however, criteria do exist for nitrogen dioxide (NO_2), which is the primary NO_X constituent of concern. An AAQC for total volatile organic compounds (VOCs), benzene, and 1,3-butadiene do not currently exist; however, 24-hour criteria do exist for formaldehyde and acetaldehyde. An AAQC for respirable particulate matter (fraction of PM having a diameter less than or equal to 2.5 microns ($PM_{2.5}$)) does not currently exist; however, a Canada Wide Standard (CWS) has been established for the year 2010 based on the 98th percentile ambient measurement annually, averaged over three consecutive years [2]. The Canadian Government has also established National Ambient Air Quality Objectives (NAAQOs) for numerous pollutants. Table 4.1.5.1-1 presents AAQCs, NAAQOs, and the CWS for contaminants relevant to transportation sources.

Table 4.1.5.1-1 Summary of Relevant Air Quality Guidelines [in: g/m^3]

Contaminant	1- Hour AAQC	24-Hour AAQC	1-Hour NAAQO	24-Hour NAAQO
CO (ppm)	36,200 (30)	15,700 (1)	35,000 (29)	N/A
NO_2 (ppb)	400 (200)	200 (100)	400 (200)	200 (100)
$PM_{2.5}$	N/A	30 (2)	N/A	N/A
PM_{10}	N/A	50 (3)	N/A	N/A
O_3	165	N/A	N/A	N/A
Formaldehyde	N/A	65	N/A	N/A
Acetaldehyde	N/A	500	N/A	N/A

Notes: N/A – Not applicable
AAQC – Ambient Air Quality Criterion
NAAQO – National Ambient Air Quality Objective – Acceptable Levels
(1) 8-Hour AAQC for CO
(2) Canada Wide Standard for $PM_{2.5}$ established for the year 2010 based on the 98th percentile ambient measurement annually, averaged over three consecutive years
(3) Interim AAQC

Air quality monitoring is often used to determine ambient pollutant levels, establish trends, and assess the effectiveness of mitigation strategies. The MOE and Environment Canada (EC) own and operate many ambient air quality monitoring stations across Ontario. There are two monitoring stations located in Ottawa. Both stations are part of the National Air Pollution Surveillance (NAPS) Network. NAPS Station No. 60104 is located at McDonald Gardens, near the intersection of Rideau Street and Wurtemburg Street (residential area) and is operated by the MOE (MOE Station No. 51001). NAPS Station No. 60101 is located at 88 Slater Street (commercial / industrial area) and is operated by EC. A five-year summary of measurements (1999-2003) from NAPS Station No. 60104 is presented in Table 4.1.5.2-1. A five-year summary of measurements (1999-2003) from NAPS Station No. 60101 is presented in Table 4.1.5.2-2. Refer to Figure 4.1.5.2-1 for the locations of the monitoring stations.

Table 4.1.5.2-1 Summary of Ambient Measurements from MOE Station No. 51001 (Rideau/Wurtemburg)

Pollutant	Statistic	1999	2000	2001	2002	2003
CO (ppm)	1-hr Max	3.0	3.2	2.9	2.8	2.2
	8-hr Max	2.8	1.9	1.8	1.9	1.5
	Annual Mean	0.9	0.7	0.7	0.7	0.6
	1-hr 90th Percentile [1]	1.0	1.0	1.0	1.0	0.8
	The Number of Times the Measured 1-hr Concentration Exceeds the 1-hr AAQC (36,200)	0	0	0	0	0
	The Number of Times the Measured 8-hr Concentration Exceeds the 8-hr AAQC (15,700)	0	0	0	0	0
NO_2 (ppb)	1-hr Max	93	66	72	55	83
	24-hr Max	53.9	38.3	36	39	60
	Annual Mean	12.2	13.8	14.3	INS	13.7
	1-hr 90th Percentile [1]	27	28	27	31	30
	The Number of Times the Measured 1-hr Concentration Exceeds the 1-hr AAQC (200)	0	0	0	0	0
	The Number of Times the Measured 1-hr Concentration Exceeds the 24-hr AAQC (100)	0	0	0	0	0
$PM_{2.5}$ TEOM (µgm^3)	1-hr Max	50	50	54	129	60
	24-hr Max	35	31	32	70	41
	Annual Mean	6.8	6.3	8.5	7.5	7.2
	24-hr 90th Percentile [1]	16	14	18	17	17
	The Number of Times the Measured 24–hr Concentration Exceeds the 24-hr CWS (30)	1	1	3	4	4
PM_{10} TEOM (µgm^3) [2]	1-hr Max	n/a	n/a	n/a	n/a	n/a
	24-hr Max	58	52	53	117	68
	Annual Mean	11	11	14	13	12
	24-hr 90th Percentile [1]	27	23	30	28	28
	The Number of Times the Measured 24-hr Concentration Exceeds the 24-hr AAQC (50) *	n/a	n/a	n/a	n/a	n/a
O_3 (ppb)	1-hr Max	90	69	92	90	104
	24-hr Max	55	42.4	71	61	65
	Annual Mean	21.2	19.9	25	24.9	24.7

Table 4.1.5.2-1 Summary of Ambient Measurements from MOE Station No. 51001 (Rideau/Wurtemburg)

Pollutant	Statistic	1999	2000	2001	2002	2003
	1-hr 90th Percentile [1]	38	35	45	43	44
	The Number of Times the Measured 1-hr Concentration Exceeds the 1-hr AAQC (80)	7	0	26	7	15

Notes: [1] The 90th percentile background concentration is chosen because it provides a reasonable worst-case level that does not include extreme emission events such as fires, nearby idling vehicles, or monitoring station irregularities.
[2] Years 1999 through 2003 PM_{10} data was unavailable for MOE Station No. 51001, therefore the MOE equation of $PM_{10} = PM_{2.5}/0.6$ was used to predict Years 1999 through 2003 PM_{10} data
n/a – Not available
TEOM – Tapered Element Oscillating Microbalance (Continuous Monitor)
AAQC – Ambient Air Quality Criterion
CWS – Canada Wide Standard
INS - Insufficient data to compute relevant statistics
* Interim AAQC

Table 4.1.5.2-2 Summary of Ambient Measurements from NAPS Station No. 60101 (88 Slater Street)

Pollutant	Statistic	1999	2000	2001	2002	2003
CO (ppm)	1-hr Max	6.0	4.0	3.0	n/a	n/a
	Median	1.0	1.0	1.0	n/a	n/a
	1-hr 90th Percentile	1.0	2.0	1.0	n/a	n/a
	The Number of Times the Measured 1-hr Concentration Exceeds the 1-hr AAQC (30)	0	0	0	n/a	n/a
NO_2 (ppb)	1-hr Max	141	76	144	n/a	n/a
	Median	30	20	25	n/a	n/a
	1-hr 90th Percentile	59	36	49	n/a	n/a
	The Number of Times the Measured 1-hr Concentration Exceeds the 1-hr AAQC (200)	0	0	0	n/a	n/a
Formaldehyde (:g/m^3)	24-hr Max	6.9	4.6	6.2	n/a	n/a
	Annual Mean	3.0	2.6	3.3	n/a	n/a
	1-hr 90th Percentile	4.4	3.8	5.0	n/a	n/a
	The Number of Times the Measured 1-hr Concentration Exceeds the 1-hr AAQC (65)	0	0	0	n/a	n/a
Acetaldehyde (:g/m^3)	24-hr Max	4.1	4.0	4.0	n/a	n/a
	Annual Mean	1.8	1.6	1.7	n/a	n/a
	1-hr 90th Percentile	2.7	2.3	2.8	n/a	n/a
	The Number of Times the Measured 1-hr Concentration Exceeds the 1-hr AAQC (500)	0	0	0	n/a	n/a
Benzene (:g/m^3)	24-hr Max	4.2	4.6	4.5	3.2	n/a
	Annual Mean	2.0	1.6	1.5	1.3	n/a

Table 4.1.5.2-2 Summary of Ambient Measurements from NAPS Station No. 60101 (88 Slater Street)						
Pollutant	**Statistic**	**1999**	**2000**	**2001**	**2002**	**2003**
	1-hr 90th Percentile	3.2	2.6	2.6	2.2	n/a
	The Number of Times the Measured 1-hr Concentration Exceeds the 1-hr AAQC	N/A	N/A	N/A	N/A	N/A
1,3-Butadiene (:g/m^3)	24-hr Max	0.8	0.8	0.8	0.6	n/a
	Annual Mean	0.4	0.3	0.3	n/a	n/a
	1-hr 90th Percentile	0.6	0.5	0.6	0.4	n/a
	The Number of Times the Measured 1-hr Concentration Exceeds the 1-hr AAQC	N/A	N/A	N/A	N/A	N/A

Notes: The 90th percentile background concentration is chosen because it provides a reasonable worst-case level that does not include extreme emission events such as fires, nearby idling vehicles, or monitoring station irregularities.
Data is presented as reported in government documents
AAQC – Ambient Air Quality Criterion
N/A – Not applicable
n/a – Not available

Figure 4.1.5.2-1 Location of Air Quality Monitoring Stations

The review of historical ambient air quality measurements indicates that levels of CO, NO_2, formaldehyde, and acetaldehyde are well below their respective ambient air quality guidelines at both monitoring sites in Ottawa. There are no established guidelines for 1,3-butadiene and benzene. The air quality levels measured at these two stations are common to many cities in Southern Ontario, where there are infrequent measured levels in excess of the guidelines for PM_{10}, $PM_{2.5}$ and ground level ozone only. Particulate matter and ozone levels are associated with long range transport and complex chemical interactions in the atmosphere. While fine particulate matter is emitted from vehicles in addition to being formed in the atmosphere, ozone is not directly discharged as a vehicular emission.

4.2 Description of Socio-Economic Environment

4.2.1 Existing Landuse

The purpose of this section is to document the existing land use conditions in the Study Corridor. Various policy documents and background material have been reviewed and considered for this report. The Study Corridor for the proposed North-South LRT extension is approximately 31 km long. It traverses through heavily urbanized areas and rural areas of the City of Ottawa and includes the existing O-Train line. The existing O-Train route follows the former Canadian Pacific Railway (now owned by the City of Ottawa) line and is approximately 8 km long with five stations at key land use developments. Bayview is the existing station furthest to the north and Greenboro is the existing station furthest to the south at South Keys Shopping Centre. Although the O-Train route does not extend south of Greenboro, the rail line continues southerly for another 5.4 km to approximately 200 m north of Leitrim. At this point the Study Corridor swings west to Riverside South and crosses the Rideau Canal to Barrhaven. The Study Corridor is divided into five sections, which are described below and illustrated in Figure 4.2.1-1.

- Section 1: King Edward Avenue to Somerset Street West
- Section 2: Somerset Street West to Riverside
- Section 3: Riverside to South Keys
- Section 4: South Keys to Limebank (Airport Lands and Greenbelt)
- Section 5: Limebank (Airport Lands and Greenbelt) to Greenbank.

The existing O-Train line and the proposed transit extension lies within many jurisdictions and land use designations. This section will summarize the applicable federal, provincial, and municipal policies, various plans, and other policy documents that provide guidance and direction in the planning and development of lands within the Study Corridor. Additional information on the Rideau Canal are included in Section 4.2.4 of this report.

Corridor Section 1: King Edward Avenue to Somerset Street West

The boundary for Corridor Section 1 is from King Edward Avenue to Somerset Street West. The residential communities found in this Section are: Lowertown, Centretown, Hintonburg, and Chinatown as illustrated in Figure 4.2.1-2.

The predominant areas and/or land uses include: the ByWard Market, the Rideau Centre, the Rideau Canal, the Congress Centre, the National Arts Centre, the Provincial Court House, City Hall, Department of National Defence, the University of Ottawa, the Chateau Laurier, the Parliamentary Precinct, the Core Area, the Garden of the Provinces, the former City Centre building, LeBreton Flats, and Bayview Facilities. The existing OC Transpo Transitway serves these areas. The Bayview O-Train station is also located in this Corridor Section.

Recent developments in this area include several high-rise condominiums, including one adjacent to Chateau Laurier. The construction for the new Canadian War Museum has just been completed in LeBreton Flats.

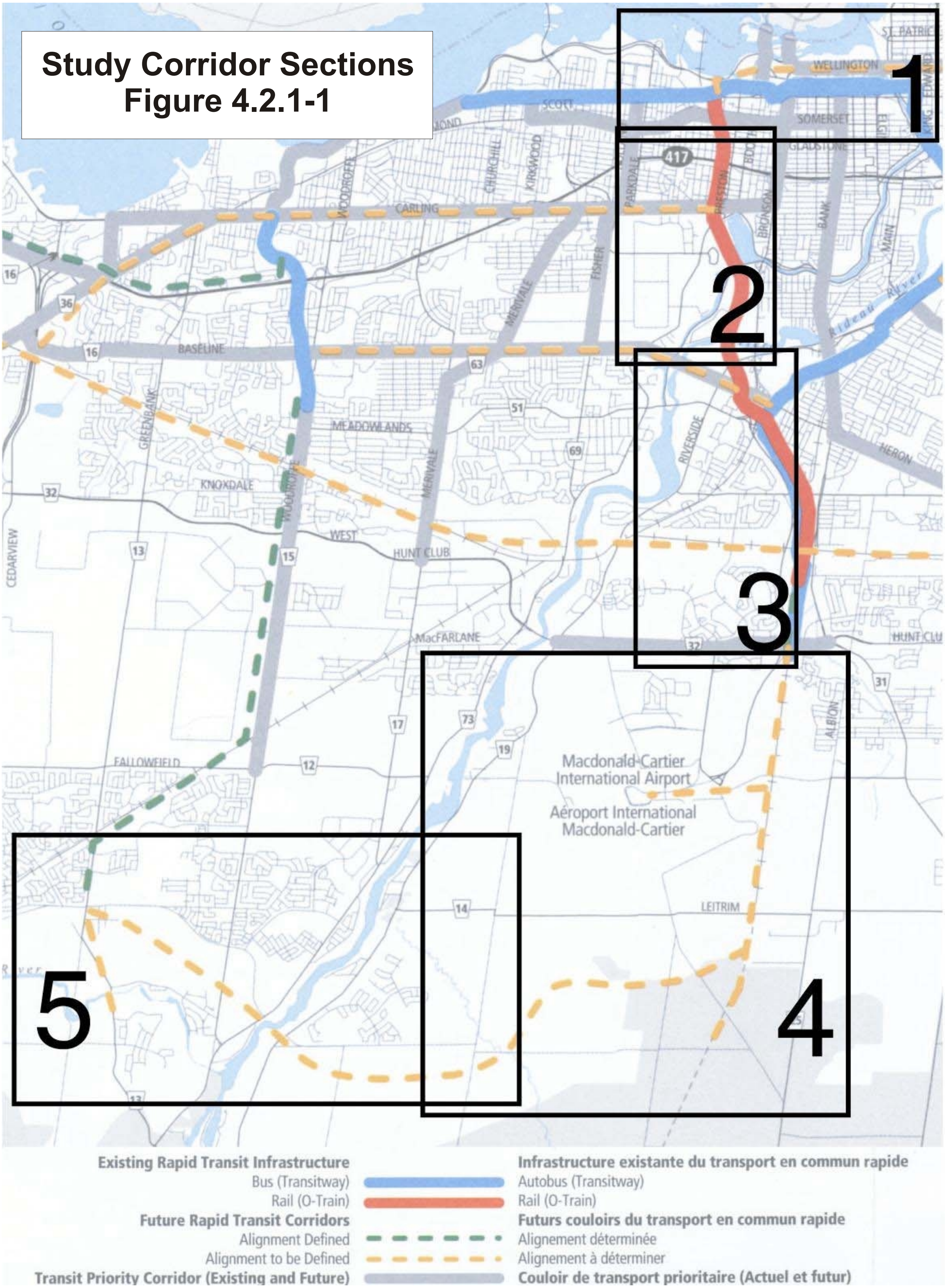
The Downtown Ottawa Urban Design Strategy 2020 (DOUDS) report, prepared in 2004, is a strategic document that was prepared to aid the City of Ottawa, Consultants, and the public in achieving a vibrant urban Core. This document identifies the various neighbourhoods within the urban core and establishes planning guidelines and strategies to achieve the overall vision of each community. The DOUDS Core Area Concept Plan is provide as Figure 4.2.1-9.

The National Capital Greenbelt Concept Plan is provided as Figure 4.2.1-7.

Corridor Section 2: Somerset Street West to Riverside

The boundary for Corridor Section 2 is from Somerset Street West to Riverside Drive as illustrated in Figure 4.2.1-3. Little Italy is the predominant community in the area. Although there is low-medium residential density, the predominant land use is Carleton University. This section includes the Rideau Canal (Dows Lake) and the Rideau River. The existing O-Train runs through a tunnel under Dows Lake. There are also large recreational areas including pathways linking to the Experimental Farm. Highway 417 (the Queensway) traverses through the Corridor Section in an east-west direction. The headquarters for Natural Resources Canada is also located in this Section. Recent developments in the area include new institutional buildings at Carleton University and some infill development in the residential area. There is also a mixed-use development south of Hwy 417 and east of Preston St, which consists of a new apartment building, and plans for a new office tower and other residential development.

Study Corridor Sections
Figure 4.2.1-1



City of Ottawa Official Plan Schedule D - Primary Transit Network

Corridor Section 3: Riverside to South Keys

The boundary of Corridor Section 3 is from Riverside Drive to South Keys, specifically south of Hunt Club Road as illustrated in Figure 4.2.1-4. Riverside Park is the community located to the west of the O-Train and there is also residential to the east of the O-Train near Walkley Road. The predominant land use is Confederation Heights, which is a federal government complex containing offices for Canada Post and Public Works and Government Services Canada. It also serves the large retail area known as South Keys. The Airport Parkway runs in a north-south direction and is almost parallel to the former CPR track. In addition, the National Capital Commission recreational pathways traverse the track. The Transitway runs parallel to the O-Train to the east of the track. A recent development in the area is the Home Depot, which is located to the north of South Keys, as well as infill residential development.

Corridor Section 4: South Keys to Limebank (Airport Lands and Greenbelt)

The boundary for Corridor Section 4 is from South Keys to Limebank as illustrated in Figure 4.2.1-5. The National Capital Greenbelt is found in this corridor section. A separate master plan exists for this Greenbelt which describes the various policies associated with development in this area. Figure 4.2.1-8 shows the various land designations from the 1996 Greenbelt Master Plan. This Corridor Section also includes the Uplands community, as well as the Leitrim community, which is located in the southeast portion of the Corridor Section. Within the Greenbelt, the predominant land use is the Macdonald-Cartier International Airport. The Macdonald-Cartier International Airport has expanded its services through its new terminal building, which opened in 2003. The National Research Council (NRC) wind tunnel and other offices are also located in this Corridor Section. There is a switchback on the former CPR track, which accesses the rear of the NRC lands.

Corridor Section 5: Limebank (Airport Lands and Greenbelt) to Greenbank

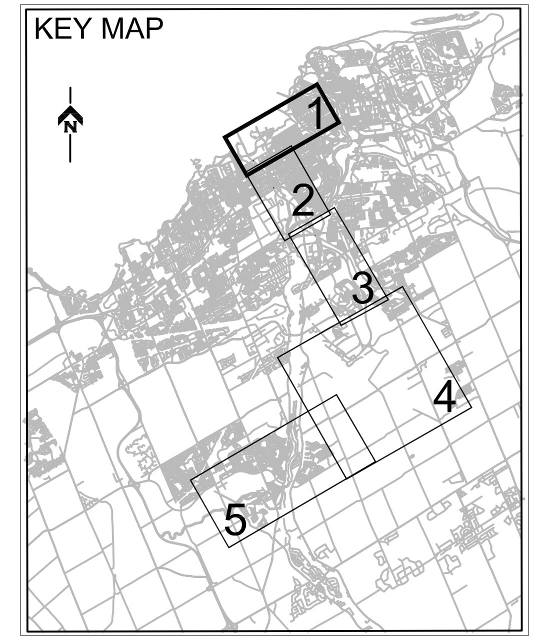
The boundary of Corridor Section 5 extends from Limebank to Greenbank as illustrated in Figure 4.2.1-6. There are several communities in this area including the emerging Riverside South and Barrhaven. Although there are existing and expanding residential areas, there is a large amount of rural lands in this Corridor Section within the urban boundary. The predominant land use features are the Jock River, Chapman Mills Conservation Area, located west of the Rideau Canal, and the Barrhaven Town Centre development, which is a large retail area in Barrhaven. Recent developments include residential and institutional developments in the Riverside South community, retail development west of Woodroffe, south of Strandherd Drive, as well as residential development in the emerging Chapman Mills area.

Existing Land Use Conditions -

North-South Corridor LRT Project Environmental Assessment

Figure 4.2.1-2: Existing Land Use - Corridor Section 1:

King Edward Avenue to Somerset Street West



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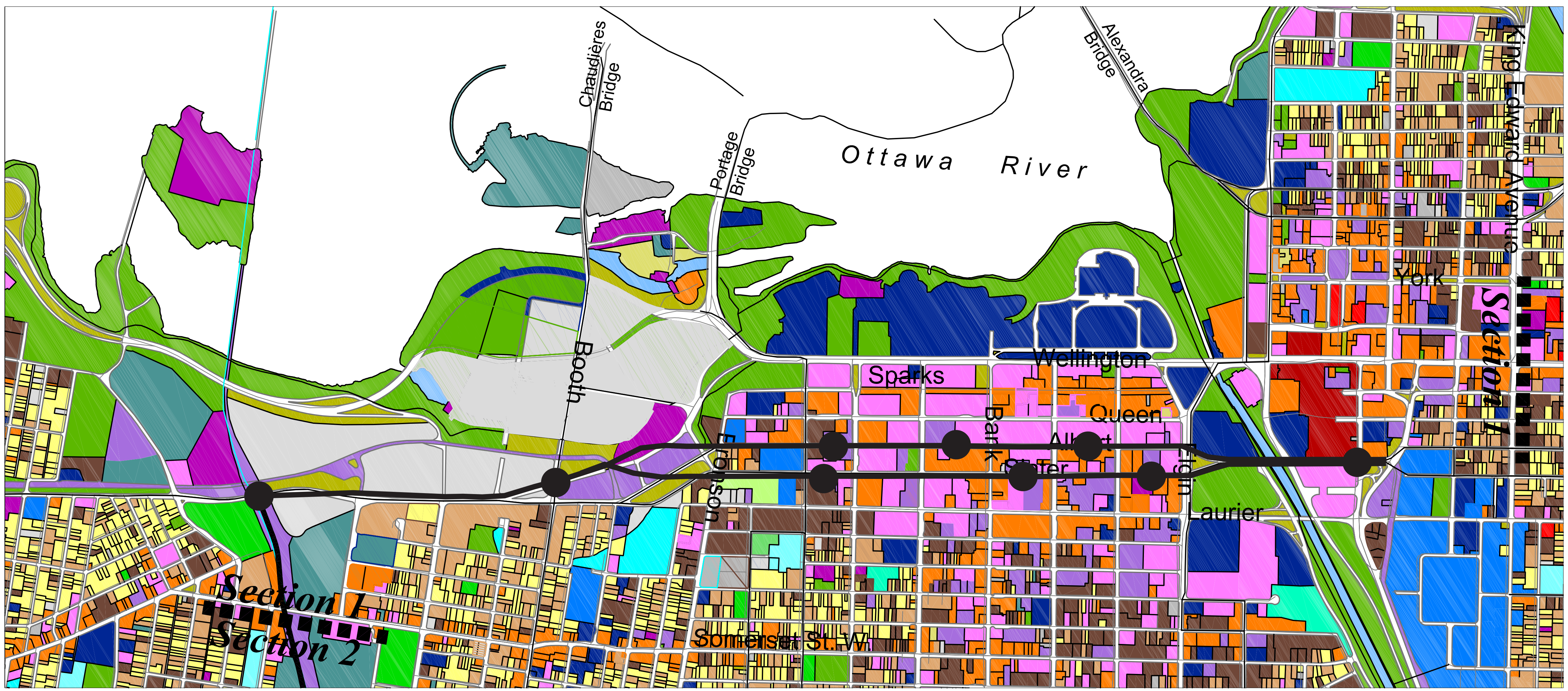
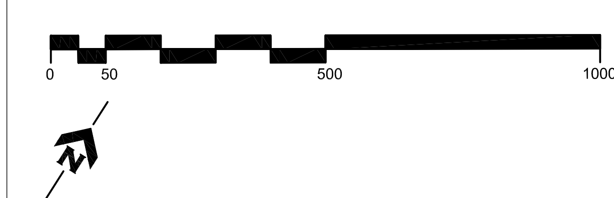
Proposed LRT Alignment

Modifications by MRC May 3, 2006



SECTION 1

- Residential: Low Density
- Residential: Medium Density
- Residential: High Density
- Mobile Home Park
- Commercial: Regional Shopping Centre
- Commercial: Community Shopping Centre
- Other Commercial
- Institutional: Elementary School
- Institutional: High School
- Institutional: University/College/Vocational
- Institutional: Hospital/Rehabilitation/Nursing Home
- Other Institutional
- Industrial
- Industrial Mall
- Transportation
- Utilities
- Communications
- Office
- Recreation: Active
- Recreation: Passive
- Recreation Active: (on School Property)
- Recreation Passive: (on School Property)
- Agriculture
- Open Space
- Vacant Buildings
- Vacant Land
- Under Construction
- Street



Base mapping provided by the City of Ottawa

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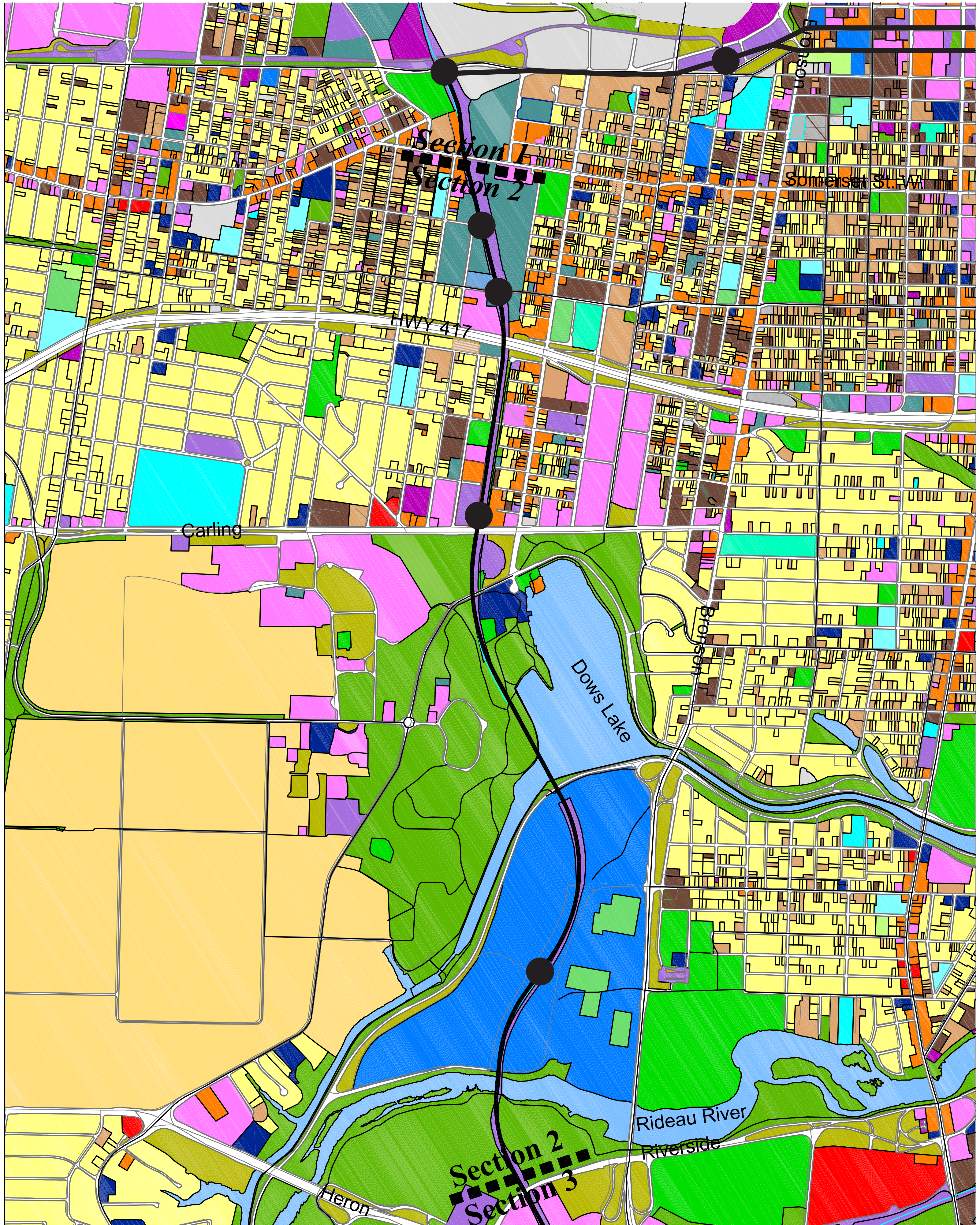

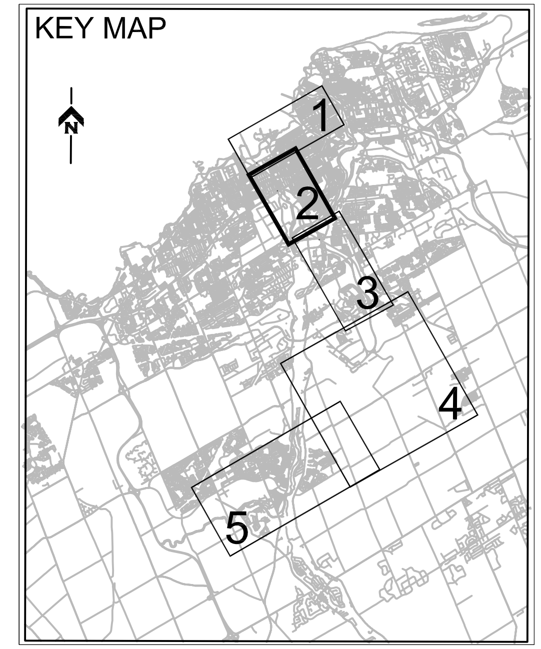

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Proposed LRT Alignment

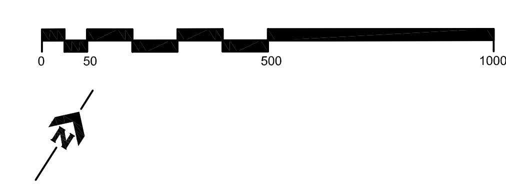
Modifications by MRC May 3, 2006

Existing Land Use Conditions -

North-South Corridor LRT Project Environmental Assessment

Figure 4.2.1-3: Existing Land Use - Corridor Section 2: Somerset Street West to Riverside

- Residential: Low Density
- Residential: Medium Density
- Residential: High Density
- Mobile Home Park
- Commercial: Regional Shopping Centre
- Commercial: Community Shopping Centre
- Other Commercial
- Institutional: Elementary School
- Institutional: High School
- Institutional: University/College/Vocational
- Institutional: Hospital/Rehabilitation/Nursing Home
- Other Institutional
- Industrial
- Industrial Mall
- Transportation
- Utilities
- Communications
- Office
- Recreation: Active
- Recreation: Passive
- Recreation Active: (on School Property)
- Recreation Passive: (on School Property)
- Agriculture
- Open Space
- Vacant Buildings
- Vacant Land
- Under Construction
- Street



SECTION 2

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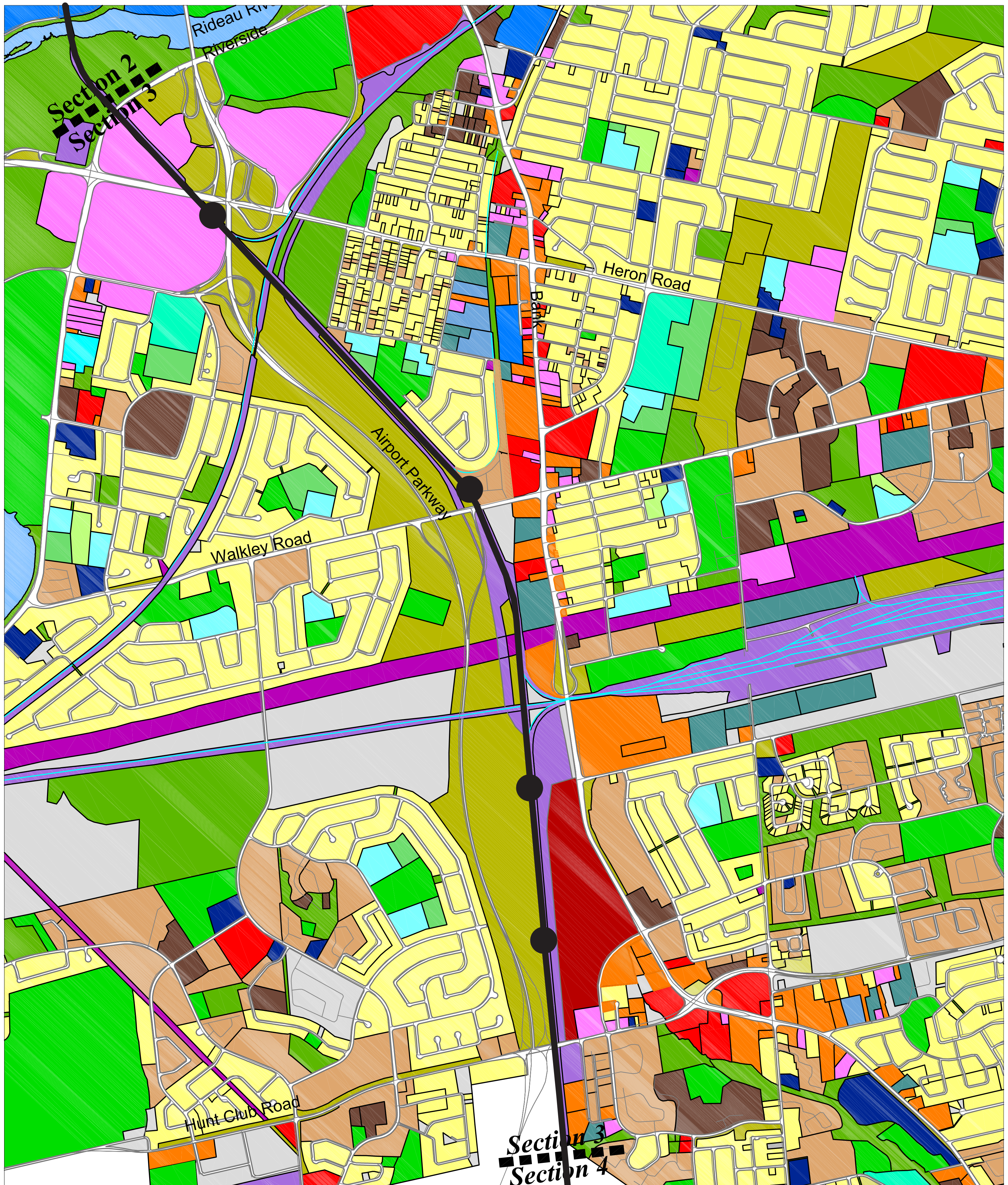

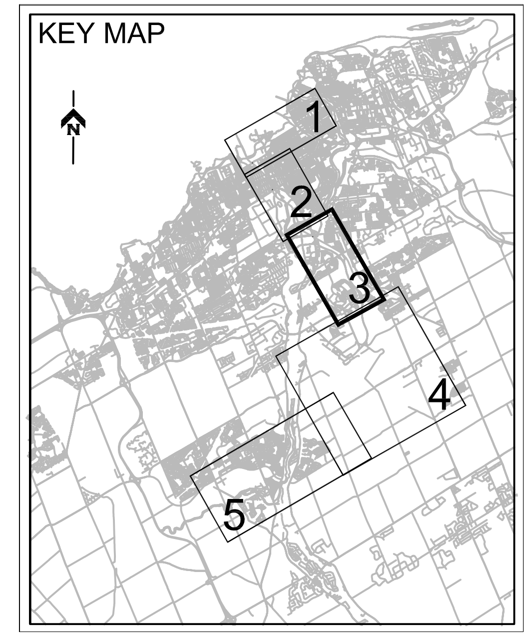

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Proposed LRT Alignment

Modifications by MRC May 3, 2006

SECTION 3

Existing Land Use Conditions -

North-South Corridor LRT Project Environmental Assessment

Figure 4.2.1-4: Existing Land Use - Corridor Section 3: Riverside to South Keys

- Residential: Low Density
- Residential: Medium Density
- Residential: High Density
- Mobile Home Park
- Commercial: Regional Shopping Centre
- Commercial: Community Shopping Centre
- Other Commercial
- Institutional: Elementary School
- Institutional: High School
- Institutional: University/College/Vocational
- Institutional: Hospital/Rehabilitation/Nursing Home
- Other Institutional
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- Industrial Mall
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- Recreation: Active
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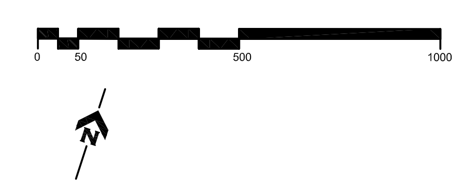
- Street



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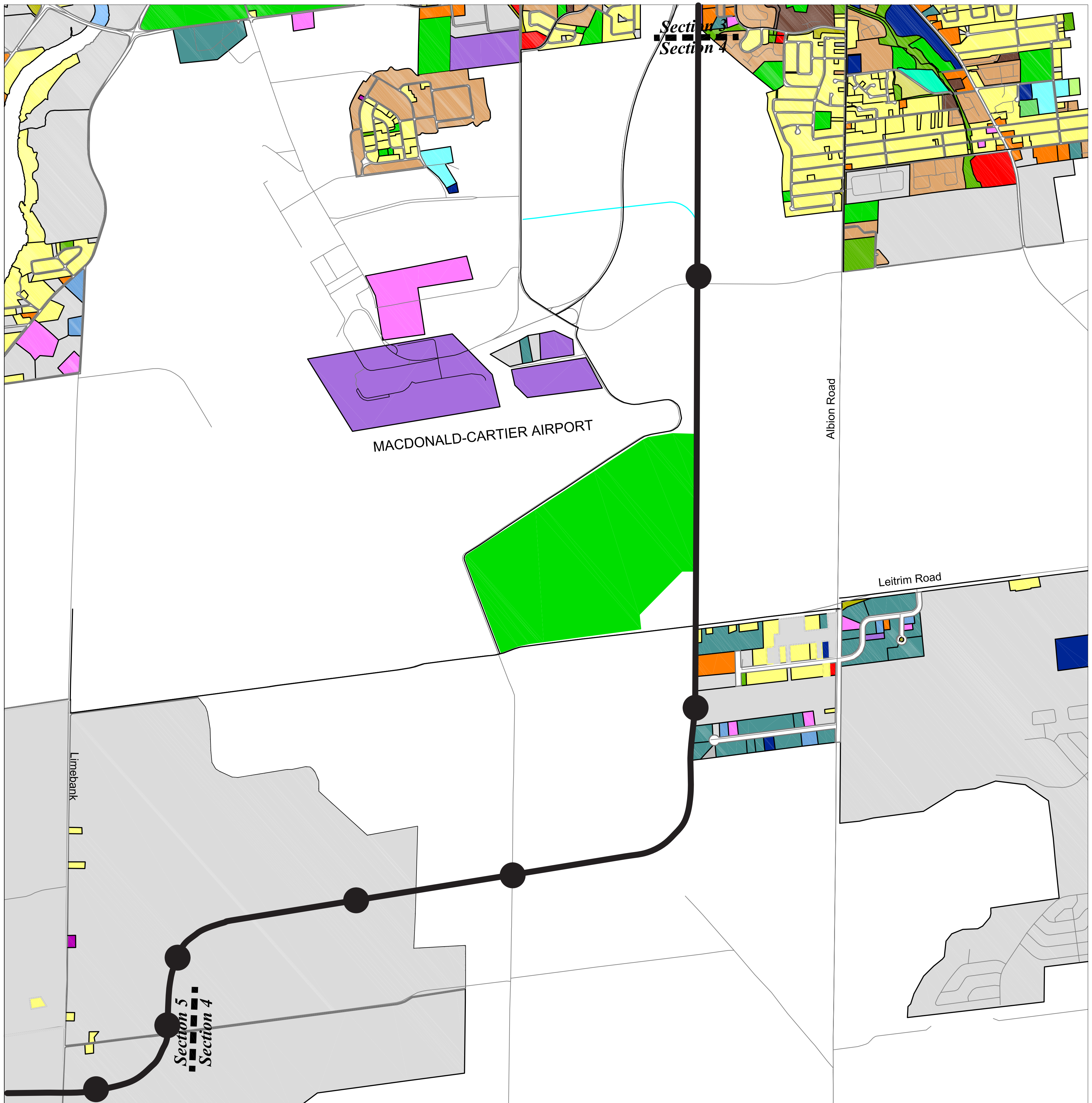

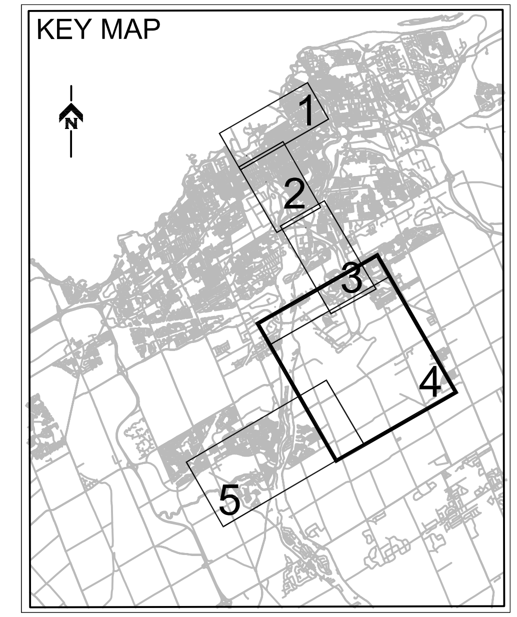

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Proposed LRT Alignment

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Existing Land Use Conditions -

North-South Corridor LRT Project Environmental Assessment

Figure 4.2.1-5: Existing Land Use - Corridor Section 4: South Keys to Limebank (Airport Lands & Greenbelt)

- Residential: Low Density
- Residential: Medium Density
- Residential: High Density
- Mobile Home Park
- Commercial: Regional Shopping Centre
- Commercial: Community Shopping Centre
- Other Commercial
- Institutional: Elementary School
- Institutional: High School
- Institutional: University/College/Vocational
- Institutional: Hospital/Rehabilitation/Nursing Home
- Other Institutional
- Industrial
- Industrial Mall
- Transportation
- Utilities
- Communications
- Office
- Recreation: Active
- Recreation: Passive
- Recreation Active: (on School Property)
- Recreation Passive: (on School Property)
- Agriculture
- Open Space
- Vacant Buildings
- Vacant Land
- Under Construction
- Street

Base mapping provided by the City of Ottawa

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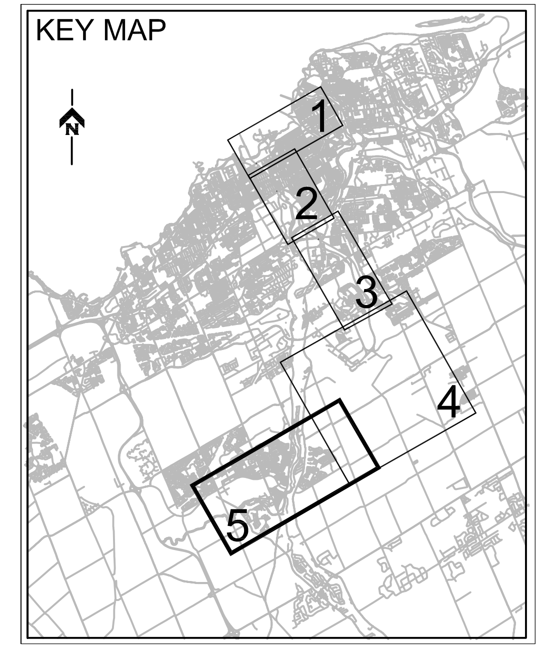
SECTION 4

Existing Land Use Conditions -

North-South Corridor LRT Project Environmental Assessment

Figure 4.2.1-6: Existing Land Use - Corridor Section 5: Limebank (Airport Lands & Greenbelt) to Greenbank



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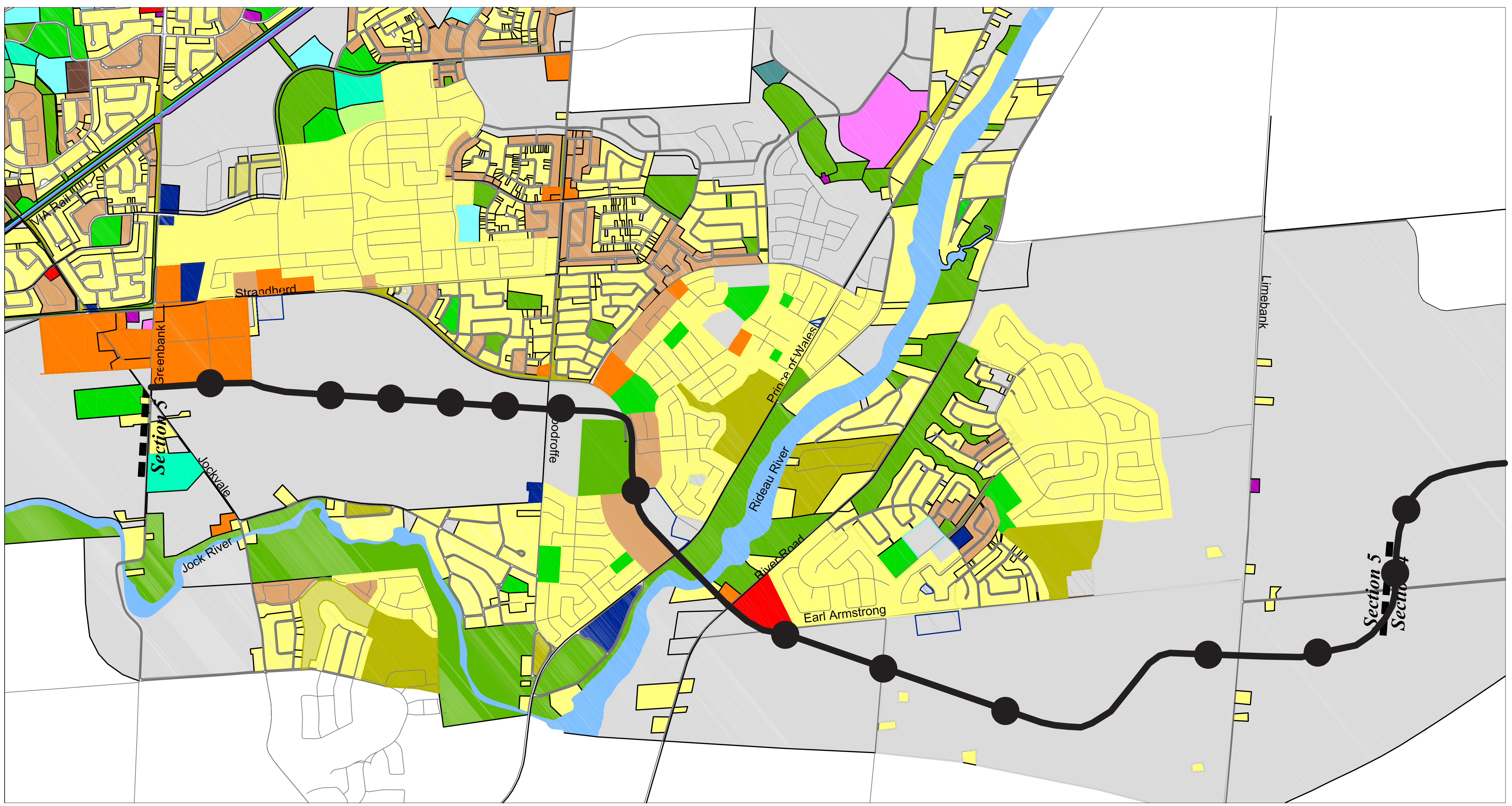
Proposed LRT Alignment

Modifications by MRC May 3, 2006

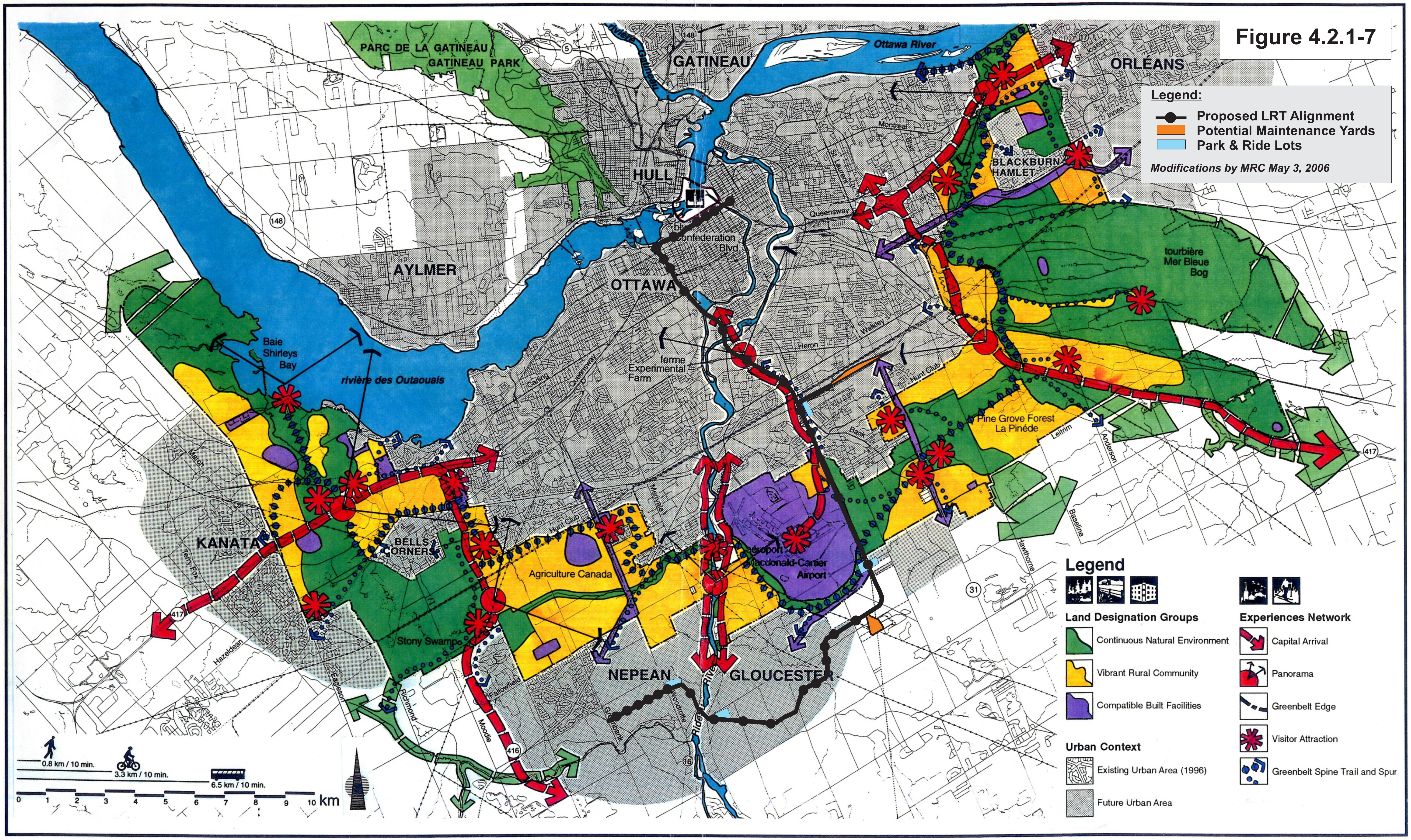


SECTION 5

- Residential: Low Density
- Residential: Medium Density
- Residential: High Density
- Mobile Home Park
- Commercial: Regional Shopping Centre
- Commercial: Community Shopping Centre
- Other Commercial
- Institutional: Elementary School
- Institutional: High School
- Institutional: University/College/Vocational
- Institutional: Hospital/Rehabilitation/Nursing Home
- Other Institutional
- Industrial
- Industrial Mall
- Transportation
- Utilities
- Communications
- Office
- Recreation: Active
- Recreation: Passive
- Recreation Active: (on School Property)
- Recreation Passive: (on School Property)
- Agriculture
- Open Space
- Vacant Buildings
- Vacant Land
- Under Construction
- Street

Base mapping provided by the City of Ottawa

MAY 2005



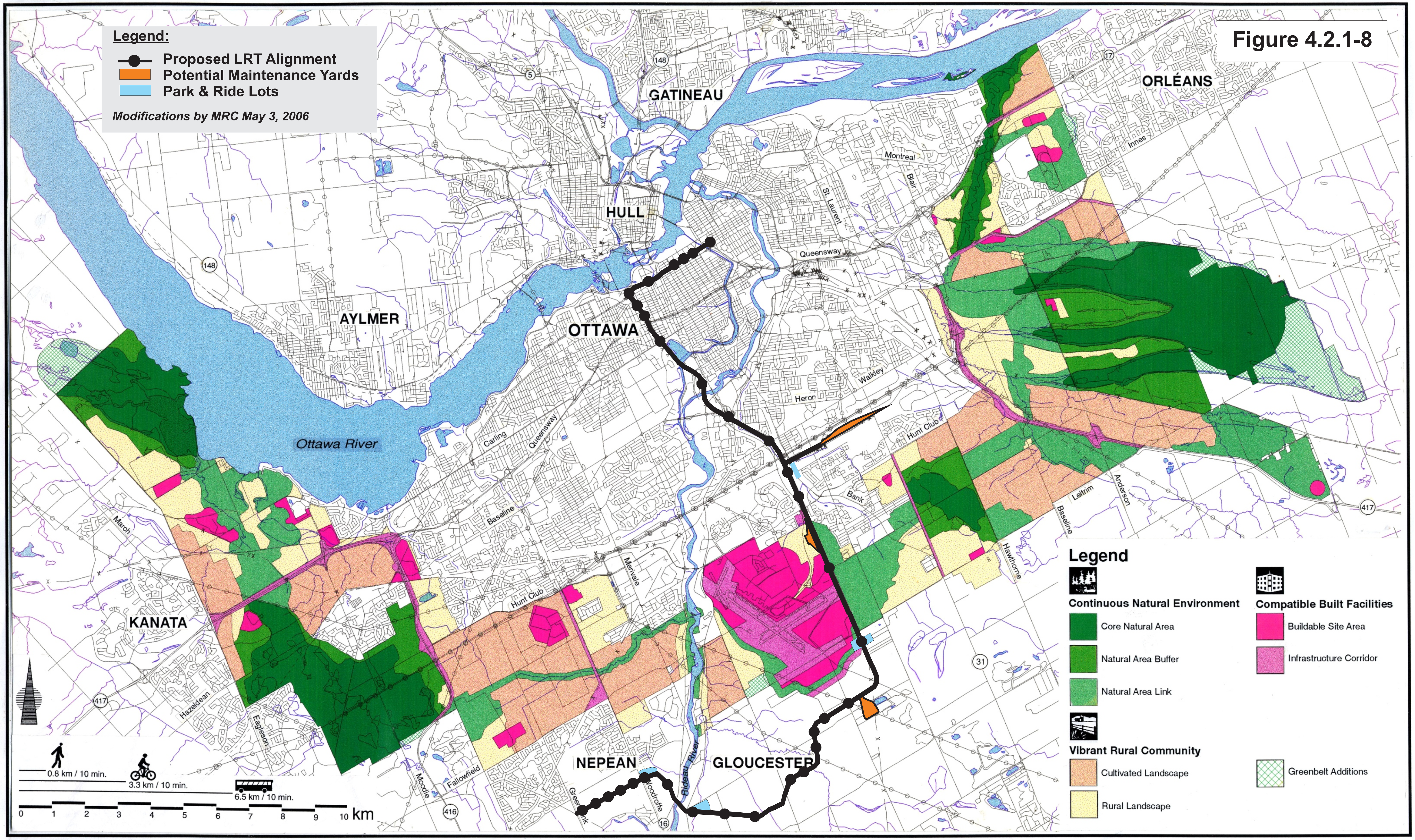
National Capital Commission / Commission de la Capitale nationale

Canada

1996

The National Capital Greenbelt

Concept Plan



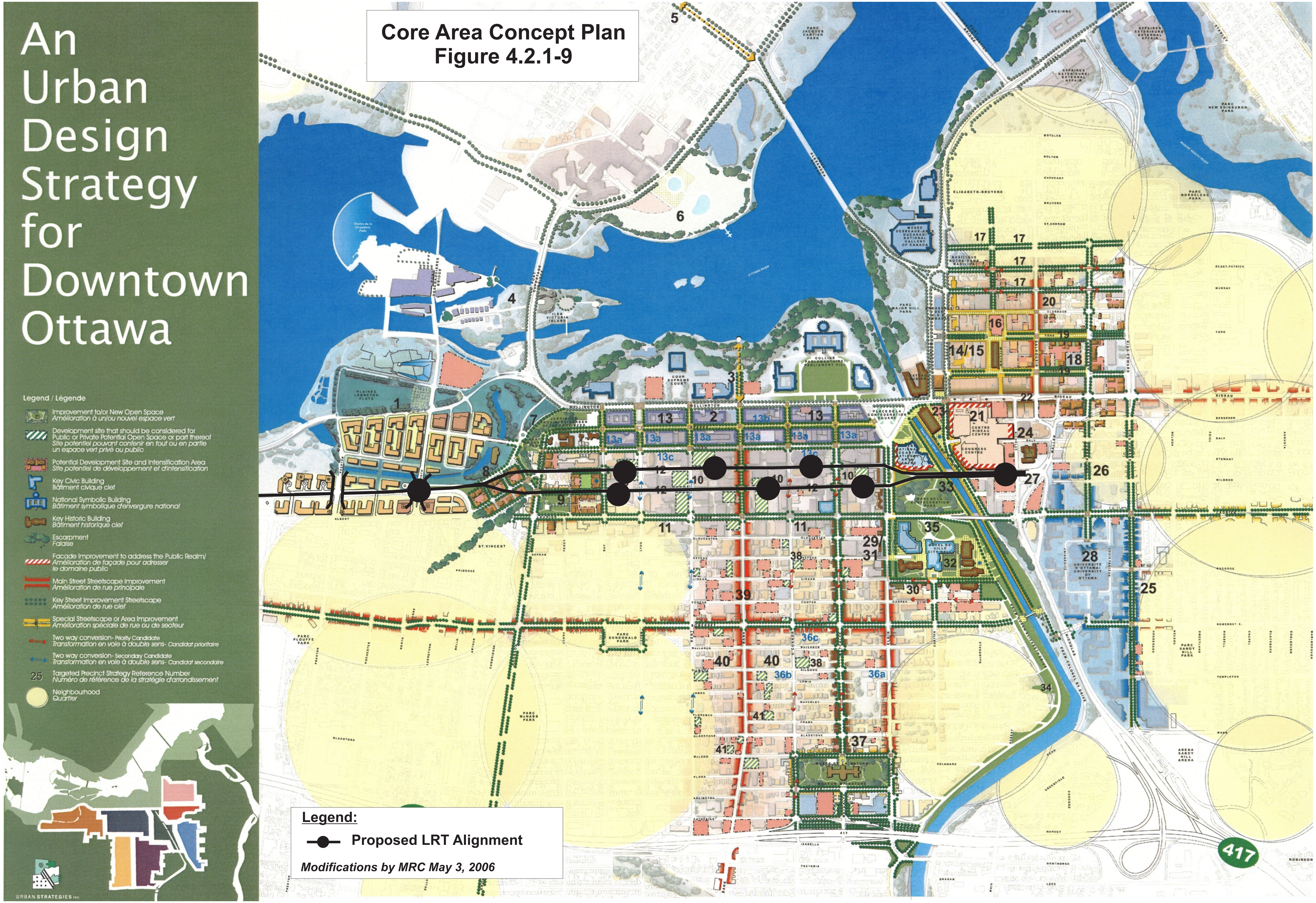
National Capital Commission | Commission de la Capitale nationale

Canada

1996

The National Capital Greenbelt

Land Designations



Core Area Concept Plan
Figure 4.2.1-9
An Urban Design Strategy for Downtown Ottawa
Legend / Légende
Improvement to/or New Open Space
Amélioration à un/ou nouvel espace vert
Development site that should be considered for Public or Private Potential Open Space or part thereof
Site potentiel pouvant contenir en tout ou en partie un espace vert privé ou public
Potential Development Site and Intensification Area
Site potentiel de développement et d'intensification
Key Civic Building
Bâtiment civique clef
National Symbolic Building
Bâtiment symbolique d'envergure national
Key Historic Building
Bâtiment historique clef
Escarpment
Falaise
Facade Improvement to address the Public Realm/
Amélioration de façade pour adresser le domaine public
Main Street Streetscape Improvement
Amélioration de rue principale
Key Street Improvement Streetscape
Amélioration de rue clef
Special Streetscape or Area Improvement
Amélioration spéciale de rue ou de secteur
Two way conversion- Priority Candidate
Transformation en voie à double sens- Candidat prioritaire
Two way conversion- Secondary Candidate
Transformation en voie à double sens- Candidat secondaire
25 Targeted Precinct Strategy Reference Number
Numéro de référence de la stratégie d'arrondissement
Neighbourhood
Quartier
URBAN STRATEGIES INC.
Legend:
Proposed LRT Alignment
Modifications by MRC May 3, 2006
417

4.2.2 Future Landuse

There are four recently completed Community Design Plans for the areas within the Study Corridor that are to experience significant growth: Bayview/Somerset, Leitrim, Riverside South, and South Nepean Town Centre. Many of these areas are designated in the new City of Ottawa Official Plan as Developing Community. These developments are being planned with public transit in mind, if not as a focal point. The Official Plan promotes the intensification of the inner city. The redevelopment of the LeBreton Flats and the Bayview/Somerset area reflects this effort. It is also in the City of Ottawa's best interest to develop suburban communities that have a strong presence of rapid transit in order to create commercial centres and to discourage urban sprawl. The Leitrim, Riverside South and South Nepean communities are being planned with these principles.

The LeBreton Redevelopment Plan

LeBreton Flats is a 65 ha. (160 acres) site approximately one and half kilometres west of Parliament Hill. It is intended to be a dense, compact, mixed use community anchoring the western edge of downtown Ottawa. The NCC's master plan envisages a vibrant, multifaceted, public transit oriented, urban neighbourhood, which also benefits from its proximity to the Ottawa River landscape and from the connections to its recreational pathways, the existing Transitway and the future light rail transit line.

The master plan for LeBreton Flats includes 24 ha (60 acres) of park and festival space, 6 ha (14 acres) of federal cultural institutional use, and 22 ha (54 acres) of high density mixed residential, office and retail development. Municipal zoning of the development will permit 4,000 to 4,500 residential units, between 80,000 and 90,000 square metres of office space and 20,000 square metres of retail space. The site already includes the new Canadian War Museum and most of the planned park and festival space. The first phase of private sector residential development, consisting of approximately 850 residential units, is underway with expected occupancy beginning as early as 2007.

The City of Ottawa will grade separate Booth and Preston Streets above the Transitway which would be placed, along with light rail, in a semirecessed trench. Through the course of the EA, the NCC proposed a change to the alignment of the Light Rail Transit/Transitway in order to accommodate larger development parcels along Wellington Street and to provide opportunities for a high-quality recreational pathway environment along the south side of the open Aqueduct. The Light Rail Transit/Transitway Corridor is now proposed to be located immediately south of the existing Transitway alignment as a result. The advantage for LeBreton Flats is that most development is located within 400 m of the main bus/rail station at Booth Street.

The concept plan illustrated in Figure 4.2.2-1 for this new community fully integrates pedestrian and recreational pathways with roads and transit and knits the existing pathway network with the new community linking amenities and the community together with parkland.

Guidelines for development contain prescriptive requirements for the construction of the public realm elements, the requirement for active and directly accessible ground floors to enliven and strengthen the streetscape and the creation of a 'street wall' built form with internal private and semi-private courtyards. Descriptive elements make up the balance of the design and development guidelines, addressing such issues as building materials, landscaping and architectural expression.

Figure 4.2.2-1 LeBreton Flats Redevelopment

Bayview/Somerset Area Secondary Study

The Study Corridor includes the lands north and east of Hintonburg, Mechanicsville from Somerset Street West to the Ottawa River and east over to Preston Street. The study has many constraints in terms of transportation, former landfill sites, and major servicing infrastructure traversing the site. Mixed-use centre type uses with medium to high density residential and potential for a major public use (new main Library, museum) are being considered as illustrated in the concept plan in Figure 4.2.2-2.

The recommended development concept aims to promote transit-oriented, higher density mixed use development, while maximizing the development potential and minimizing the impacts on the existing communities, and to better integrate heritage assets into future development. The recommended Light Rail Transit alignment through the Bayview area is centred on the development of a multi-modal transit station, integrating the surrounding land uses with a key interconnection of the bus and rail rapid transit networks. The Official Plan in concert with previous planning work, has identified lands surrounding the Bayview area as a mixed-use centre intended to facilitate a more intense development pattern than presently exists, oriented to the rapid transit network. The implementation of Bayview Station is crucial to its success.

On January 12, 2005, City of Ottawa Council approved the Bayview/Somerset Area Secondary Planning Study as a concept to guide the development of a Community Design Plan and subsequent Official Plan and zoning amendments. Council directed staff to undertake a “Proof of Concept” environmental scan of the Bayview/Somerset area. Other directions from Council included the following:

- “a scoping exercise of lands surrounding the Bayview/Somerset area, including a review of planning studies previously undertaken or underway, to demonstrate contextual fit and connection amongst the areas and identify any deficiencies, and to determine the need, resources and timing for more detailed planning analysis”;
- “the manner in which the design of the area will be built into the development process, including design guidelines for integration into the surrounding community, and consideration of a design competition”; and
- “that the Community Design Plan and Plan of Subdivision ensure that housing is provided that is affordable to a range of incomes and household sizes. That affordable housing be integrated throughout the development and the timing of the construction mirror the rest of the development”

Figure 4.2.2-2 Bayview/ Somerset Development

Bayview/Somerset Area Secondary Planning Study
– Recommended Development Concept
Étude de planification secondaire du secteur Bayview/Somerset
– Concept Recommandé De Développement

Leitrim Approved Community Design Plan.

The Leitrim Community is located approximately 2 km southeast of the Macdonald-Cartier International Airport. The Community Design Plan encompasses an area of approximately 500 hectares. The study area consists of a mix of uses including residential, institutional, industrial, and recreational. The central portion of the study area is primarily vacant or used for farming. The proposed LRT would run along the western edge of the study area, beyond Albion Road.

The concept plan prepared in March 2005 is illustrated in Figure 4.2.2-3. A community of 5,300 residents is being planned for this area consisting of low-medium density residential, mixed-use, institutional, and employment uses. The Macdonald-Cartier International Airport is located near this community and therefore development plans are constrained by the Airport vicinity development zone and the Ottawa airport operating influence zone (OAOIZ). These zones are in place to insulate the airport from incompatible, noise-sensitive land uses. A rail transit station and a Park-and-Ride lot are proposed where the future LRT corridor intersects with Leitrim Road. The Community Design Plan has been approved by City Council.

Riverside South Approved Community Design Plan

The Riverside South Community encompasses approximately a 1,800 hectare area with a proposed population of 51,500 and a proposed employment figure of 14,690, located south of the Macdonald-Cartier International Airport. The draft concept plan, prepared in March 2005, illustrates the alignment of the proposed LRT as illustrated in Figure 4.2.2-4. Development sites adjacent to the rapid transit corridor would be designed to mitigate noise and potential pedestrian/vehicular conflicts. Furthermore, the Community Design Plan provides guidelines for rapid transit stations and bus stops. A business park is suggested for the north-eastern part of the community since some of the land falls near the OAOIZ. The Community Design Plan has been approved by City Council.

An east-west Transit Street is proposed within the Community Core. The Street is envisioned to be pedestrian-oriented, provide retail/commercial and residential functions and have a community wide appeal.

Overview of Planning Process and Status of Development

The Riverside South community is within the Urban Area of the City of Ottawa and is comprised, in terms of Official Plan land use categories, of General Urban and Employment lands as well as Major Open Space and Urban Natural Features designations. The northwest quadrant of the community is presently developed or is subject to immanent development approvals providing for a total of approximately 8,000 residents. The balance community, divided into six neighbourhoods for planning purposes, is expected to be fully built-out over the next 20 to 25.

As of the spring of 2006, the City has received preliminary submissions for subdivision approval for the entire Neighbourhood One (N1) area which will provide approximately 3,300 homes and a population of about 8,700. The LRT alignment bisects the N1 area east of Limebank Road and north of Earl Armstrong Road. A trunk sanitary sewer pipe is being constructed through N1 in 2006 that will set the stage for phased development approvals. In addition to anticipated residential approvals, a school board has indicated that it needs to open a high school in N1 in September 2008 and the City is projecting need to construct a major recreation complex adjacent to the LRT alignment in N1 in 2011.

The City has also received preliminary submissions for subdivision approval on two sites that abut the LRT alignment in Neighbourhood 2 (N2) south of Earl Armstrong Road. The LRT alignment traverses the northerly part of N2. The completion of approvals related to the LRT and finalisation of the Master Servicing Study for Riverside South later in 2006 will enable approvals of these submissions and is expected to be a significant catalyst for future applications for development in proximity to LRT facilities.

The land use planning process that resulted in the approval of the Riverside South Community Design Plan (CDP) in June 2005 included preparation of a series of supporting master studies including commercial space demand, transportation, water, sanitary sewer, storm water management and Significant Woodlot Study Update (Niblett 2005). Among other guidelines and legislated study approval processes, the supporting studies and CDP are consistent with the Natural Heritage conservation requirements of the Provincial Policy Statement and were carried out in accordance with the City of Ottawa Official Plan environmental protection policies. Also, representatives from the Rideau Valley Conservation Authority (RVCA), which by contract also represent matters of Provincial interest to MNR and which has the ability to recommend bump-up to DFO, were part of the study team for the CDP land use plan.

The Significant Woodlot Study Update recommended retention of the "T" shaped portion of the Armstrong South Woods. This woodlot area, which is designated in the Ottawa Official Plan as an Urban Natural Feature, was retained in the CDP design with the intent to protect it from development. The southerly "tail" to the "T" shaped woodlot was not identified as containing significant plant species and no thretened or endangered species were identified as being present by the RVCA. As a result, this part of the woodlot is to be developed in the future for housing, public roads and will contain the right-of-way for the LRT.

The City of Ottawa has two processes aimed at the preservation of natural features that will apply as individual development applications are received within the future Riverside South community and throughout the City. All applications for development located within 30 metres from the boundary of all designated Urban Natural Features, such as the Armstrong Road South Woods, must be accompanied by an Environmental Impact Statement (EIS). The preparation of an EIS is guided by detailed Environmental Impact Statement Guidelines prepared by the City of Ottawa in accordance with the Natural Heritage Reference Manual for Policy 2.3 - Natural Heritage of the Provincial Policy Statement (1997), as prepared by the Ministry of Natural Resources. An EIS is prepared by an environmental consultant and must include:

a) A map drawn to scale identifying the location and extent of the feature, a description of the environmental values within the environmental feature or designation which could potentially be adversely affected by the proposed development, a description of the terrain/topography, vegetative cover and types, soil type and depth, and surface water movement patterns;
b) A description of the proposed development;
c) A description of the impacts on the environmental feature that might reasonably be expected to result from the proposed development;
d) A description of the actions that may be reasonably required to prevent, change, minimize or mitigate impacts on the environmental feature as a result of the proposed development, including the identification of opportunities for ecological restoration, enhancement and long-term conservation of the feature;
e) A description of the flora and fauna present on the site and how the development may impact on the flora and fauna within the site or natural feature and proposed mitigation measures to be taken during and after construction;

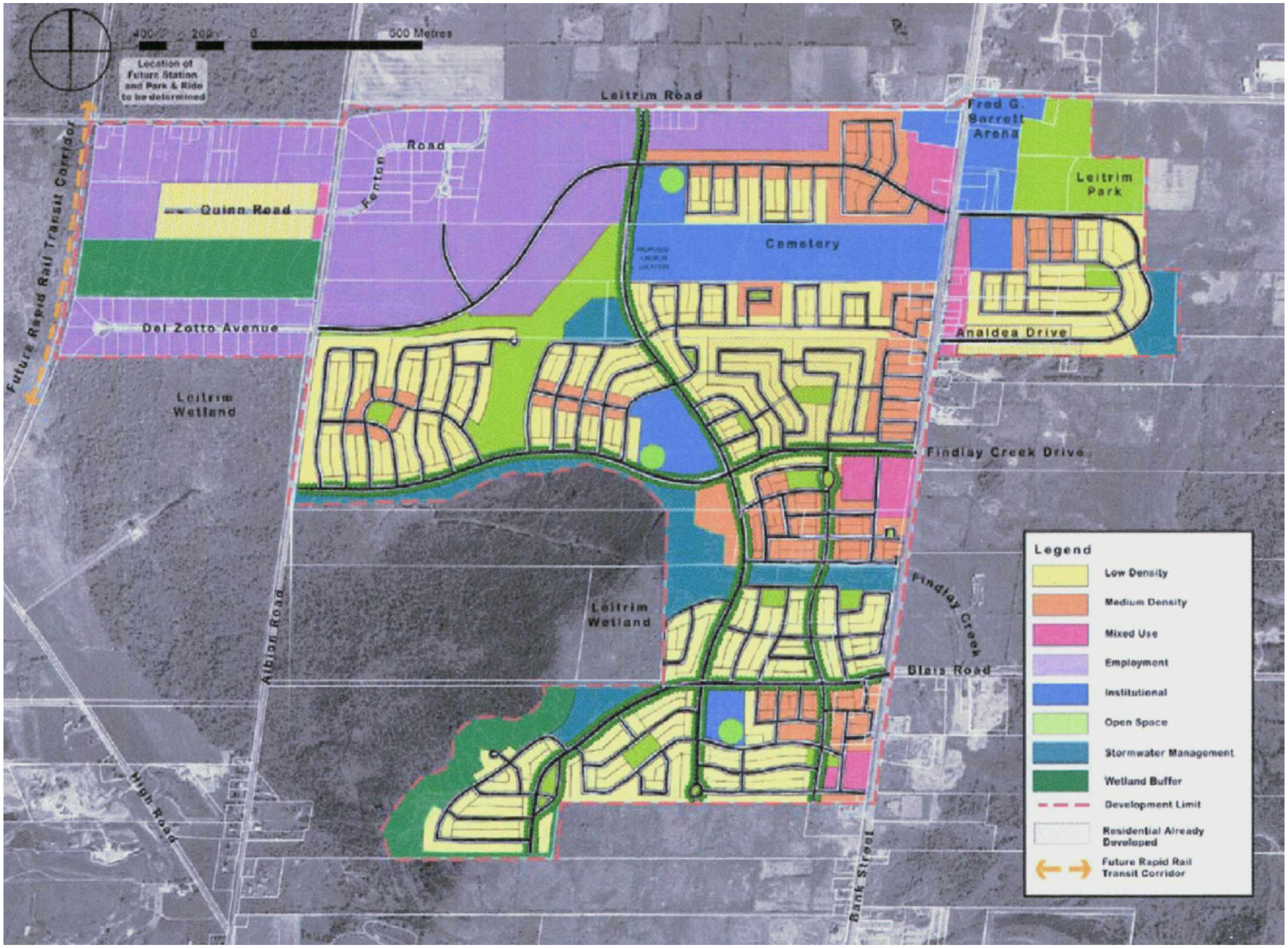
f) An evaluation of the cumulative effects that the proposed development (in light of other known projects or activities in the area) may have following mitigation measures on the natural features and ecological functions identified in the area;
g) A professional opinion on whether negative effects on the natural features and ecological functions will occur, and the significance of these impacts in the context of the evaluation of the natural area (i.e., the natural features and functions for which the area was originally identified as significant and the residual impact of the proposed development on the general significance rating of the larger natural area);
h) Identification of monitoring needs and recognition of parties to be responsible for assessing and reporting on these needs over a prescribed period of time.

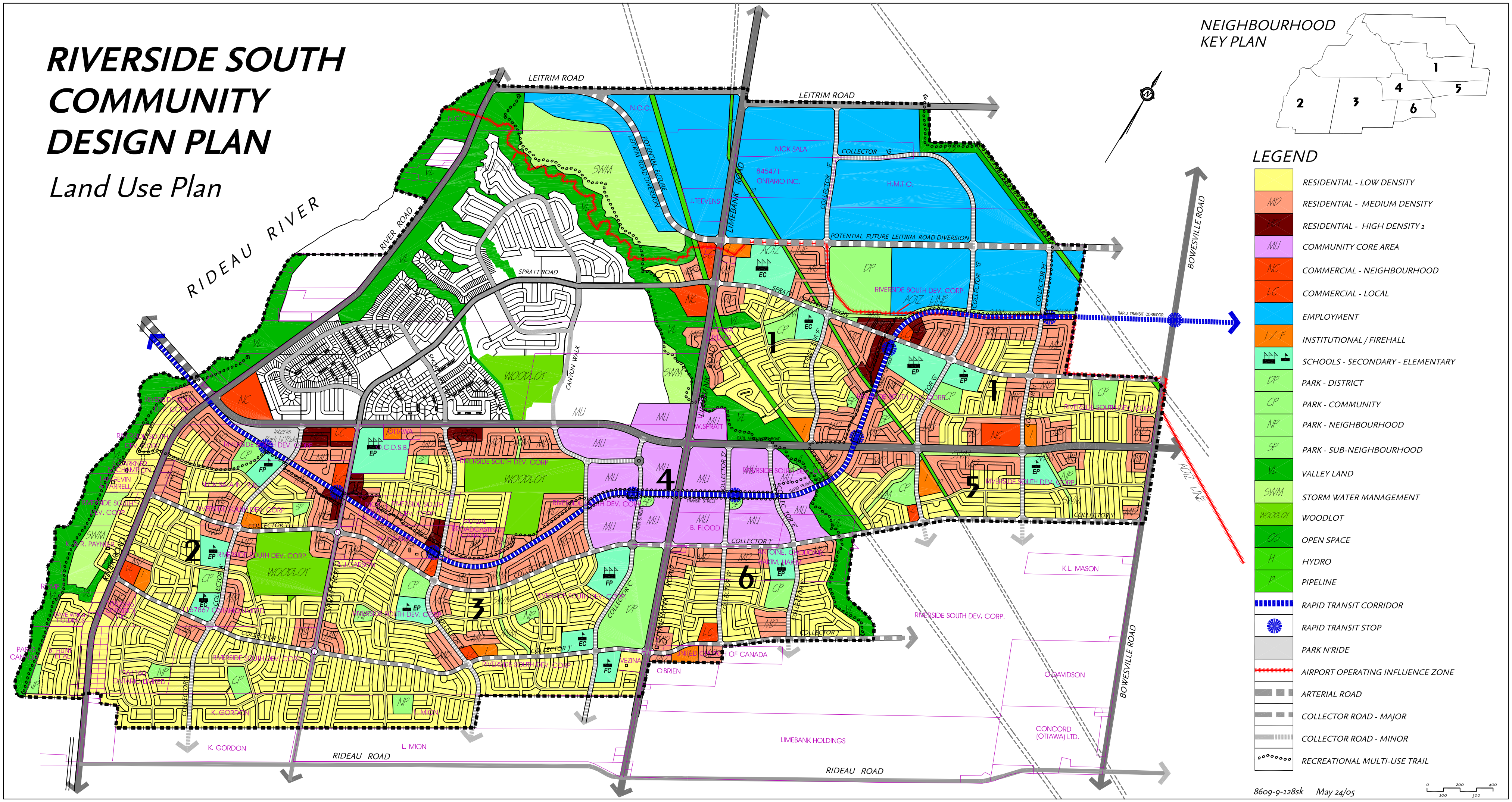
The amount to detail and requirements for each individual EIS is scoped by the City planner and Conservation Authority staff based on the characteristics of each site. Once submitted, a technical review of the EIS is undertaken on behalf of the City of Ottawa by staff of the appropriate Conservation Authority, while City of Ottawa staff review of the EIS to ensure that it is consistent with all City of Ottawa policies. Conservation Authority staff identify any inaccuracies and deficiencies in the EIS, and may require that additional work be undertaken. Once accepted, conditions of development approval are written directly into the subdivision and site plan agreements that reflect the mitigation and monitoring measures as proposed in the Environmental Impact Statement.

In addition to Environmental Impact Statements, the City requires the preparation of a Tree Preservation and Protection Plan to support all site plan and subdivision applications in support of the City's Official Plan objective to acheive a target of 30% forest cover throughout the City. Development applications will be required to preserve vegetative cover to the greatest extent possible, or replace it where removal cannot be avoided. The Plans are intended to retain as much natural vegetation as possible, with particular emphasis on high quality or rare vegetative communities. These plans must, among other things

a) Identify individual trees or stands of trees that warrant retention;
b) Outline measures for their protection during construction and over the long term;
c) Describe the area and nature of the tree loss and compensation measures proposed;
d) Investigate the appropriateness of of the use of native species in tree planting strategies;
e) Provide a reference document for future residents on the importance and care of trees on their property; and
f) Where there is substantial alteration of the natural vegetation cover on the site, identify how the impact on the fauna or rare species during and after construction will be considered and propose mitigation measures.

Figure 4.2.2-3 Leitrim Approved Community Design Plan





Approved Plan - Figure 4.2.2-4

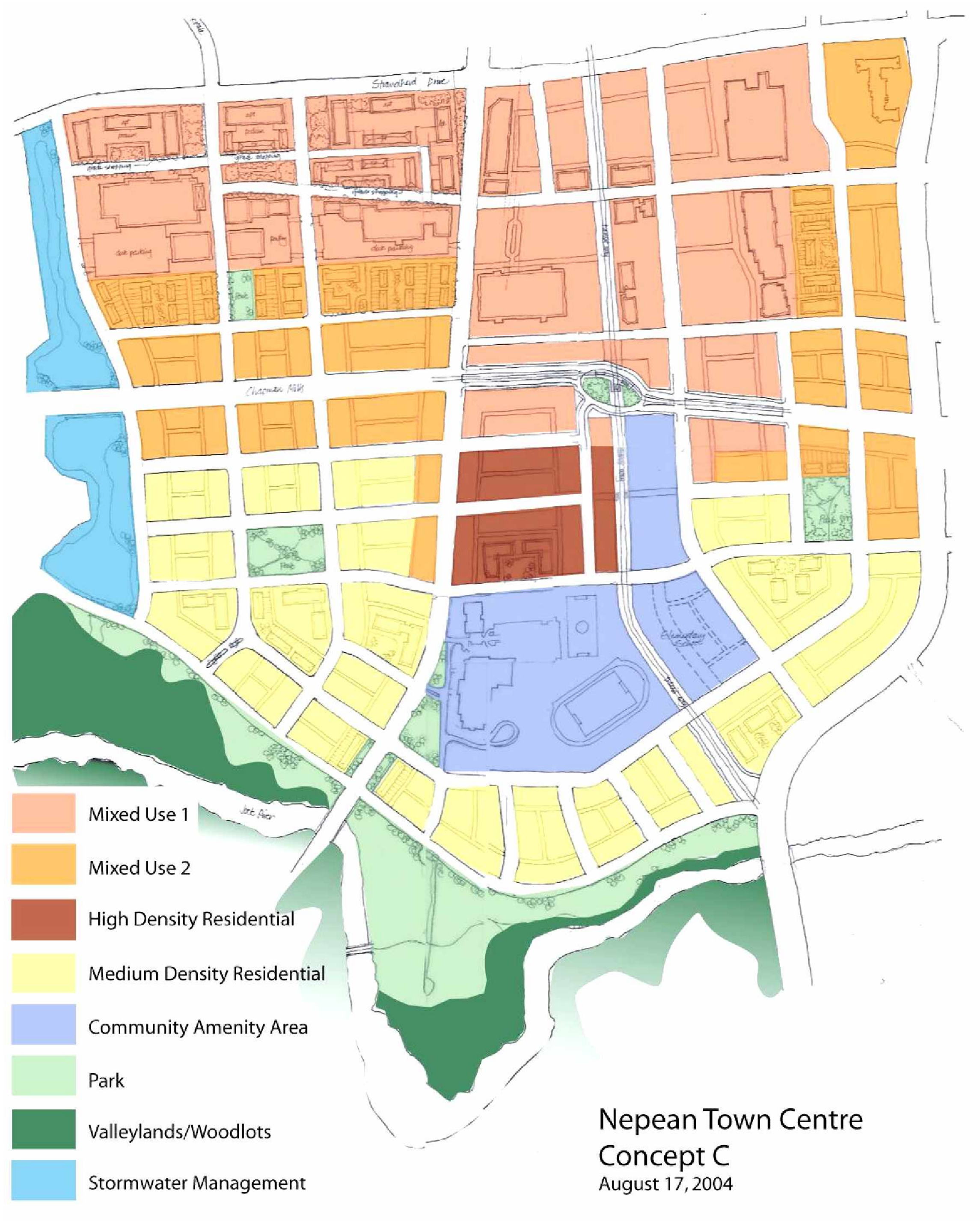
South Nepean Town Centre Community Design Plan

The South Nepean Town Centre is one of the three mixed-use town centres identified in the City of Ottawa's Official Plan that are strategically located within the future rapid transit network and major roads. The study area is approximately 225 hectares. A population target of 8,000 people with a minimum employment target of 10,000 jobs has been identified for this area. Figure 4.2.2-5 illustrates the proposed land uses, which include a mix of residential, commercial, retail, and employment in a compact, pedestrian-friendly, transit supportive urban form.

A transit station is proposed within the Town Centre at the intersection of the proposed east-west LRT line and the north-south bus Transitway. One of the key features of the concept plan is a proposed Main Street with a dedicated transit corridor at the centre. At the June 23rd, 2004 public workshop for the Community Design Plan, it was discussed that the proposed LRT line was currently being designed to co-locate within the right-of-way of the major east-west arterial for the Town Centre (Chapman Mills Boulevard).

It is intended that the existing Transitway would extend from its current terminus at Woodroffe and Fallowfield and intersect the future LRT at the centre of the future Town Centre in an intermodal station, before continuing southward across the Jock River.

Figure 4.2.2-5 South Nepean Community Design Plan



Sensitive Land Uses

There are a variety of land uses that might require extra consideration when analyzing the effect of a LRT facility. These sensitive areas, as defined by Heath Canada in the Federal Scoping Document (Appendix L), include institutions such as schools, day care centres, old age homes, hospitals, and arts facilities. Additional details are also included in Section 4.2.10.

Downtown (Wellington to Somerset)
The downtown sector of the study area does contain many sensitive land uses. The NAC is located within this area, and is potentially sensitive to vibrations during both the construction and operations phases. Vibrations in this area will be mitigated through design. In addition a boat docking facility is located in the Rideau Canal in the vicinity of the NAC. There are four day care centres, four elementary and high schools, and a single senior housing centre. Only two of these establishments are located north of Laurier Street, in the core of Downtown Ottawa.

LeBreton Flats
The LeBreton redevelopment area currently does not support many land uses as it is mostly undeveloped. St. Vincent's hospital is located on the southern portion of this area where Albert and Slater split. There is also an old age home near Wellington and Preston Street.

Existing Rail Corridor
The existing rail corridor from Bayview to the Macdonald-Cartier International Airport captures the majority of sensitive land uses within the study area. No effects to sensitive land uses are anticipated in the area adjacent to the existing rail corridor as predicted noise and vibrations levels will be less than those observed from current O-train and freight operations.

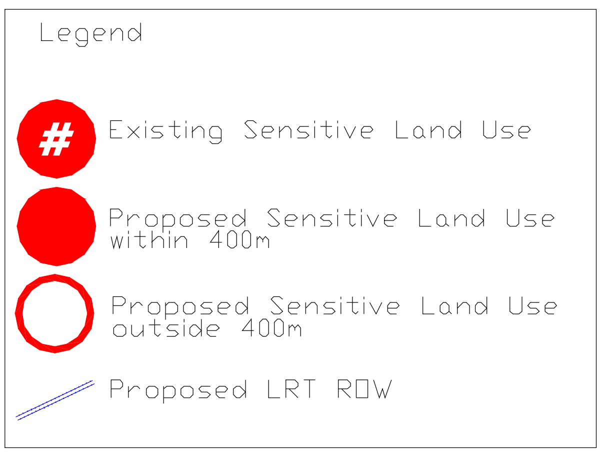
Southern Development Areas
The south portion of Ottawa is currently undeveloped. The Riverside South Community does not currently have any sensitive land uses; however, this will not be the case when Riverside South is fully developed. A total of 10 Elementary and 4 High Schools are proposed in the RSDC with 5 and 3 schools within 400 m of the proposed alignment respectively. The community of Barrhaven is relatively new and has some schools and retirement homes.

Existing sensitive land uses within the study area have been identified and included in Table 4.2.2-1 and labeled in Figures 4.2.2-6 and 4.2.2-7. An additional 8 schools are to be constructed with 400 m of the alignment in the Riverside South Development Community (shown as solid red points on Figure 4.2.2-7).

Table 4.2.2-1 Existing Sensitive Land Uses			
Land Use	**ID #**	**Name**	**Distance from Track (m)**
Child Care	5	St. Luke's Childcare Centre/Centre Educatif St. Luc	110
	7	Wellington Ward Child Care Centre	355
	8	Children On The Hill/Enfants de la Colline, Les	295
	10	Centretown Cooperative Kindergarten Program	235
	15	Nanny Goat Hill Nursery	500
	18	Devonshire School Age Program	125
	21	Early Learning Childcare Centre	295
	25	Dow's Lake Daycare/Garderie Lac Dow Inc	375
	27	Colonel By Child Care Centre	150
	28	Tupper Tots Day Care Centre/Garderie les tout-petits de Tupper	410
	31	Centre Educatif La Clementine "Satellite Lamoureux"	230
	38	Children's Castle Day Care Centre	385
Elementary & High Schools	6	Lisgar Collegiate Institute	165
	9	St. Patrick Adult High School	255
	11	Centennial Public School	235
	12	Albert Street Site	35
	17	Devonshire Comm. Public School	125
	22	Adult High School	290
	23	Joan of Arc Academy	275
	24	St. Mary Catholic E.S.	285
	29	Brookfield High School	450
	30	Lamoureux	220
	32	Parsifal	555
	33	Marius Barbeau	740
	34	Clifford Bowey Special Ed. School	535
	36	R. Byrns Curry Public School	640
	37	Holy Family Catholic E.S.	545
	41	Strandherd School Age Program	1525
	42	Monsignor Paul Baxter	1525
	46	St. Joseph High School	560
University	2	University of Ottawa	150

Table 4.2.2-1 Existing Sensitive Land Uses			
Land Use	**ID #**	**Name**	**Distance from Track (m)**
	26	Carleton University	on line
Senior Housing	14	Coopérative d'Appartements des Jardins Lteé	495
	16	Tomkins Housing Coopérative Inc	190
	19	Ottawa-Carleton Housing (Gladstone)	230
	20	Ottawa-Carleton Housing (Rochester)	325
	39	Bridlewood Retirement Home	300
	40	Carleton Lodge	450
	43	Longfields Manor	1415
	44	Ottawa Retirement Residence	530
	45	Barrhaven Manor	1090
Other	1	Union Mission for Men	220
	3	National Art Centre	60
	4	Rideau Canal Overnight Boat Dock	on line
	13	St. Vincent Hospital	160

Legend for Sensitive Land Uses



Sensitive Land Use North of Greenbelt
Figure 4.2.2-6

Sensitive Land Use South of Greenbelt
Figure 4.2.2-7

4.2.3 Central Experimental Farm

The Central Experimental Farm is a National Historic Site located within the study area. As a rare example of a farm within a city, the Central Experimental Farm forms a distinctive cultural landscape. The more than 400 hectares of the Central Experimental Farm includes the Dominion Arboretum, ornamental gardens, display beds, experimental gardens and various buildings including the Canadian Agriculture Museum. The farm was founded in 1886 as part of a Department of Agriculture experimental farms initiative and continues to represent significant agricultural contributions, and the central role of agriculture in the formation of Canada.

The eastern portion of the Central Experimental Farm is bounded by Dows Lake and the Rideau Canal. This area of the farm includes many unique and historically significant trees within a 26 hectare Dominion Arboretum. The Dominion Arboretum was established in 1889, and from then on has been the recipient of many donated trees from around the world. The collection also consists of plants obtained from exchanges with other Arboreta. New plants have been introduced at various times in attempt to develop hardiness. New cultivars have enriched the ornamental value of collection with their particular and interesting characteristics. Dominion Arboretum is both a scientific and natural attraction which is also commonly used as a recreational site for walks and picnicking.

4.2.4 Rideau Canal

The Rideau Canal is a National Historic Site of Canada, designated Canadian Heritage River and is a candidate site for World Heritage status. Parks Canada currently has jurisdiction of the Rideau Canal from Ottawa to Kingston, which includes the Rideau River upstream of Hog's Back.

The Rideau Canal is North America's oldest continuously operating waterway. Celebration of the 175th anniversary of the opening of the Rideau Canal is planned for 2007. Officially opened in 1832, the Rideau Canal was created to provide a route for unimpeded boat travel along 202km (including 47 locks) from Bytown to Kingston. The Rideau Canal was easily navigable and eventually became a major commercial waterway. With the ultimate decline of commercial travel along the canal, appreciation grew for the Rideau Canal's cultural and scientific significance and recreational resources. Additional details regarding Rideau Canal recreational uses are provided in Section 4.2.5. Details on natural features associated with the Canal have been provided in Section 4.2.1

4.2.5 Recreation

Rideau Canal

Recreational uses of the Rideau Canal are not limited to aquatic activities; many visitors enjoy a variety of activities along the shores of the canal, including larger events such as the annual Winterlude celebrations. The Rideau Canal Management Plan notes the following regarding the variety and popularity of recreation activities within and along the Rideau Canal.

> *The lands and waters of the Rideau Waterway support an impressive array of leisure and recreational activities for hundreds of thousands of visitors and residents every year. The three nodes of recreational activity include the historic City of Kingston, the traditional cottage country of the Rideau Lakes, and the lively, world-class water-related events and facilities in and around Ottawa, the Nation's Capital.*
>
> *The Rideau Waterway is a prime recreational destination for much of eastern North America. The swimming, pleasure boating, fishing, and hunting in and near the Waterway*

is renowned and has been for over 160 years. It did not take long after the Canal was built for civilian boaters, sportsmen and private adventurers to use Colonel By's Canal route as a path to interior lakes and rivers that were previously inaccessible. Today, there are many provincial and municipal parks and marinas, numerous fine beaches, camps, resorts and scenic roads for visitors along the Waterway. The Rideau is also used extensively by school and camp groups who canoe it in part or in its entirety.

Boating is the prime recreational activity drawing people from far and wide to cruise the restorative waters of the Rideau in canoes, power boats and sailboats. In 1997, over 76,000 vessels of all sorts locked through the system during the relatively short five month boating season. Boating is not new on the Rideau. In fact, use of water craft on the Rideau has now been documented back to about 6,000 B.C.

The explosion of civilian use of the waterway in the late 1800s brought thousands of people onto the lakes every summer for holidays, many on steamboats. First in luxury hotels like Kenny's at Jones Falls and the Opinicon at Chaffey's Lock, and later in private cottages and residences tucked serenely on the grey rocks of the Precambrian Shield, the reputation of the Rideau Waterway for civilized wilderness experiences grew and grew. Today, the Rideau Lakes are one of the best locations for cottaging and summer fun anywhere in eastern North America.

World-class rowing and kayaking facilities can be found at Mooney's Bay in Ottawa. Under the auspices of the Rideau Canoe Club, games, festivals and training takes place from ice out in the spring to late October. Several of Canada's Olympic athletes and world champions train here regularly. The Canadian Recreational Canoeing Association (CRCA) chose the Rideau Waterway at Merrickville for its national headquarters in 1995.

There are 43 marinas on the waterway serving thousands of resident and transient boaters. Antique and classic boats hold regattas and shows on the waterway. Festivals such as the Tulip Festival, the Ottawa Jazz Festival, Festival Canada and the Franco-Ontarien Festival are held on the Rideau each year. Ottawa is also the site of Winterlude, one of the nation's premier winter festival centered on skating on the Rideau Canal. For ten to twelve weeks in mid-winter, the Canal becomes one of the world's longest skating rinks stretching some 8 km. from the National Arts Center to Hartwell's Locks across from Carleton University.

The Rideau Waterway corridor is home to some of the best hiking and cross-country ski trails in eastern Ontario. Foremost among these is the 300 km. Rideau Trail linking Kingston to Ottawa. The Rideau Trail opens up whole new venues for birding, nature appreciation, conservation education and fitness.

The Rideau Waterway has a hallowed place in Canada's family of National Historic Canals. … The Rideau Waterway is, on a larger scale, part of the international canal network. Many people travel the great distances using interconnecting navigable water routes to see and enjoy some of the world's finest water systems.

Parks and Pathways

The major recreational parks that fall within the study corridor are the Dominion Arboretum and the Dows Lake pavilion. The existing O-Train line has already been integrated through this area. The portion of the LeBreton Flats around the War Museum has been landscaped and provides an open grassy field. There are two more recreational sites in the new developments of Riverside

South and Barrhaven. These sites are environmentally significant woodlots that are protected to enhance the natural features and recreational potential in the area. Baseball, basketball and football/soccer fields and playgrounds are located throughout the neighbourhoods.

The Transportation Master Plan (TMP) and Official Plan provides detailed maps showing recreational pathways. According to the OP, the City of Ottawa will "provide multi use pathways where required to facilitate walking cycling within and between neighbourhoods and provide walking and cycling crossings of rapid transit corridors." Within the study area there are a number of pathways. The recreational pathway and cycling transportation network maps as presented in the TMP are presented as Figures 4.2.5-1 and 4.2.5-2.

Currently there is a recreational path that travels from the Ottawa River in the north (at Bayview) along the existing O-Train line to Dows Lake and the Dominion Arboretum. This path continues through the Dominion Arboretum and then along the west of the Rideau Canal to Hogs Back.

According to the TMP, recreational paths travel along the airport parkway, which runs in the same transportation corridor as the current O-Train. The Airport Parkway deviates from the existing CP rail line south of Hunt Club Road. The recreational path does not continue along the Parkway into the Airport but follows the rail line south to Lester Road. The multi purpose path travels through the Leitrim Community where it joins other paths to contribute to the citywide network.

There are four main locations where a recreational path crosses the existing rail line; the Rideau Canal (Downtown), Dows Lake, Rideau River (Vincent Massey) and south of Walkley Rd. . Both sides of the Rideau Canal have multi purpose recreational paths, including pathways that run along the Rideau Canal in the downtown area. Portions of these paths provide good access to the O-Train station at Carling and they are grade-separated to minimize conflicts with train operations. The LRT currently operates below grade in a rock cut on the north side of Dows Lake and returns back to grade at Carleton University. The current rail structure that crosses the Rideau River also spans over the recreational paths on either side of the river.

The conceptual multi-use pathways network also suggests an alignment that follows the East - West rail line that crosses near Walkley Road. This path could be developed in conjunction with the East -West rail line and would be grade separated from the Airport Parkway and North-South rail line.

Hunt Club Road accommodates the multi use pathway from the existing rail line to the west. Hunt Club is grade-separated from the current rail line.

The recreational network should facilitate movement between neighbouring communities. The Leitrim Community and the Riverside South Community are to be connected with a multi-purpose path that runs along the new Leitrim alignment and along Earl Armstrong Road. This path travels through the centre of the proposed development before crossing the Rideau Canal and continuing to the Barrhaven Town Centre. Another path runs along Mosquito Creek and crosses the study area before heading more south to Manotick.

Multi-use pathways and cycling routes exist and are planned west of the Rideau Canal. In Barrhaven, recreational paths follow Greenbank and Jockvale Roads and the north side of the Jock River. There are also paths that follow both sides of the Rideau Canal. There is a planned cycle route that follows the proposed LRT alignment from Greenbank Road to the Rideau Canal. This path traverses the Nepean/Chapman Mills east woodlot, a conservation area with preserved natural features. One more cycle route crosses the LRT alignment on Woodroffe Avenue and heads south intersecting the multi-use pathway before crossing the Jock River.

The Chapman Mills Conservation Area is located along the west bank of the Rideau Canal near Prince of Whales Drive. This conservation area features 23 acres of conservation land often used for passive recreational activities including hiking along a 1.5 km trail of stone/dust pathways and boardwalks. The trail features lookouts, a picnic shelter and access to fishing platforms, viewing platforms and a canoe launch. Interpretative signs along the trail provide visitor information regarding the local environment.

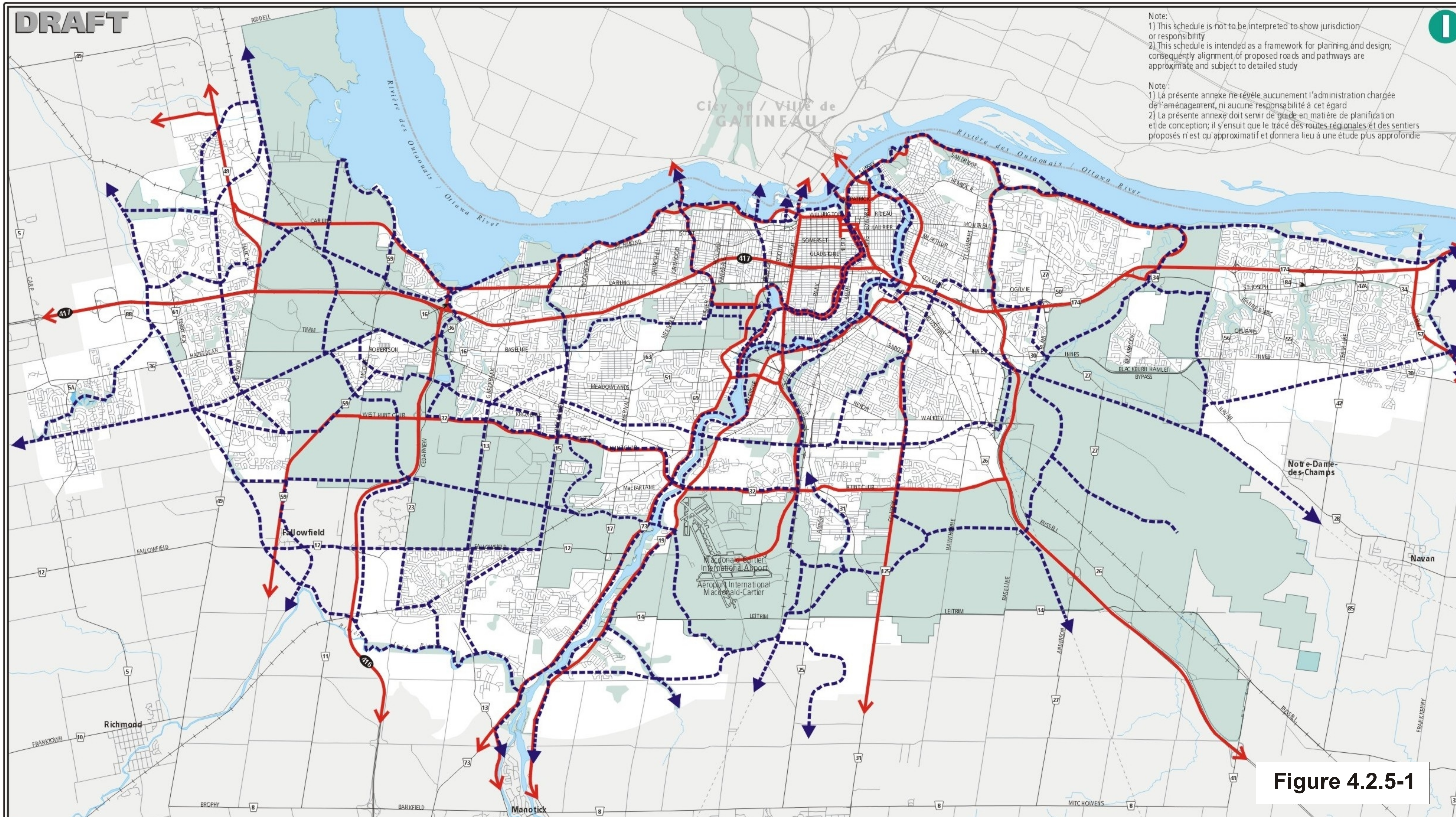


Figure 4.2.5-1

Official Plan - Schedule I
Major Recreational Pathways & Scenic-Entry Routes (Urban)

Prepared by: CITY OF OTTAWA, DEVELOPMENT SERVICES DEPARTMENT, RESEARCH & TECHNICAL SERVICES DIVISION, December 2002

Plan officiel - Annexe I
Principaux sentiers récréatifs et routes d'entrée - panoramiques (urbain)

Preparé par : VILLE D'OTTAWA , SERVICES D'AMÉNAGEMENT, DIVISION DE LA RECHERCHE ET DES SERVICES TECHNIQUES, Décembre 2002

Major Recreational Pathways — Principaux sentiers récréatifs
Scenic-Entry Routes — Routes d'entrée panoramiques
Select Green Spaces — Espaces verts choisis

Ottawa

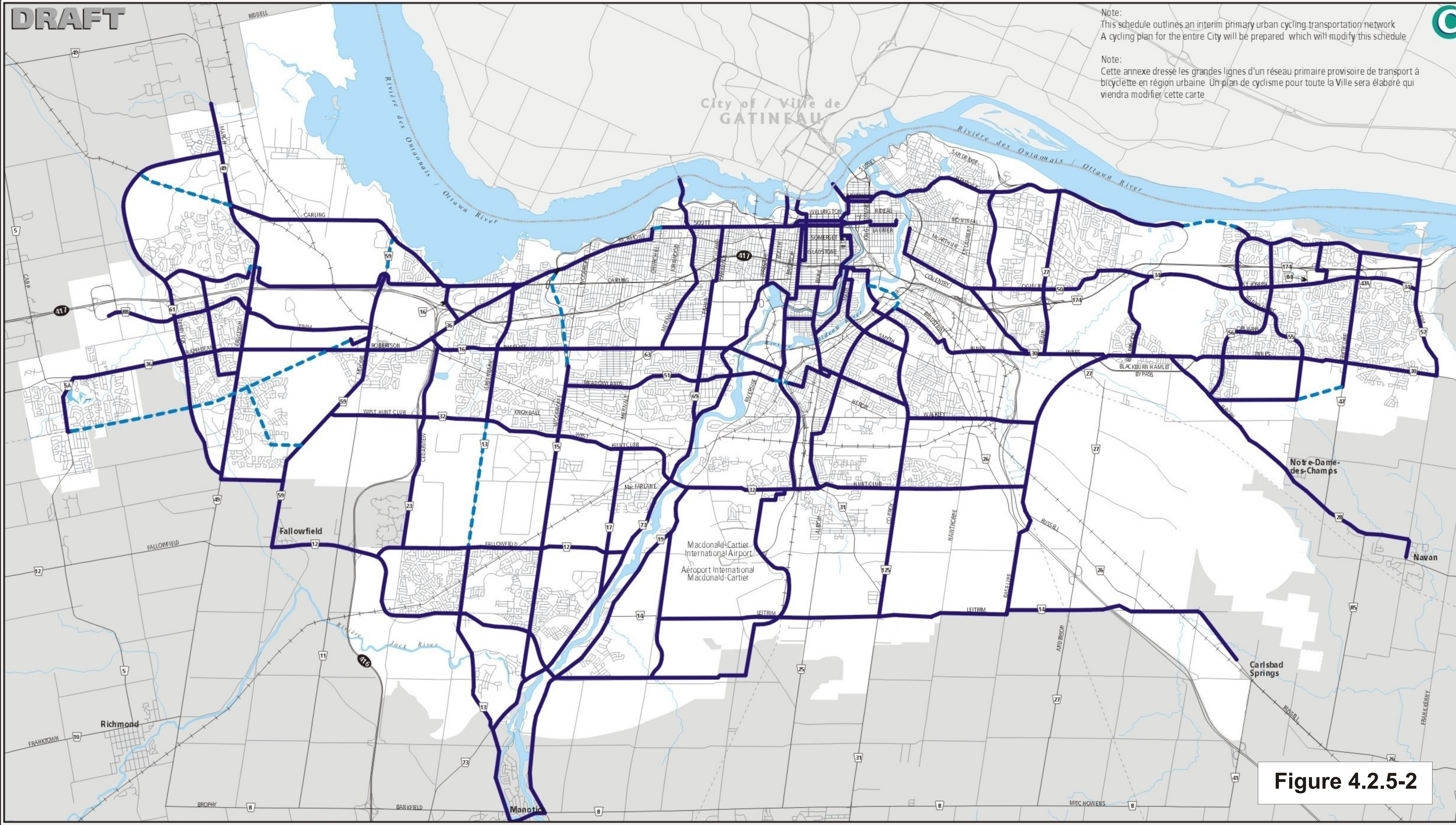


Figure 4.2.5-2

Official Plan - Schedule C
Primary Urban Cycling Transportation Network

Prepared by: CITY OF OTTAWA, DEVELOPMENT SERVICES DEPARTMENT, RESEARCH & TECHNICAL SERVICES DIVISION, December 2002

Plan officiel - Annexe C
Plan du réseau urbain de pistes cyclables principales

Preparé par : VILLE D'OTTAWA , SERVICES D'AMÉNAGEMENT, DIVISION DE LA RECHERCHE ET DES SERVICES TECHNIQUES, Décembre 2002

On-road Cycling Routes — Voies cyclables
Off-road Cycling Routes - - - Cyclables hors chemin

Ottawa

2km 2 0 1 2 3 4km

Waterways (boating and skating)

The only navigable waters that fall within the study area are the Rideau Canal, the Rideau River, and the Jock River. During winter months, the Rideau Canal is frozen over and is used for skating from the Ottawa River to Carleton University including Dow's Lake. There will be 2 locations where the Rideau Canal Skateway will cross the LRT. The northern crossing is at the Mackenzie King Bridge next to the NAC and Rideau Centre, and crosses using the existing structure over the Canal. The second crossing uses the existing and a twined tunnel under the canal in the vicinity of the Dominion Arboretum and Carleton University.

Many boats that use the Rideau Canal Network use the Rideau Canal south of Hog's Back and the Rideau Canal to the north. The Ottawa River can only be accessed from the Rideau Canal using the locks next to parliament. In addition there are docking facilities in the vicinity of the National Arts Centre. At Hog's Back, there are rapids that boaters do not cross. The Rideau River north of Hog's back is used for many recreational uses such as canoeing, kayaking, and fishing.

The Jock River runs east between the SNTC and Barrhaven South Communities. It originates approximately 50 km west of Ottawa at the Goodwood Marsh and outlets into the Rideau Canal. While un-navigable for most of the year, the Jock River provides a scenic, natural corridor for numerous recreational activities including hiking, bird watching and fishing. Every spring the Jock River hosts the Annual Jock River Canoe Race for white-water enthusiasts.

4.2.6 Archaeology and History

Heritage Quest Inc. was retained to undertake a Stage 1 Archaeological and Heritage Assessment of the study area. The Assessment was carried out with the objectives of both identifying known archaeological sites and built heritage and cultural landscape resources and determining the archaeological potential of the study corridor.

The study involved a review of documents pertaining to the corridor including historic maps, local histories and aerial photographs. The Ontario Ministry of Culture, Parks Canada and Archaeological Consultants working in the Ottawa area were contacted for current information on registered archaeological sites and previous archaeological assessments undertaken in the vicinity. Information on built heritage and cultural landscapes was obtained from the City of Ottawa (including the records from the Local Architectural Conservation Advisory Committees for the former Cities of Nepean and Gloucester), the National Capital Commission, the Federal Heritage Building Review Office and Parks Canada. Archaeological potential studies undertaken for the City of Ottawa and the National Capital Commission were also examined. A detailed review of land registry records and census reports was beyond the scope of the present study although some use was made of information obtained from these sources during previous assessments within the study corridor. A general reconnaissance of the entire study area and a detailed field verification of built heritage properties in the portion of the study corridor south of Hunt Club Road was completed over several days in the late summer and early fall of 2004.

Most recently, several large sites of possible Palaeo-Indian or Early Archaic affiliation have been located near the southeast corner of the corridor suggesting an early Native presence in the region. From Archaic (ca. 7000 B.C.) times onward, both the Ottawa and Rideau Rivers served as important transportation corridors for Native peoples, and isolated finds of Archaic and Woodland period artifacts have been made along both river systems, including at several locations within the study corridor. The Ottawa River became the main route to the interior for early French explorers and traders through the seventeenth and eighteenth centuries, and it is likely that they also traveled along the Rideau River and its tributaries.

Permanent Euro-Canadian occupation of the study area began in the early nineteenth century with the arrival of Ira Honeywell in Nepean Township and Braddish Billings in Gloucester Township. Settlement remained limited until the construction of the Rideau Canal (1828 - 1832). By the mid-nineteenth century most of the lots within the study area had been settled, and many of the early rough hewn cabins had been replaced by stately frame, brick or stone homes, often on large, prosperous farms. Bytown, soon to become the capital of Canada, was emerging as a significant town, while small villages, including Billings Bridge, Gateville, Bowesville, Johnston's Corners and Jockvale served the rural areas to the south. The road system had been expanded significantly and, of particular significance to the present study, the Bytown and Prescott Railway had been constructed through the area in 1854. A spur line from Chaudiere Junction to the Chaudiere was added to what had by then become the St. Lawrence and Ottawa Railway in 1874. While urban development continued through the northern portion of the study area, the more southerly parts remained largely rural through the nineteenth and twentieth centuries.
As would be expected, this large study area includes many significant cultural heritage resources. Built heritage properties are concentrated in the area north of the Rideau Canal/Dow's Lake. These areas are highlighted in Figure 4.2.6-1. In addition to thousands of individually designated and listed properties (some of which are also considered National Historic Sites), portions of seven Heritage Conservation Districts occur within this part of the corridor. More disbursed built heritage properties are located in the southern part of the corridor. These areas are identified in Figure 4.2.6-2.

Designated cultural landscapes include Parliament Hill, the Central Experimental Farm, Confederation Boulevard and the Rideau Canal as shown in Figure 4.2.6-3. The National Capital Commission is presently considering a cultural landscape classification for the entire Parkway System and the Greenbelt. The Rideau Canal/River is also a National Historic Site, designated Canadian Heritage River and is a candidate site for World Heritage status. Other cultural landscapes identified in the present study are located in rural south Gloucester and include early roads, farm complexes, the Bytown and Prescott/St. Lawrence and Ottawa Railway (former CPR) and Mosquito Creek. Among these, the High Road/CPR corridor area and the Earl Armstrong Road/Limebank Road/Mosquito Creek area are particularly significant as they combine many elements of the nineteenth century rural settlement landscape. A summary of the identified heritage properties within the study corridor is provided in Table 4.2.6-1.

Figure 4.2.6-1 Built Heritage north of Hunt Club

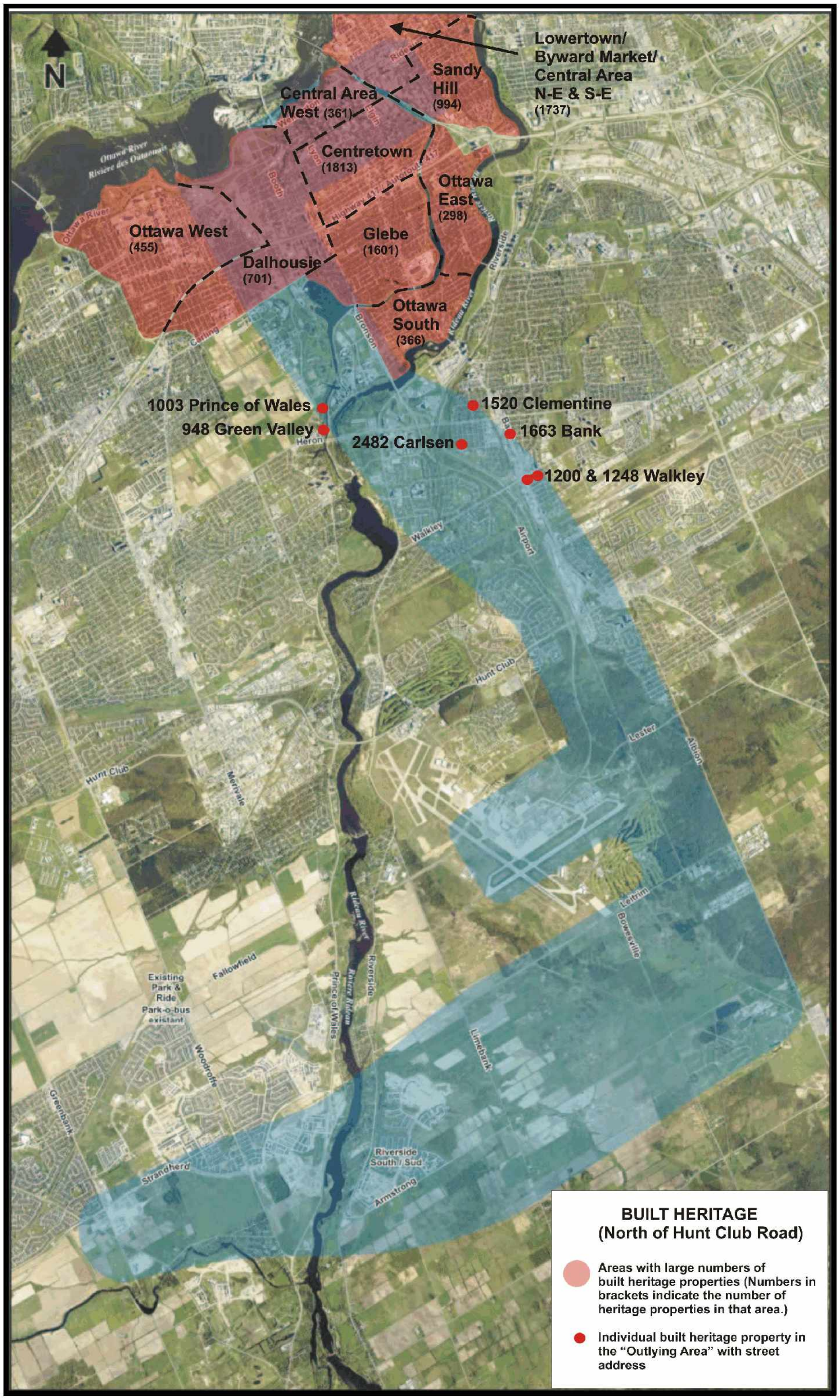


Figure 4.2.6-2 Built Heritage south of Hunt Club

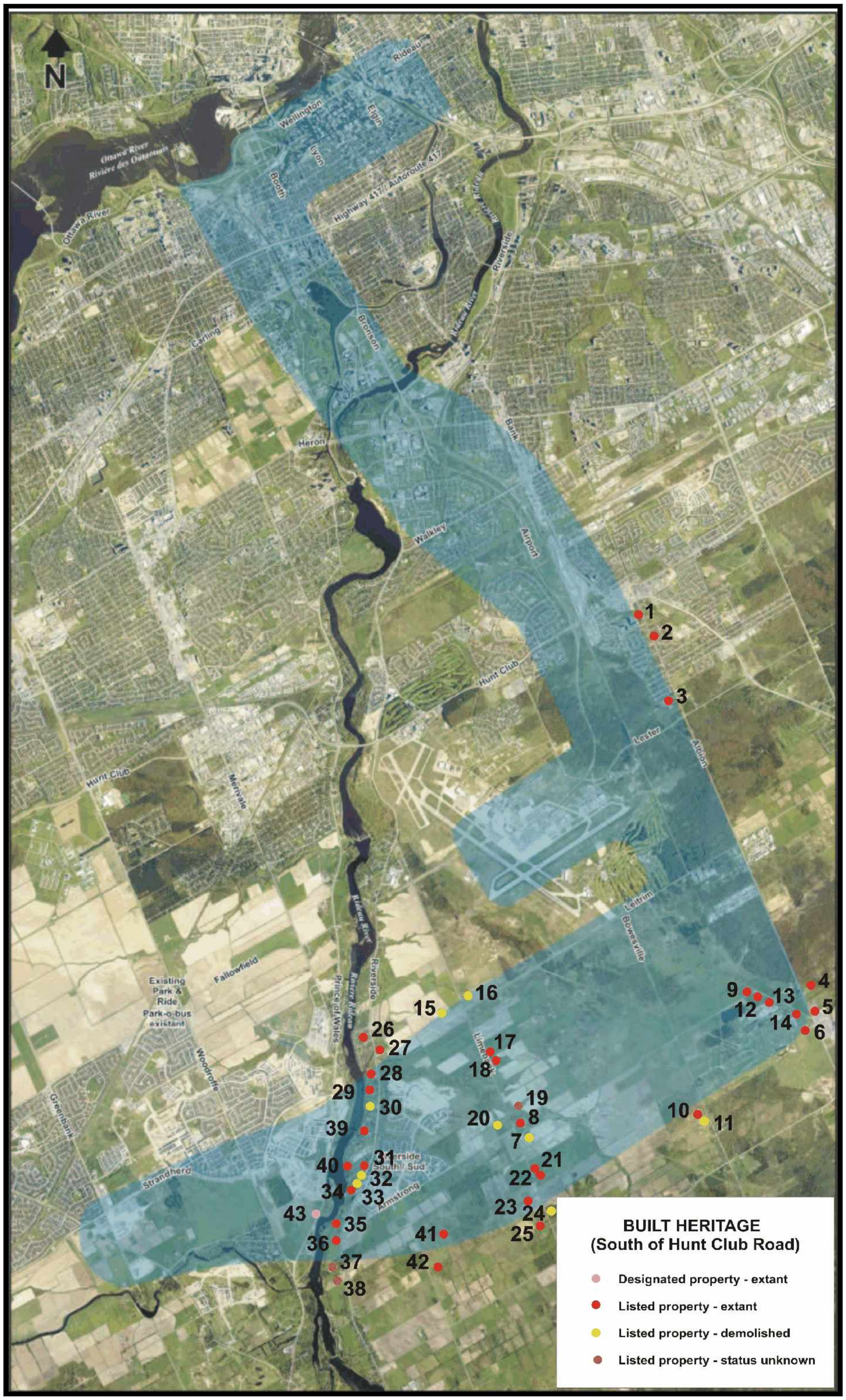


Figure 4.2.6-3 Cultural Landscapes

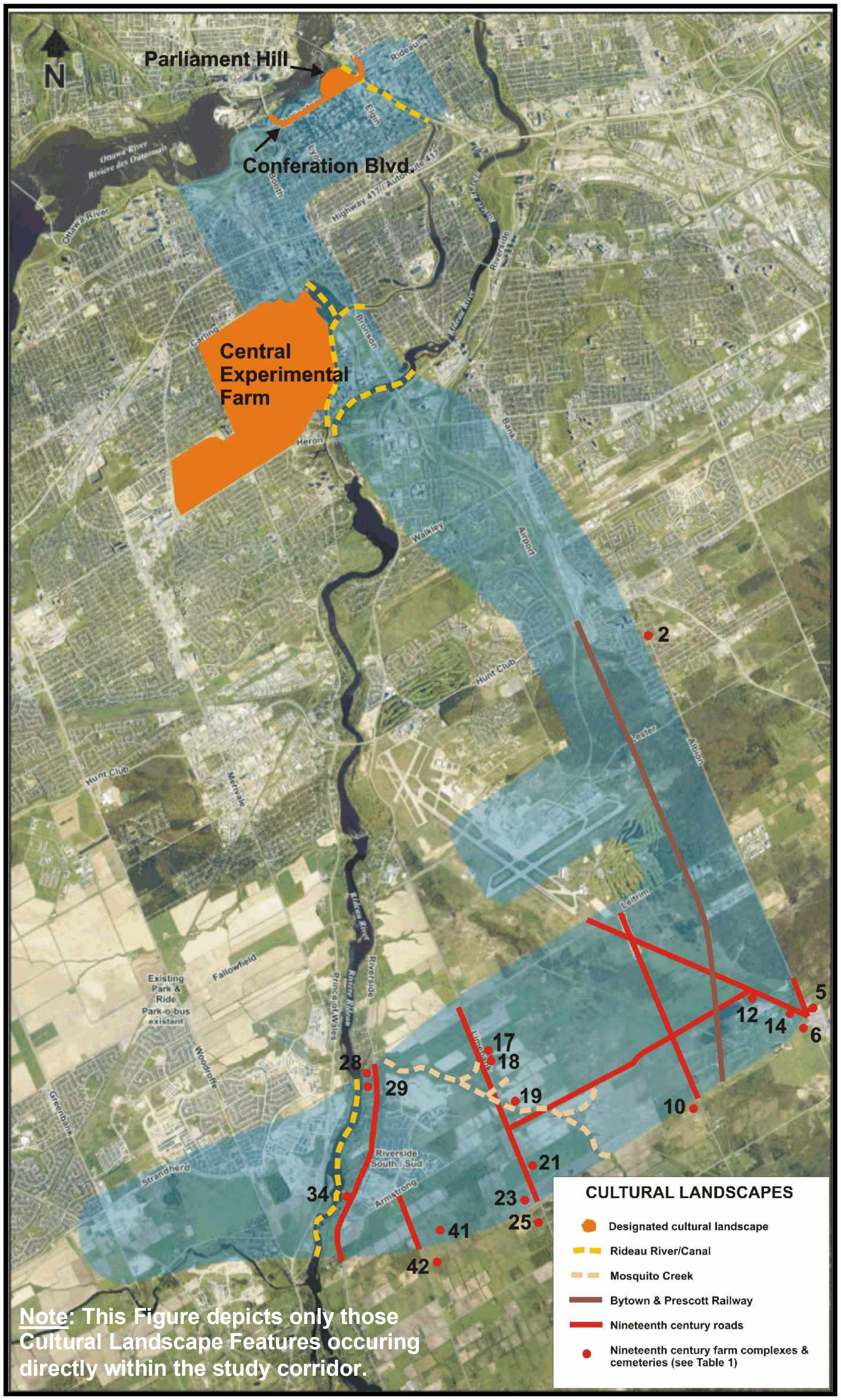


Table 4.2.6-1 Summary of Heritage Properties							
No. on Figure	**Municipal Address**	**Lot & Concession**	**Name**	**Nature**	**Designation**	**Comments**	**Status**
1	3560 Albion Rd	6 III RF Gloucester		Residence	Listed	"Two and a half storey brick house with white clapboard extension	Extant
2	Albion Rd	7 IV RF Gloucester		Cemetery	Listed CL	Roman catholic cemetery at Blossom Park. Located on northeast corner of intersection of Albion Rd and D'Aoust. Just east of study corridor	Extant
3	3960 Albion Rd	10 III RF Gloucester		Residence	Listed	Three storey, mansard roof	Extant
4	4667 Albion Rd	22 IV RF Gloucester	Log House	Residence	Listed	Modern second storey	Extant
5	4859* Albion Rd	23 IV RF Gloucester	Cemetery at Race track / Johnston's Corners Cemetery	Cemetery	Listed CL	*Street address appears to be incorrect. Cemetery is located on east side of Albion, just north of High Rd. Just east of study corridor	Extant
6	4788 * Albion Rd	23 III RF Gloucester	W.A. Spratt & Sons Farm	Farm residence & outbuildings	Listed CL	* The City of Ottawa inventory lists 4770 Albion rd but this is a modern house. The 1995 Gloucester LACAC inventory lists the address as 4792 Albion rd. 4788 Albion rd is an historic red brick farmhouse with numerous historic outbuildings on the property.	Extant
7	1420 Earl Armstrong Rd	W ½ 21 II RF Gloucester	S. Markwell Farm	Residence	Listed	Two storey house, truncated gable roof	Demolished
8	1423 & 1425 Earl Armstrong Rd	W ½ 20 II RF Gloucester		Farm Buildings	Listed	Five sectional barn of varying age	Extant
9	Earl Armstrong Rd	20 III RF Gloucester		Barns	Listed	Two side-by-side barns. Located 400m NW of 4538 High rd	Extant
10	4836 Bowesville Rd	22 II-III Gore RF Gloucester	Harold Kearns Farm	Farm residence & barns	Listed CL	Two storey white clapboard house, log barns	Extant
11	Bowesville Rd	24 II-III Gore RF Gloucester		Residence	Listed	Abandoned at the time of the 1995 Gloucester LACAC survey. No address – 300m NW of Fricko Cres.	Demolished

Table 4.2.6-1 Summary of Heritage Properties							
No. on Figure	Municipal Address	Lot & Concession	Name	Nature	Designation	Comments	Status
12	4538 High Rd	21 III RF Gloucester	Carl Quinn Farm	Farm residence & barns	Listed CL	Residence has 6/6 windows. Three zigzag connected barns.	Extant
13	4600 High Rd	E ½ 21 III RF Gloucester	F. Capella	Farm Residence and barns	Listed	Red brick house with round window heads, barns	Extant
14	4730 High Rd	22 III RF Gloucester	Hobby farm	barn	Listed CL	Gambrel roof barn, old bungalow	Extant
15	Leitrim Rd	15 I RF Gloucester		Barn	Listed	Located 400 m NW of junction with Limebank rd. Just northwest of study corridor	Demolished
16	3995 Limebank Rd	15 II RF Gloucester	Lowell Timber Barn	Barn	Listed	Barn was abandoned at time 1995 Gloucester LACAC survey, modern house on property. Just north of study corridor	Demolished
17	4209 Limebank Rd	17 II RF Gloucester	M. Lennox Property	Farm residence and outbuildings	Listed CL	One storey white shiplap house, numerous outbuildings	Extant
18	4269 Limebank Rd	N ½ 18 II RF Gloucester	Gail Sharpe Farm	Farm residence and outbuildings	Listed CL	Brick house, many outbuildings	Extant
19	4469 Limebank Rd	N ½ 20 II RF Gloucester	C.J. Tripp	Residence	Listed	One and a half storey white clapboard house with double dormer. Property marked no trespassing, lane impassable. No buildings visible from road	Demolished ?
20	4500 Limebank Rd	E ½ 20 I RF Gloucester	Carmen Moodie Farm	Residence	Listed	Two-storey brick house with detailing. No building visible from road.	Demolished
21	4689 Limebank Rd	N ½ 22 II RF Gloucester		Farm residence & outbuildings	Listed CL	Two storey white house, small log house, two barns	Extant
22	4705 Limebank Rd	S ½ 22 II RF Gloucester		Barns	Listed	Modern house at this address. The remains of two outbuildings immediately to the southeast of this house probably represents the heritage structures. One has collapsed, the second is still	Extant

Table 4.2.6-1 Summary of Heritage Properties

No. on Figure	Municipal Address	Lot & Concession	Name	Nature	Designation	Comments	Status
						standing	
23	4776 Limebank Rd	23 I RF	Mahoney Farm	Farm residence & barns	Listed CL	Two storey brick house with central gable, two barns	Extant
24	4875 Limebank Rd	W ½ 24 II RF Gloucester	Bert Hanna	Residence	Listed	Three storey stone house with mansard roof. House was well set back from road. According to an area resident, the house burned a number of years ago	Demolished
25	4898 Limebank Rd.	24 I RF Gloucester	Thea Bossart Farm	Residence	Listed CL	Two storey stone house with central eave. Just south of study corridor	Extant
26	1425 Mulligan St.	N ½ 15 I RF Gloucester		Farm residence & outbuildings	Listed	Two-storey house with barn/garage. Just north of study corridor	Extant
27	497 River Rd	15 I RF Gloucester		Farm outbuildings	Listed	Small board barn with silo on south side. Modern house. Just north of study corridor. 3933 River rd at time of 1995 LACAC survey	Silo extant, barn demolished
28	538 River Rd	16 I RF Gloucester		Farm residence & outbuildings	Listed CL	Slightly gambrelled board barn (3 way stable), blue house. 4060 River rd at time of 1995 LACAC survey	Extant
29	564 River Rd	17 I RF Gloucester		Farm residence & outbuildings	Listed CL	Two storey beige house, veranda & balcony, sheds	Extant
30	River Rd	N ½ 19 BF RF Gloucester		Barn	Listed	Very poor condition at time of 1995 Gloucester LACAC survey. House had burned in 1989. 4192 River rd. at time of 1995 Gloucester LACAC survey.	Demolished
31	636 River Rd	19 BF RF Gloucester	J & L Butler	Residence	Listed	Two storey white house, well in front yard. 4280river rd at time of 1995 Gloucester LACAC survey	Extant
32	River Rd	19 BF RF Gloucester		Barns	Listed	Remains of two barns and a silo, located 300 m SW of 636 River rd. No address at time of	Demolished

Table 4.2.6-1 Summary of Heritage Properties

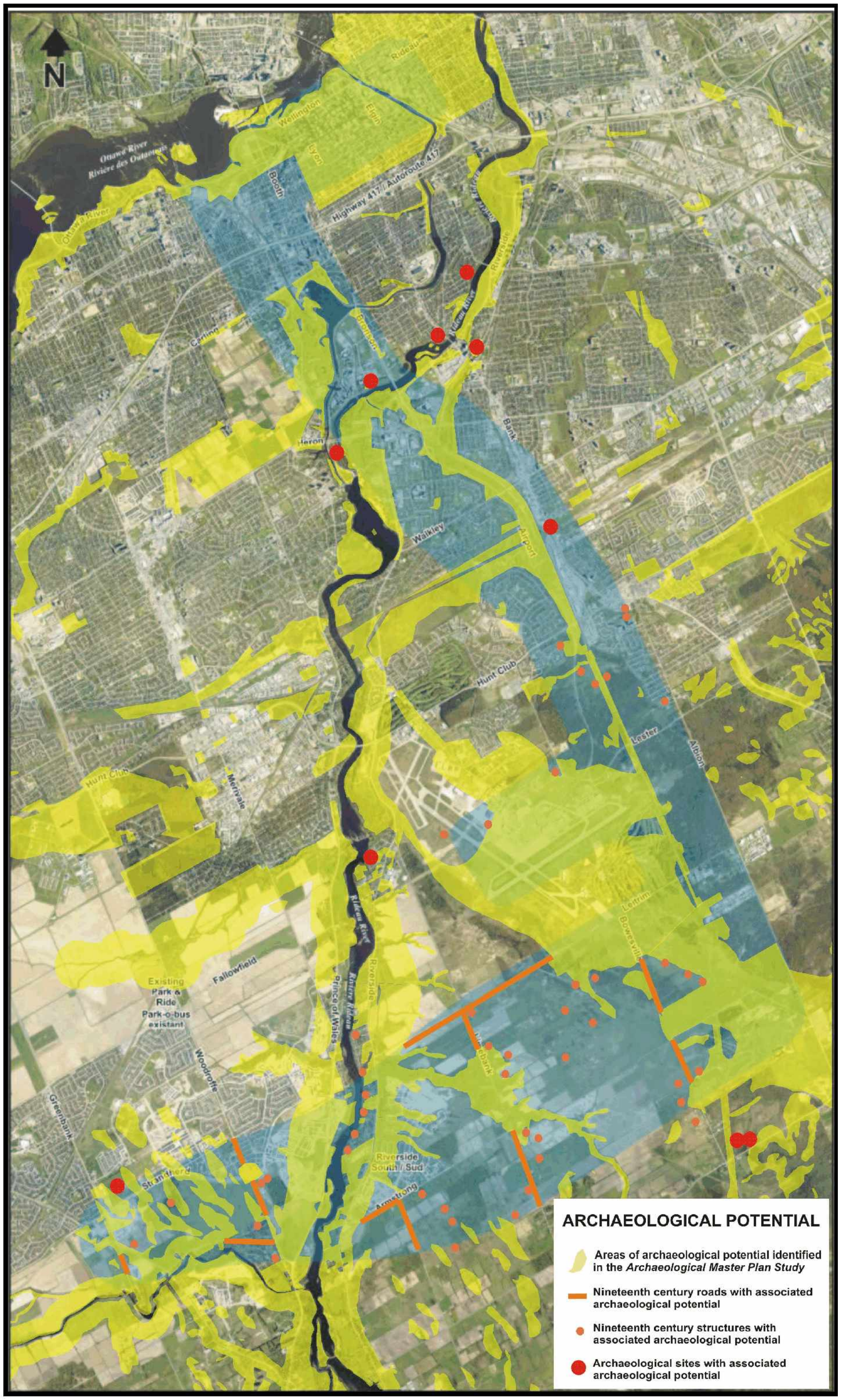
No. on Figure	Municipal Address	Lot & Concession	Name	Nature	Designation	Comments	Status
						1995 Gloucester LACAC survey	
33	River Rd	W ½ 20 BF RF Gloucester	Camille Collins	Residence	Listed	One and a half white clapboard house with long extensions. 4340 River road at time of 1995 Gloucester LACAC survey	Demolished
34	River Rd	20 BF RF Gloucester	James Moodie Family Cemetery	Cemetery	Listed CL	No address. Located on the west side of River rd. near the south edge of Claudette Cain Park	Extant
35	River Rd	20 BF RF Gloucester		Farm outbuildings	Listed	At time of 1995 Gloucester LACAC survey, abandoned farm, large ruin of barn and small shed. 4606 River rd. at time of 1995 Gloucester LACAC survey	Extant
36	River Rd	N ½ 21 BF RF Gloucester	Earl Armstrong	Farm residence and outbuildings	Listed	Large two-storey house, barns & silo ruin. 4498 River rd at time of 1995 Gloucester LACAC survey. May correspond to 708 River road	Demolished / ruin
37	River Rd	N ½ 22 BF RF Gloucester	Craig (A. Findlay, Mullvale investments)	Residence	Listed	House in woods 4622 River rd at time of 1995 Gloucester LACAC survey. Should correspond to 740 River rd but present house is modern	Demolished ?
38	River Rd	22 BF RF Gloucester		Residence	Listed	Two part two-storey house, joined by single storey. 4836 River rd at time of 1995 Gloucester LACAC survey. Should correspond to 788 River rd but house is modern	Demolished ?
39	39 Ryeburn Rd	18 I RF Gloucester		Residence	Listed	Small log house, modern house on lot.	Extant
40	110 Ryeburn Rd	18 I RF Gloucester	Dunlop House	Residence	Listed	Abandoned at time of 1995 survey; now occupied	Extant
41	4725	22 I RF	Panchuck	Farm	Listed CL	End to end board	Extant

Table 4.2.6-1 Summary of Heritage Properties							
No. on Figure	**Municipal Address**	**Lot & Concession**	**Name**	**Nature**	**Designation**	**Comments**	**Status**
	Spratt Rd	Gloucester	Farm	outbuildings		barns, log shanty	
42	4975 Spratt Rd	25 I RF Gloucester		Residence	Listed CL	Two-storey brick house. South of study corridor.	Extant
43	3436 Prince of Wales Dr.	12 I RF Nepean	Captain Stephen Collins House	Residence	Designated (IV)	Stone house, ca. 1830	Extant

There are 46 registered archaeological sites and a number of unregistered sites within the broad study area, and an additional 9 sites within two kilometres of the corridor. Details on the locations of these sites have not included in this report as the Ministry of Culture protects the specific location of known sites. The sites represent a range of prehistoric and historic period occupations dating from the Palaeo-Indian period through to the twentieth century. While some of these sites have been fully mitigated and a few do not merit further investigation, most have only been partially excavated and additional archaeological assessment would be required should they be impacted by planned construction.

The size of the present study area prevents a comprehensive determination of archaeological potential. The Archaeological Resource Potential Mapping Study of the Regional Municipality of Ottawa-Carleton: Technical Report (or Archaeological Master Plan) (Archaeological Services Inc. & Geomatics International Ltd. 1999b) provides a preliminary indication of archaeological potential. In general, lands within 300 m of the Rideau and Jock Rivers and within 200 m of smaller streams such as Sawmill Creek and Mosquito Creek have precontact archaeological potential. The large Greely Ridge and smaller drumlins located to the west also have potential for Native sites. Historic site potential is associated both with the location of known nineteenth century buildings and with early transportation corridors, including nineteenth century roads, the Bytown and Prescott Railway and the Rideau River/Canal. While recent urban growth has destroyed the archaeological potential of some locations, important archaeological deposits may remain even in heavily built-up areas. In addition, parts of the study area have seen little or no development in the twentieth century and have retained much of their archaeological integrity. While the potential map produced for the Archaeological Master Plan, and provided herein as Figure 4.2.6-4, appears reasonably accurate in delineating areas of prehistoric site potential, there are clear deficiencies in its identification of potential for historic period sites. Although some effort to address this issue has been made in the present study, more detailed historical research related to specific properties is required in order to obtain a complete assessment of archaeological potential.

Figure 4.2.6-4 Archaeological Potential



4.2.7 Contaminated Sites

A site contamination study was completed for the study corridor. Its principle objective was to identify areas of actual and potential site contamination. The study involved an analysis of all the historical records and documents regarding the study area and a site reconnaissance (visual inspection).

Historical Records and Reports

Applicable existing reports were compiled for the study area. These previous reports identified four areas of potential site contamination: 1) the CPR Ellwood/Prescott Subdivision; 2) CPR Walkley Train Facility (Walkley Road and Bank Street); 3) the former Gloucester Landfill (south of Letrim Road); and 4) Lebreton Flats. Please refer to Appendix G for a detailed list of reports reviewed.

Ellwood/Prescott Subdivision (O-Train Corridor)

A Phase I Environmental Site Assessment (ESA) of the CPR owned lands known as the Ellwood subdivision and a portion of the Prescott subdivision was completed in 2004 by AMEC for the City of Ottawa in order to identify environmental issues in support of acquisition of these railway lands (report available in Appendix G). The results of the Phase I ESA indicated that numerous areas of concern (AEC) and areas of potential environmental concern (APEC) reside at or in the vicinity of the O-Train corridor; from the Ottawa River to Letrim Road. Several AECs were identified on adjacent properties that lie in close proximity to the corridor.

Significant AECs involving petroleum hydrocarbon impacted soils were identified within the corridor. Contamination within the corridor was likely caused by the former Bruce Coal/Bruce Fuels Company (now Paradise Auto) and the NCC Breezehill Avenue lands (former Canadian Oil Company Limited lease). The cost to remediate the contaminated soil for both properties is estimated to be $190,000 (2005). Soil contaminated with heavy metals (e.g. iron ore pellets), as well as petroleum hydrocarbons, was identified across the former Ottawa West Yard, in the vicinity of the former 70-foot Roundhouse. Additional heavy metals impacts were observed over the length of the rock cut between Gladstone Avenue and Somerset Street. The cost to remediate both properties using conventional excavation techniques is estimated at over $2-million dollars (2005).

APECs were identified on adjacent properties to the O-Train corridor. The former Sunoco Hickory Street Terminal was located 30 m west of the corridor, north of Carling Avenue. Although the former Sunoco Hickory Street Terminal is no longer present, contamination may exist due to the reported presence of free phase liquid petroleum hydrocarbons beneath Hickory Street. Another APEC of notable significance included the former British American Oil Company petroleum bulk storage facility located immediately east of the corridor on the north side of Highway 417.

AMEC concluded that the above impacts were unlikely to pose a potential risk to humans given the current use corridor; however, future redevelopment could result in increased potential for exposure to humans and the environment, and increased risk and financial liability. AMEC recommended that supplemental Phase II ESAs should be carried out to assess the previously un-investigated APECs; confirm the site contamination conditions defined in previous reports; and further define the extent and magnitude of effects.

Note: a copy of AMEC's Phase I ESA report is included as Appendix B of the Site Contamination Study Report, which is attached as Appendix G of this report.

Walkley Train Facility

It has been established through previous studies that the Walkley Train Facility does contain some contaminants in the subsurface soil and water as a result of its previous use as a train facility. Some remediation work would be required to develop the site.

Gloucester Landfill

Several studies have been completed for the former Gloucester Landfill, of which the most comprehensive is the Area Wide Risk Assessment (AWRA) completed by Franz Environmental Incorporated in July 2003. The AWRA included a human health risk assessment and an ecological risk assessment. A review of the AWRA by a technical advisory committee concluded that the environmental conditions associated with the Gloucester Landfill do not represent either a human health or ecological risk to current or future land use.

Domestic waste was disposed of at the landfill, as were oils and cleaning solvents in drums or bulk quantities. Wastes generated by various federal departments were only removed from the special waste compound portion of the landfill between 1987 and 1989, though contaminants do remain and appear to be present east of the former landfill. A groundwater treatment facility was built in 1991/1992, and has been treating groundwater since that time. Three separate groundwater contaminant plumes have been identified migrating within and away from the former landfill though no adverse effects to sensitive receptors have been observed off-site.

Under Provincial law, no development can occur on a landfill that is less than 25 years old (without an MOE Order). Even though the property is federally owned, no restrictions exist concerning development of the landfill, other than Provincial law. The former Gloucester Landfill appears to be older than 25 years, and as such is most likely exempt from development restrictions. The remaining soil contamination can be mitigated, however, the costs to perform additional remediation is unknown at this time.

LeBreton Flats

Numerous environmental investigations and assessments have been completed for LeBreton Flats since 1991. Aqua Terre Solutions Incorporated completed an environmental site assessment if LeBreton Flats in 1998. The report included a screening-level risk assessment, which concluded that the most significant potential risks at LeBreton Flats are to future residentis and worker from exposure to polycyclic aromatic hydrocarbons (PAHs), heavy metals, and petroleum contaminated soil and ash. Another consulting firm, Dessau-Soprin Incorporated, completed a preliminary ecological and human health risk assessment in 2003, on behalf of the National Capital Commission (NCC). This report concluded that the potential for human health risks to the local population was limited to ingestion of contaminated soils prior to redevelopment of LeBreton Flats.

Historically, operations and activities such as foundries, rail storage facilities, coal storage, junk facilities, landfilling, and snow dumping have occurred at LeBreton Flats. Subsequent investigations have discovered the presence of petroleum hydrocarbons, PAHs, heavy metals, PCBs in varying concentrations in association with past land uses. Elevated levels of fuels, solvents, and metals have been detected in the soil, as well as in the groundwater. The highest level of soil impacts have been noted around Scott, Wellington, and Booth Streets.

Figures 4.2.7-2, 4.2.7-3 and 4.2.7.4 indicate the heavy metal, PAH and TPH (total petroleum hydrocarbons) plumes respectively. These plumes were modelled as part of a study of Lebreton Flats completed by Geosolutions for the NCC.

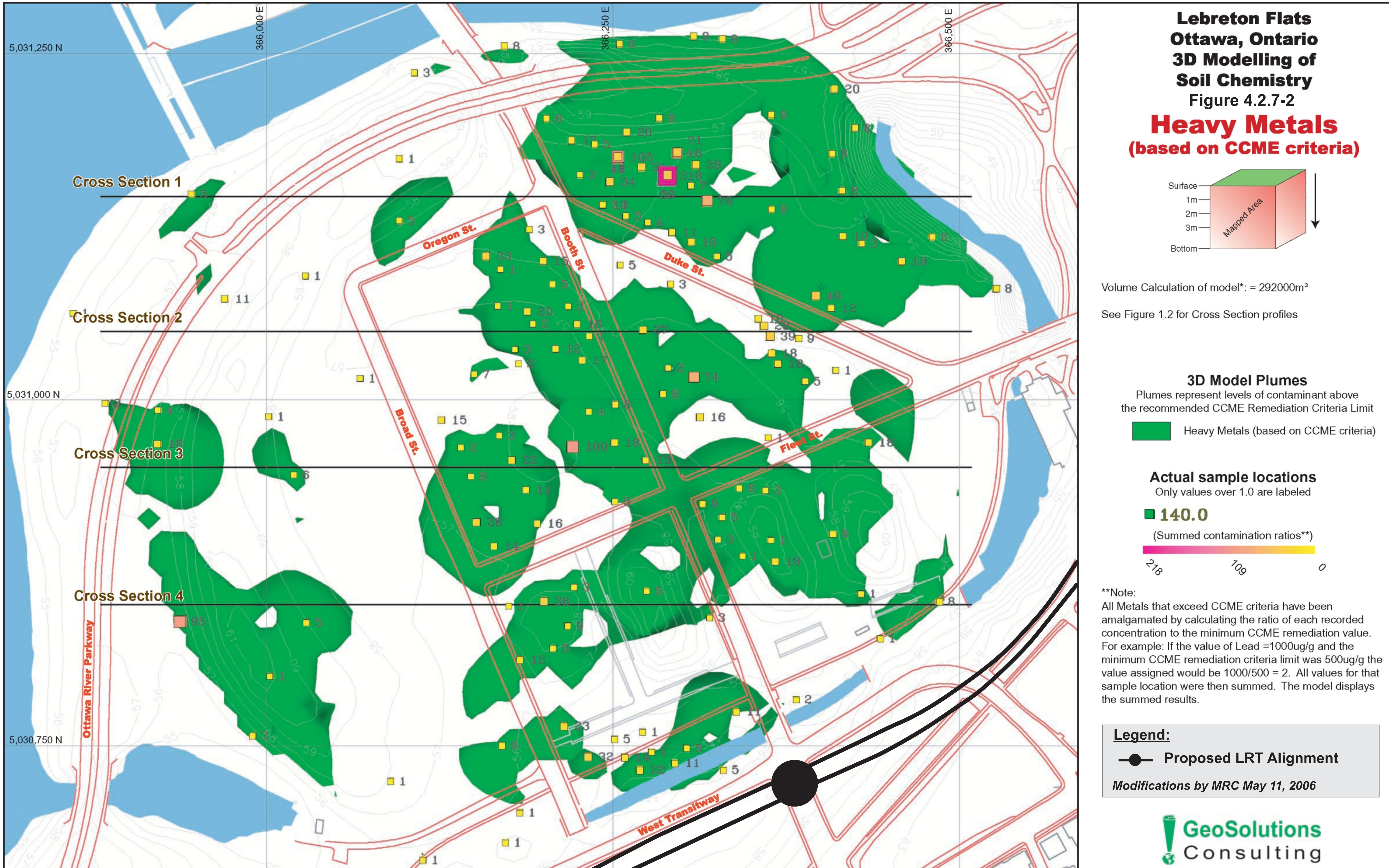
Previous reports on LeBreton Flats have concluded that areas exhibiting signs of surficial soil contamination should be capped if redevelopment is not going to occur within a short timeframe (1-5 years). Costs to fully remediate LeBreton Flats have been estimated at over $6 million dollars (1998), and do not include the cost to conduct methane gas monitoring in areas where historical dumps and landfills have been located. Further recommendations have concluded that a long-term plan to deal with the methane gas issue needs to be established should remediation of the area be considered as an option, prior to redevelopment.

In addition, a former fuel service station located north of the Queensway on the west side of the existing railway tracks (near Gladstone Ave) was identified as a point source for contamination observed to be migrating within the right-of-way of the existing O-Train corridor. No secondary source information regarding the completion of a human health or ecological risk assessment was identified for this former fuel service station.

Aerial Photographs

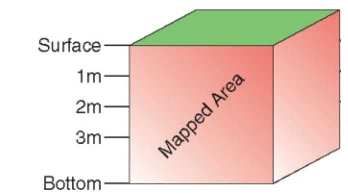
Historical aerial photographs were reviewed for the study area dated 1958, 1960/61, 1966, 1973/74, 1978/79, 1988, and 1998. The aerial photographs were viewed at the National Air Photo Library (NAPL) and the City of Ottawa Archives Department. Based on the review, the historical land use of the study area can be inferred as follows:

- Prior to the 1960's, the study area was residential and commercial north of Carling Avenue, and agricultural/undeveloped land south of Carling Avenue;
- North of the study area (LeBreton Flats) was many industrial operations and railway tracks, during the 1950's;
- By the late 1950's, subdivision construction was occurring northeast of the international airport, along the east side of the study area;
- Both the Canadian National Railway (CNR) and Canadian Pacific Railway (CPR) were operating in the 1950's;
- The land use remained the same throughout the 1960's, though residential units increased north of Carling Avenue;
- By the early 1970's, LeBreton Flats (adjacent to the study area) was cleared of industrial and rail facility operations, and was largely vacant (idle) land;
- By 1978, the study area was heavily developed east and west for residential land use. No significant new industrial activities were established;
- By the late 1980's, the study area was surrounded by residential and commercial operations. Barrhaven Town Centre had begun to expand slightly with residential development. The area south of the airport remained largely undeveloped;
- By the late 1990's, the study area and surrounding land was heavily urbanized (i.e. residential and commercial). Barrhaven Town Centre was expanding east towards the Rideau Canal and west through Nepean. The land south of the airport remained largely undeveloped except for scattered agricultural and livestock farming operations.



Lebreton Flats
Ottawa, Ontario
3D Modelling of
Soil Chemistry
Figure 4.2.7-2
Heavy Metals
(based on CCME criteria)
Surface
1m
2m
3m
Bottom
Mapped Area
Volume Calculation of model*: = 292000m³
See Figure 1.2 for Cross Section profiles
3D Model Plumes
Plumes represent levels of contaminant above the recommended CCME Remediation Criteria Limit
Heavy Metals (based on CCME criteria)
Actual sample locations
Only values over 1.0 are labeled
140.0
(Summed contamination ratios**)
218
109
0
**Note:
All Metals that exceed CCME criteria have been amalgamated by calculating the ratio of each recorded concentration to the minimum CCME remediation value. For example: If the value of Lead =1000ug/g and the minimum CCME remediation criteria limit was 500ug/g the value assigned would be 1000/500 = 2. All values for that sample location were then summed. The model displays the summed results.
Legend:
Proposed LRT Alignment
Modifications by MRC May 11, 2006
GeoSolutions
Consulting
5,031,250 N
5,031,000 N
5,030,750 N
366,000 E
366,250 E
366,500 E
Cross Section 1
Cross Section 2
Cross Section 3
Cross Section 4
Oregon St.
Booth St
Duke St.
Broad St.
Fleet St.
Ottawa River Parkway
West Transitway

Lebreton Flats
Ottawa, Ontario
3D Modelling of
Soil Chemistry
Figure 4.2.7-3
PAH
(based on CCME criteria)



Volume Calculation of model: = 19,900m³

See Figure 2.2 for Cross Section profiles

3D Model Plumes

Plumes represent levels of contaminant above the recommended CCME Remediation Criteria Limit

PAH (based on CCME criteria)

Actual sample locations

Only values over 1.0 are labeled

140.0

(Summed contamination ratios**)

452 226 0

**Note:
All PAHs that exceed CCME criteria have been amalgamated by calculating the ratio of each recorded concentration to the minimum CCME remediation value. For example: If the value of Lead =1000ug/g and the minimum CCME remediation criteria limit was 500ug/g the value assigned would be 1000/500 = 2. All values for that sample location were then summed. The model displays the summed results.

Legend:

Proposed LRT Alignment

Modifications by MRC May 11, 2006

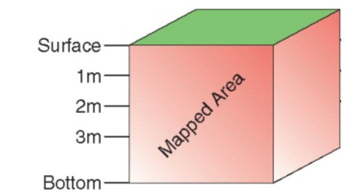
GeoSolutions Consulting

Lebreton Flats
Ottawa, Ontario
3D Modelling of Soil Chemistry

Figure 4.2.7-4

TPH

Petroleum Hydrocarbons (based on MOEE criteria)



Volume Calculation of model: = 18,700m³

See Figure 3.2 for Cross Section profiles

3D Model Plumes

Plumes represent levels of contaminant above the recommended MOEE Remediation Criteria Limit

TPH-Petroleum Hydrocarbons (based on MOEE criteria)

Actual sample locations

Only values over 1.0 are labeled

140.0

(Summed contamination ratios**)

27 13 0

**Note:
All TPH-Petroleum Hydrocarbons that exceed MOEE criteria have been amalgamated by calculating the ratio of each recorded concentration to the minimum MOEE remediation value.
For example: If the value of TPH-Gas/Diesel=2000ug/g and the minimum MOEE remediation criteria limit was 1000ug/g the value assigned would be 2000/1000 = 2. All values for that sample location were then summed. The model displays the summed results.

Legend:

Proposed LRT Alignment

Modifications by MRC May 11, 2006

GeoSolutions Consulting

Overall, the land use within the study area has changed significantly over the last 50 years. Industrial/commercial operations (primarily around LeBreton Flats) have appeared and disappeared, and residential land use has steadily increased. The area south of the airport has remained virtually unchanged (i.e. undeveloped), with scattered agricultural and livestock farming operations continuing to persist.

Between the 1950's and late 1980's, certain areas adjacent to the study area (i.e. LeBreton Flats) have changed land uses on several occasions. Based on the changes in land use observed during the aerial photograph review, the potential for site contamination does exist within the study area, primarily associated with historical industrial/commercial land uses (i.e. fuel service stations and demolished rail facilities).

It should be noted that agricultural and livestock farming activities have diminished slowly since the early 1970's. Based on the comparison of land uses observed during the site reconnaissance and those identified in the aerial photograph review, land use has shifted towards extensive areas of vacant (undeveloped) land.

Public Information Data Sets

Generator Registration Data Set

Based on the review of the MOE Generator Registration Data Set for 2002, 90 companies registered for the generation of subject wastes were identified, located within, and in proximity to, the study area. Companies that are registered for waste generation typically incorporate operations/processes that use and dispose of contaminants of concern (COC) such as solvents, petroleum products, and/or hazardous wastes.

Polychlorinated Biphenyl Storage Sites Data Set

Based on the review of the MOE PCB Storage Sites Data Set for April 2003, three registered PCB storage sites were identified in proximity to the study area and are presented in Table 4.2.7-1.

Table 4.2.7-1 Registered Storage Sites

Registration #	Company Name	Address	City
40288A214	Carleton University	1125 Colonel By Drive	Ottawa Ontario
40292A006	CAMDEV Properties Inc.	330 Sparks Street	Ottawa Ontario
40294A014	City of Ottawa	7 Bayview Road	Ottawa Ontario

Waste Disposal Sites

A review of the MOE report, entitled "*Waste Disposal Site Inventory*" (June 1991) was undertaken to identify officially active or closed waste disposal facilities within proximity of the study area. The inventory identified 10 officially closed waste disposal facilities within the vicinity of the study area.

Closed waste disposal sites may be contaminated with hazardous materials (i.e. lubricants, coolants, cleaning solvents); and poorly designed sites can result in a higher likelihood of surface soil and groundwater contamination. A list of the waste disposal sites is included in Table 4.2.7-2.

Table 4.2.7-2 Waste Disposal Sites

Registration #	County	City	Address	Date Closed	Facility Class
460701	Ottawa-Carleton	Gloucester	Unknown	1984	A1
1010	Ottawa-Carleton	Ottawa	Bayview Road and Slidell Street	1947	A5
1011	Ottawa-Carleton	Ottawa	LeBreton Flats	1964	A5
1020	Ottawa-Carleton	Ottawa	Burnside Avenue and Slidell Street	1947	A5
1021	Ottawa-Carleton	Ottawa	Scott Street (Laroche Park)	1920	A5
1023	Ottawa-Carleton	Ottawa	Broad Street (LeBreton Flats)	1920	A5
1101	Ottawa-Carleton	Ottawa	Prince of Wales Drive and Preston Street	1924	A5
1106	Ottawa-Carleton	Ottawa	Near Supreme Court Building	1944	A5
1111	Ottawa-Carleton	Ottawa	Carling Avenue and Loretta Avenue	1929	A5
1112	Ottawa-Carleton	Ottawa	Brewer Park	1935	A5

It should be noted that each of the closed waste disposal facilities are classified as Type “A”. Type “A” facilities are those which pose the highest hazard to human health, due to their proximity to urban development (e.g. employment areas and residences).

Federal Contaminated Sites Inventory

Based on a review of the Treasury Board of Canada Secretariat (TBCS) Federal Contaminated Sites Inventory, approximately 11 Federal properties are listed as being contaminated, within and surrounding the study area. All 11 properties are located within the LeBreton Flats area, adjacent to Wellington Avenue.

No records concerning rail accidents and/or cargo spills were identified, associated with any of the federally contaminated properties within or adjacent to the LRT corridor.

A list of the Federal contaminated properties is presented in Table 4.2.7-3.

Table 4.2.7-3 Table 4.2.7-3 Federal Contaminated Sites Federal Contaminated Sites

Department	Departmental Identifier	Site Number	Latitude/Longitude	Province
National Capital Commission	96037	00000015	45.41153/-75.71988	Ottawa Ontario
National Capital Commission	620	00000014	45.41174/-75.7156	Ottawa Ontario
National Capital Commission	96149	00000013	45.41307/-75.71423	Ottawa Ontario
National Capital Commission	96129	00000012	45.41307/-75.71423	Ottawa Ontario
National Capital Commission	99563	00000011	45.41367/-75.71183	Ottawa Ontario
National Capital Commission	96135	00000010	45.41388/-75.71278	Ottawa Ontario
National Capital Commission	96152	00000009	45.41405/-75.71106	Ottawa Ontario
National Capital Commission	96139	00000008	45.41437/-75.712	Ottawa Ontario
National Capital Commission	99565	00000007	45.41435/-75.71077	Ottawa Ontario
National Capital Commission	96160	00000006	45.41487/-75.70938	Ottawa Ontario
National Capital Commission	96144	00000004	45.41536/-75.71085	Ottawa Ontario

Historical Fire Insurance Plans

Historical fire insurance plans for 1878, 1888, and 1956 were reviewed at the National Archives of Canada and the City of Ottawa Archives Department. No information pertaining to USTs, ASTs, or ACMs was identified in the 1878 or 1888 fire insurance plans; however, multiple records for downtown Ottawa were available in the 1956 fire insurance plans. Within and surrounding the study area east of Booth Street, several historical USTs and ASTs used for heating oil and fuel storage (e.g. gasoline) were identified. Also identified were numerous automotive repair shops and service stations, as well as small industries (e.g. coal facilities and maintenance facilities).

It should be noted that no pertinent fire insurance plans for the rest of the study area (i.e. south of Carling Avenue) were available. This is due to the fact that the majority of the land use was classified as agricultural or vacant (idle) land.

Site Reconnaissance

A site reconnaissance of the study area was carried out on August 19 and 20, 2004. The purpose of the inspection was to look for any visual indications of actual or potential contamination within the study area.

It should be noted that the site reconnaissance did not include any building inspections or comprehensive exterior inspections of any of the properties in the study area. Therefore, any inferences regarding the presence of actual or potential site contamination is strictly based on visual observations from the roadside.

No areas of actual contamination were identified within the limits of the study area during the site reconnaissance; however, the following features which may represent sources of potential contamination were observed:

- Existing rail facility and maintenance facility located southeast of Walkley Road and Bank Street;
- Fuel service station located on the northeast side of Armstrong Road and Riverside Drive; and
- Fuel service station located on the northwest side of Woodroffe Avenue and Strandherd Drive.

The proposed LRT corridor would likely follow the existing rail line to Leitrim Road (south of the Macdonald-Cartier International Airport). As such, potential shallow soil and groundwater contamination may exist within the land parcels on and/or adjacent to the tracks. Railways can be developed on poor quality fill and ballast material. Also, the passage of trains may result in contamination of the track bed; either resulting from train/track abrasion (i.e. metal dust and lubricants), or from train cargo spills. However, the potential for site contamination resulting from this activity is considered low.

Reeds and cattails were observed in drainage ditches throughout the study area. These hydrophytes grow in shallow water, and were noted as possible evidence of shallow groundwater. In general, drainage ditches may represent a potential pathway for any contamination that may be present within the study area.

Summary of Contaminated Sites

Based on the results of the records review, properties with actual contamination were identified within and surrounding the study area; as well as potential sources of contamination associated with current and historical land uses. During the site reconnaissance of the study area, no areas of actual site contamination were identified; however, sources of potential contamination within the study area were observed (i.e. commercial/industrial operations).

Actual soil and/or groundwater contamination exists surrounding the study area, associated with the Ellwood/Prescott Subdivision (see Appendix G [Appendix B of the Site Contamination Study Report]), Walkley Train Facility, former Gloucester Landfill, LeBreton Flats, and four federal contaminated sites. Each of these areas is known to have soil and/or groundwater contaminated with hazardous substances such as petroleum hydrocarbons, polycyclic aromatic hydrocarbons (PAHs), and heavy metals. Due to the proximity of some of these properties to the study area, it is believed that the potential for site contamination could be high (depending on the actual route selected for the LRT corridor).

Potential soil and groundwater contamination may exist within the study area as a result of the following identified current and historical industrial/commercial land uses:

- Closed waste disposal facilities – oils, paints, corrosive cleaners, methane gas, lead, and ACMs;

- Registered waste generators – petroleum hydrocarbons, solvents, compressed gases, hazardous solid, liquid, and aerosol products;
- Registered PCB storage sites – polyvinyl chloride (PVC) products, construction and building materials, and organochlorine chemicals;
- Rail facility and maintenance facility – diesel and gasoline fuel, solvents, cleaners, rust inhibitors, and creosote; and
- Fuel service stations – BTEX compounds (benzene, toluene, ethyl benzene, xylene), petroleum hydrocarbons, hydraulic oils and lubricants, lead and acid, and compressed gases.

The potential for contamination associated with these land uses is primarily concentrated along the north portion of the study area (north of Heron Road). The most likely pathway for potential contaminants from these land uses is through perched/shallow groundwater, surface water run-off along drainage ditches or utility conduits (e.g. sewer and water lines), and adjacent watercourses.

Figure 4.2.7-1 illustrates the areas of potential soil and groundwater contamination. These areas have been categorized by assessing the overall relative potential of contamination in the study area from commercial/industrial land uses. This is explained below:

High Potential for Soil and Groundwater Contamination

Red highlights indicate areas with a high potential for soil and groundwater contamination. The red highlights typically correspond with locations within and adjacent to the study area where land uses consist of known contaminated properties; or current and historical industrial/commercial operations.

Based on the nature of the above-noted land uses, there is the high potential that some or any of these products and wastes may have been released into the environment and contaminated the soil and/or groundwater within the study area.

Moderate Potential for Soil and Groundwater Contamination

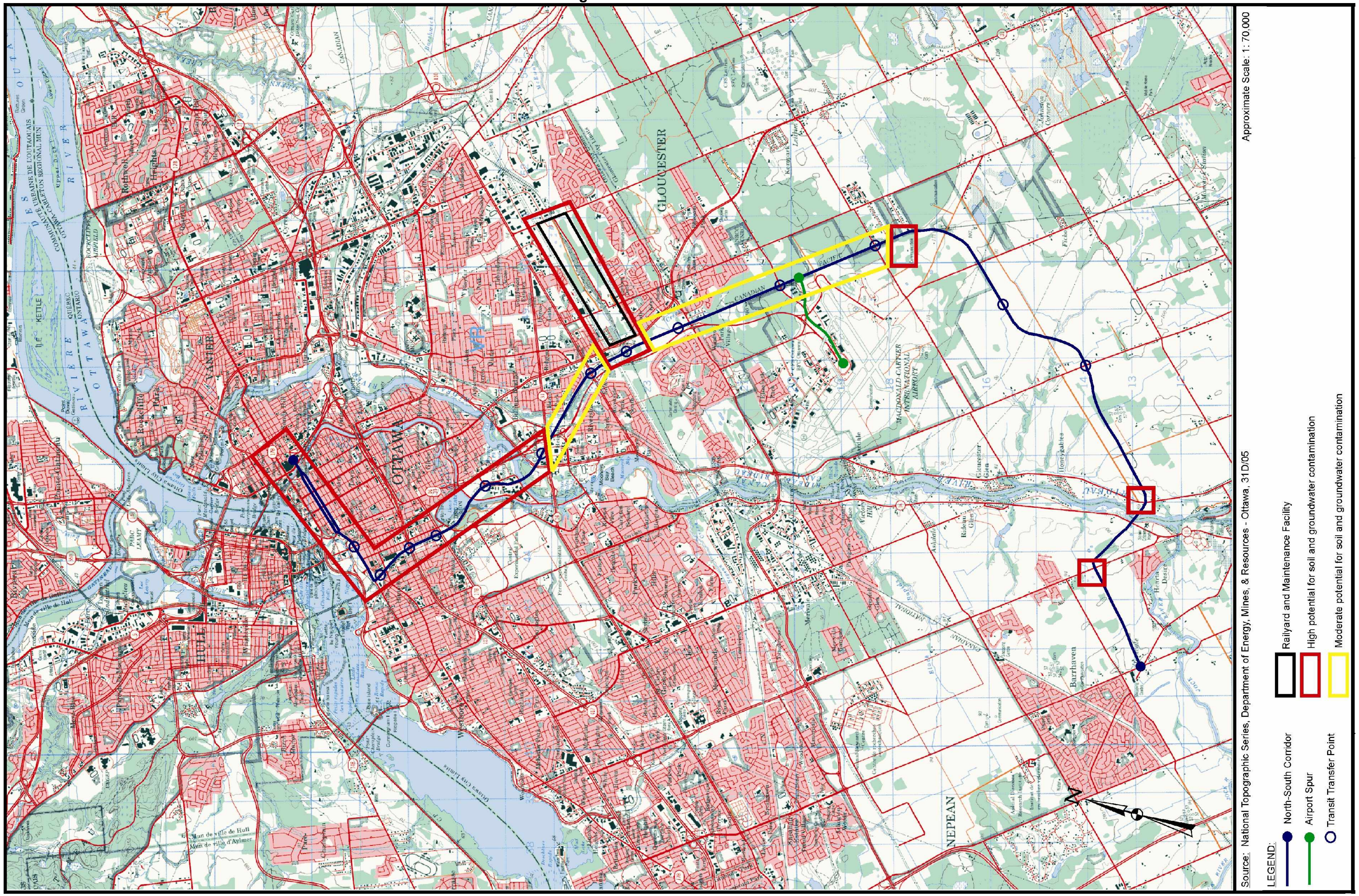
Yellow highlights indicate areas with a moderate potential for soil and groundwater contamination. These areas represent land uses that are generally residential and light commercial in nature, and have limited potential for site contamination within and surrounding the study area.

Low Potential for Soil and Groundwater Contamination

Areas not highlighted indicate a low potential for soil and groundwater contamination. These areas represent land uses that are agricultural or undeveloped. Historically, the study area was predominantly agricultural land until approximately the early 1980's. Since this time the land use has shifted towards localized areas of livestock farming and vacant (idle) land.

Given that pesticides may have been used more heavily on agricultural cropland in the past rather than in the present (due to decreased crop farming), it is believed that the likelihood of historical pesticide accumulation in the soil and groundwater is considered low.

Figure 4.2.7-1 Potential Soil and Groundwater Contamination



Contaminant Mobility

Based on the known geological and hydrogeological conditions present within the study area – particularly around the areas identified as having a high potential for soil and groundwater contamination (Figure 4.2.7-1) – the inferred mobility of any contamination would likely be of low to moderate significance.

The surficial geology within and surrounding the study area is primarily composed of silts and clays (associated with till and marine deposits), interspersed with smaller pockets of surficial sand. Silts and clays typically exhibit low permeability rates, and therefore inhibit vertical and lateral contaminant migration. However, sand pockets at or near the surface (or overlying the bedrock) will generally have higher permeability rates, and therefore transmit groundwater more readily within the aquifer system.

The drift thickness of the north portion of the study area (particularly in the downtown core) is relatively thin, ranging between 1.0 to 10 m. The drift thickness along the south portion of the study area (south of the Macdonald-Cartier International Airport) is more significant; ranging between 10 to 25 m. In general, greater drift thickness can reduce the potential for contamination of the overburden and bedrock aquifer systems; due primarily to the increase in the time available for natural attenuation processes to occur (i.e. the capacity of a material to remove contaminants from the environment).

It should be noted that contaminant migration into the overburden and regional aquifer systems can occur in low-lying areas where water collects (i.e. troughs and depressions); along man-made depressions (i.e. building foundations, utility conduits, and drainage ditches); or where permeable materials (i.e. sands and gravels) are located near the surface. Each of these processes could have a significant effect on contaminant mobility at a local scale.

4.2.8 Transportation

Transit Network

The City of Ottawa's current Transit route network is made up of six components as shown in Figure 4.2.8-1:

2. Transitway Service
3. O-Train Service
4. Main Line Service
5. Local Service
6. Express Service
7. Employment Area Service

The Transitway Service has high frequency, high-capacity rapid transit bus routes running on an exclusive right-of-way. The rapid transit system currently stretches from east of Blair in the east, to Woodroffe/Baseline in the southwest, and to South Keys in the southeast. Rapid Transit quality service with dedicated bus lanes and bus priority measures extend the reaches of the Transitway to the main suburban nodes of Kanata, Stittsville, Orleans, Barrhaven and the Airport.

The O-Train service is a high-capacity rapid transit rail service first introduced as a pilot project in the fall of 2001. It is a diesel rail transit service that is operated on land purchased by the City of Ottawa from Canadian Pacific Railway branch. The corridor has 5 stations with a total length of 8 km between Bayview and Greenboro.

Main line bus transit service consists of regular routes operating all day, seven days a week on city streets. It connects communities, activity centres and other transit focal points. As the Rapid Transit Network expands, new rapid transit lines will replace some of these main line service routes.

The City of Ottawa's local service is comprised of feeder bus routes that connect residential and employment areas to rapid transit terminals.

The Express Service is a direct-to-downtown bus route operating during peak periods to minimize the need for travelers to transfer between buses. The express service runs mostly to and from the suburban areas outside the Greenbelt such as Orleans, Kanata and Barrhaven; however, there are a few in older suburbs within the Greenbelt.

Roadway Network

The Roadway Network within the study corridor represents an assortment of major arterial roadways serving north-south traffic to a major provincial 400 series highway (Hwy. 417 - Queensway providing a major cross-town corridor (east-west traffic). Further south, Hunt Club Road provides for additional arterial-based cross-town traffic service along its east–west axis. North-South traffic service is provided by Bronson Avenue / Airport Parkway which parallels the study corridor stretching from downtown Ottawa to the Airport. In the core of Ottawa, Bronson Avenue functions as a major urban arterial throughout its length, providing full access to adjacent property owners and has at-grade signalized intersections. South of the Rideau River, the Airport Parkway functions with controlled access and full grade separation along much of its length.

Just outside the study corridor, Bank Street and Riverside Drive also provide north-south capacity to neighbourhoods within, and adjacent to, the study area. Riverside Drive converges on the corridor just south of the Rideau River and intersects with Bank Street at Billings Bridge.

North of the Rideau River, the roadway system resembles a grid pattern with typical urban cross-sections, signalization and limited opportunities for expansion due to the built urban form. The density of the network increases as one approached the downtown core.

South of Hunt Club Road, much of the arterial road service is accommodated with rural cross-sections, limited need for traffic signalization and the arterial spacing reflects of the current low density development patterns.

Future Roadway Expansion

The Transportation Master Plan (TMP) as a supporting document to the Official Plan was completed in September 2003. The TMP recognizes the growth management goals outlined in the Official Plan and strives to minimize the future need for new road widening while avoiding levels of congestion that would result in unacceptable impacts for Ottawa's quality of life and economy in terms of delay to persons and goods, air pollution and road safety. A key cornerstone of the TMP is its adoption of a Transportation Vision – ***"In 2021 Ottawa's Transportation System will enhance our quality of life, respect the natural environment, enhance the economy, and be managed in a responsible and responsive manner."***

Additional roadway capacity to maintain an adequate Level of Service on the arterial road system is documented in the TMP and includes the expansions to Limebank, Leitrim, Armstrong, Strandherd Roads and the crossing of the Rideau (2008), Albion Road (2021) and roadways outside the study area including Prince of Wales (2013).

The City of Ottawa urban and rural road networks as contained in the TMP (Map 6 and 8) are shown in Figures 4.2.8-2 and 4.2.8-3.

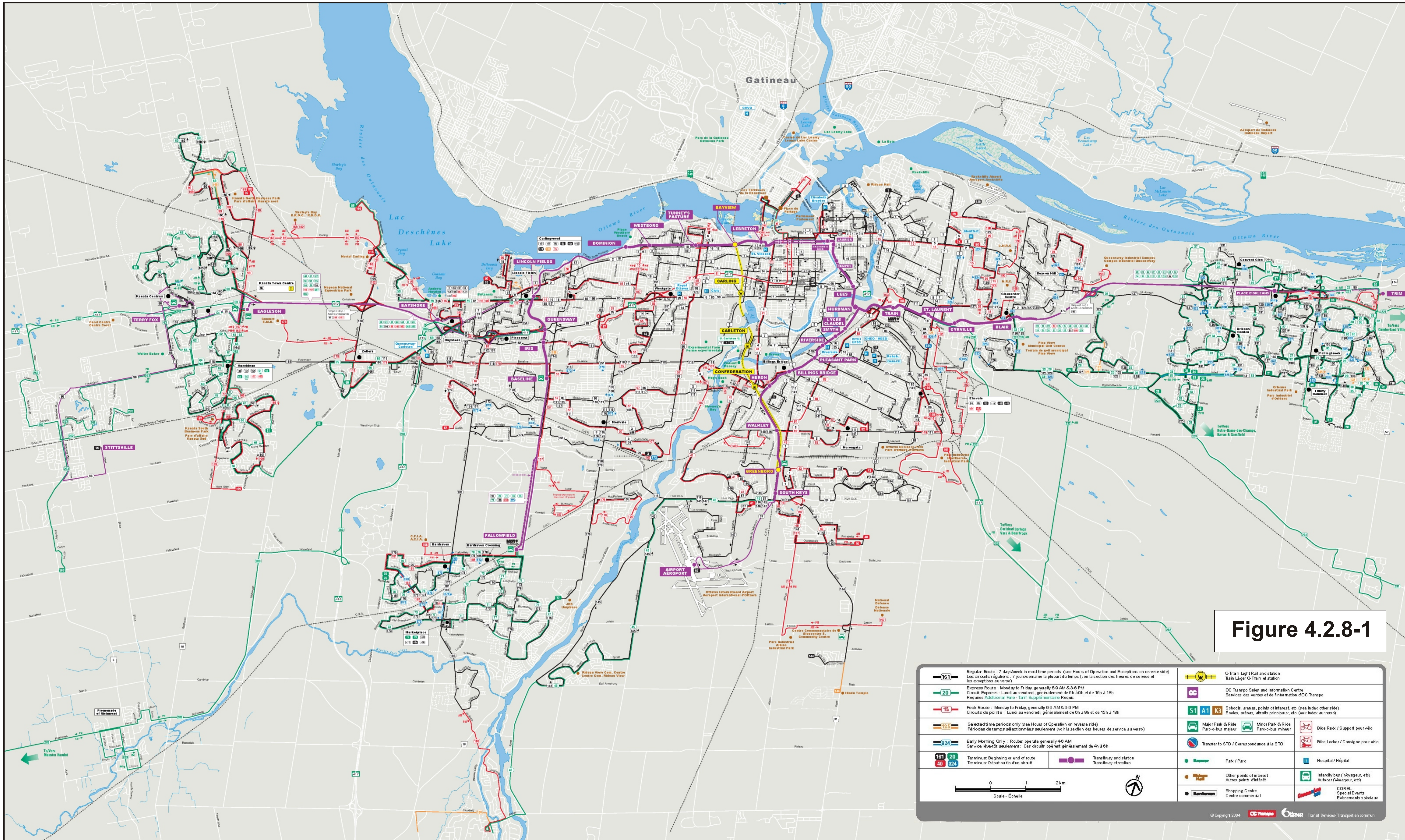

Gatineau
Lac Deschênes Lake
Ottawa River
Rivière des Outaouais
BAYVIEW
TUNNEY'S PASTURE
WESTBORO
DOMINION
LEBRETON
LINCOLN FIELDS
CARLING
CARLETON
CONFEDERATION
HERON
WALKLEY
GREENBORO
SOUTH KEYS
BAYSHORE
QUEENSWAY
IRIS
BASELINE
EAGLESON
TERRY FOX
STITTSVILLE
FALLOWFIELD
AIRPORT AEROPORT
LEES
HURDMAN
LYCEE CLAUDEL
SMYTH
RIVERSIDE
PLEASANT PARK
BILLINGS BRIDGE
TRAIN
ST. LAURENT
CYRVILLE
BLAIR
PLACE D'ORLEANS
TRIM
Regular Route : 7 days/week in most time periods (see Hours of Operation and Exceptions on reverse side)
Les circuits réguliers : 7 jours/semaine la plupart du temps (voir la section des heures de service et les exceptions au verso)
Express Route : Monday to Friday, generally 6-9 AM & 3-6 PM
Circuit Express : Lundi au vendredi, généralement de 6h à 9h et de 15h à 18h
Requires Additional Fare - Tarif Supplémentaire Requis
Peak Route : Monday to Friday, generally 6-9 AM & 3-6 PM
Circuits de pointe : Lundi au vendredi, généralement de 6h à 9h et de 15h à 18h
Selected time periods only (see Hours of Operation on reverse side)
Périodes de temps sélectionnées seulement (voir la section des heures de service au verso)
Early Morning Only : Routes operate generally 4-6 AM
Service lève-tôt seulement: Ces circuits opèrent généralement de 4h à 6h
Terminus: Beginning or end of route
Terminus: Début ou fin d'un circuit
Transitway and station
Transitway et station
0 1 2 km
Scale - Échelle
N
O-Train Light Rail and station
Train Léger O-Train et station
OC Transpo Sales and Information Centre
Services des ventes et de l'information d'OC Transpo
Schools, arenas, points of interest, etc. (see index other side)
Écoles, arénas, attraits principaux, etc. (voir index au verso)
Major Park & Ride
Parc-o-bus majeur
Minor Park & Ride
Parc-o-bus mineur
Bike Rack / Support pour vélo
Transfer to STO / Correspondance à la STO
Bike Locker / Consigne pour vélo
Park / Parc
Hospital / Hôpital
Other points of interest
Autres points d'intérêt
Intercity bus (Voyageur, etc)
Autocar (Voyageur, etc)
Shopping Centre
Centre commercial
COREL
Special Events
Evénements spéciaux
© Copyright 2004
Transit Services- Transport en commun

Figure 4.2.8-1

Figure 4.2.8-2 Transportation Master Plan Map 6 Urban Road Network

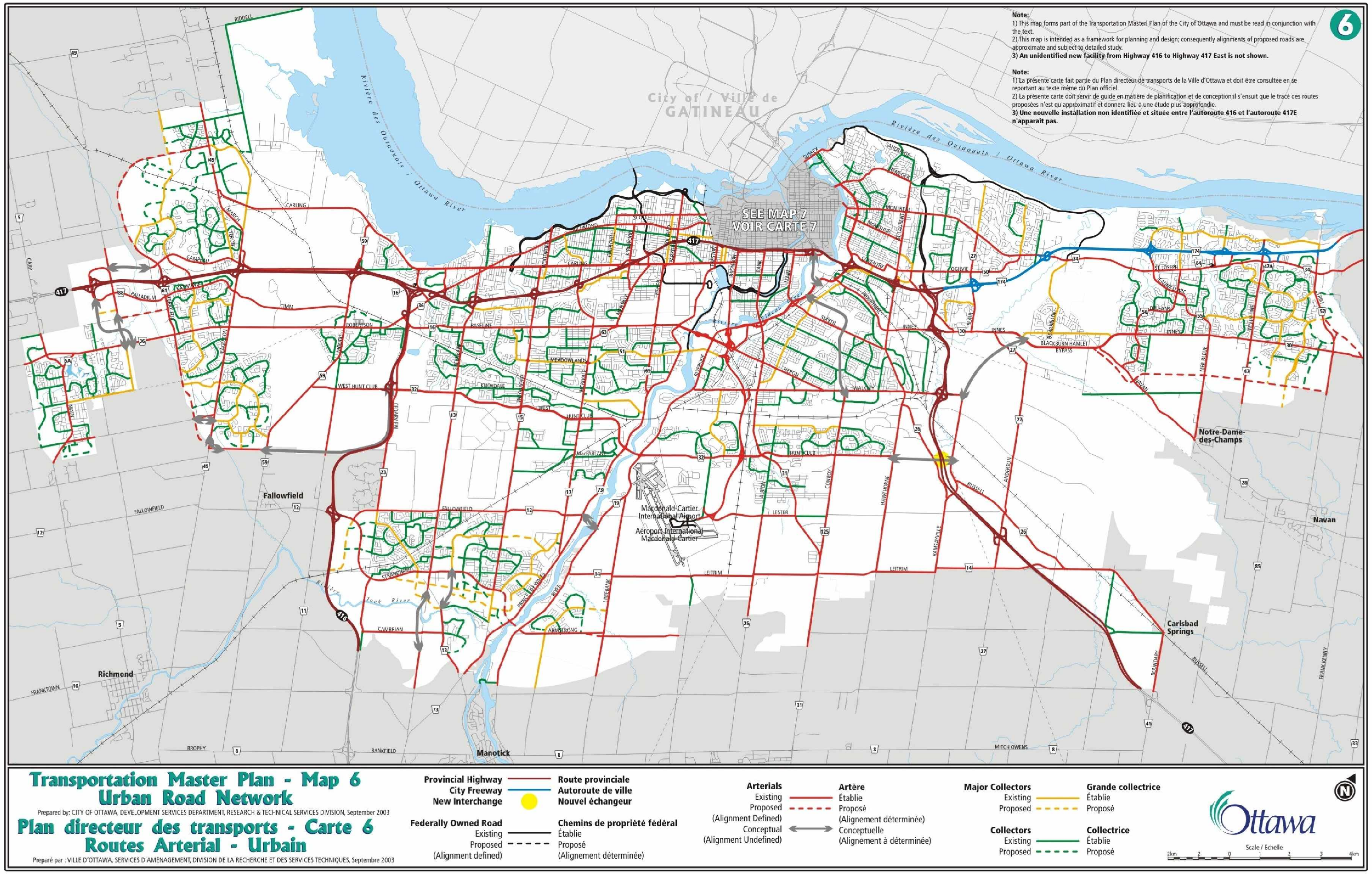
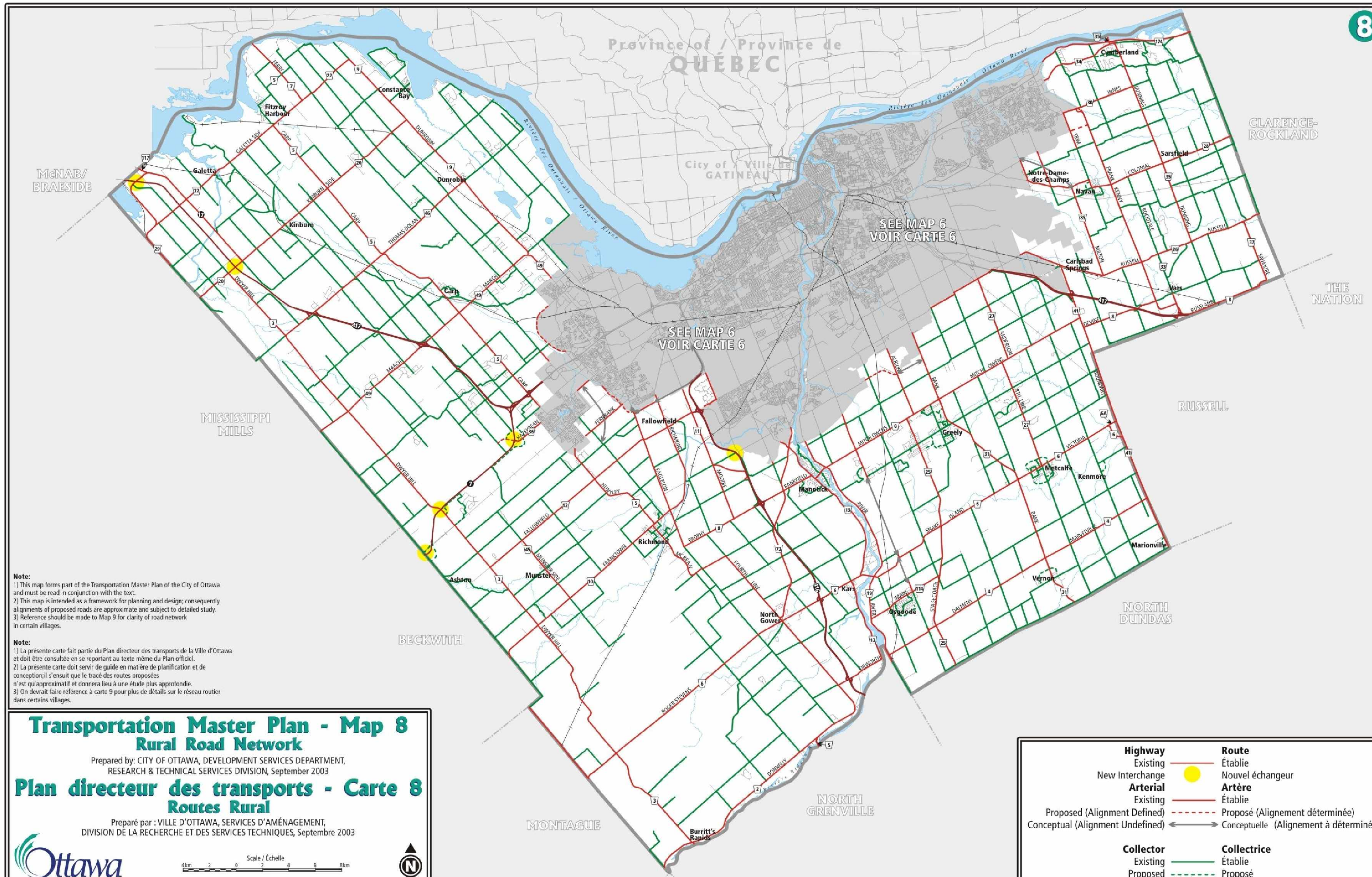


Figure 4.2.8-3 Transportation Master Plan Map 8 Rural Road Network



4.2.9 Utilities

There are a number of existing underground and overhead utilities within the recommended LRT Corridor that are affected by the project. These were identified and assessed based on reviews of available utility base mapping and as-built information provided by the City of Ottawa. Follow-up meetings were also held with the affected utility companies. All known utility features have been compiled onto a composite utility base plan.

In addition, the EA Study Team has made three separate presentations to the Ottawa Utilities Coordinating Committee (UCC) to provide updated information on the progress of the study and proposed alignment information.

The following utilities have been contacted over the course of the study and have confirmed the location of existing plant, identified potential conflicts and provided preliminary relocation cost estimates (where applicable):

- Hydro Ottawa
- Hydro One
- Bell Canada
- Enbridge Consumers Gas
- Group Telecom
- Rogers
- Allstream
- Sprint (Call-Net)
- Level 3 Communications
- 360º Networks (Group Telecom/Bell)
- PWGSC (Steam Plant)
- Trans-Northern Pipelines Inc.
- City of Ottawa
- Videotron

There has also been on-going co-ordination with City utilities (sewer, water, street lighting and traffic signals), including the proposed high and low-pressure water main (Lines ‘A’, ‘B’ and ‘C’) replacement projects. The City of Ottawa has carried out closed-circuit television (CCTV) inspection of all existing sewers along Albert and Slater Streets (including cross-streets) to assess the need to rehabilitate or reconstruct any existing storm, sanitary or combined sewers.

The majority of notable utility conflicts will occur in the downtown (Bronson to Elgin) since all the major streets downtown have a wide variety of underground utilities. The existing O-Train alignment has some utilities that cross and run parallel to the tracks. Sprint, Level 3 Communications and 360º Networks all have fibre-optic cables (long distance carriers) running along the existing O-Train Corridor between Bayview and Leitrim. All three utilities have determined that their plant is in conflict with the proposed LRT line. Most of the cable is buried with some rigid duct banks running above ground at a number of structures. Level 3 Communications is located south of Walkley only and 360º Networks is located north of Walkley only.

There are only minor conflicts along the Corridor south of Leitrim through the proposed Riverside South Community and into Barrhaven. These are related to existing storm and sanitary sewer and water main crossings. There is also a Trans-Northern Pipeline crossing. There are strict regulations regarding what can be constructed on top or adjacent to the pipeline; therefore, a guideline has been provided for construction in the vicinity of these pipelines. Capital Railway is currently signatory to the Transport Canada *Standards Respecting Pipeline Crossings Under Railways*. This standard outlines requirements for pipelines within the right-of-way. The standard can be reviewed online at: http://www.tc.gc.ca/railway/Rules/TC_E-10.htm.

4.2.10 Noise

A detailed noise assessment was undertaken as part of this study. The noise assessment examined operational noise issues and construction noise issues. Section 5.1.2.6 outlines the results of this assessment. The full report is included in Appendix D. The following provides a general overview of the existing noise conditions.

Noise sensitive receptors of concern within the study area are located adjacent to (within 75 m) the proposed and existing LRT line and in close proximity to (within 400 m) the alternative Maintenance Facility Sites. Residences have different setback distances and various degrees of visual screening from the LRT system. In keeping with Ministry of the Environment (MOE) and Health Canada (HC) practices, noise sensitive receptors include the following existing and zoned for future use land uses:

- Permanent and seasonal residences;
- Hotels, motels and campgrounds;
- Churches and places of worship;
- Hospitals and senior's residences;
- Universities, schools, and daycare centres; and
- Sites within the study area where socially significant First Nations cultural or religious ceremonies may take place.

It should be noted that industrial and commercial land uses are not considered noise sensitive land uses, and have not been included in the assessment (other than hotels, schools, and the National Arts Centre). The noise sensitive land uses included in the assessment are consistent with the definitions used in Health Canada's draft "Fact Sheet for Noise (2005)".

A total of 20 noise sensitive receptors (NRs), typically residences, were selected as representative of locations where worst-case noise effects were expected to occur. Impacts to any other NRs in the study area would be less than at these receptors. The selected receptors include residential areas, downtown hotels, Carleton University, and the National Arts Centre/Rideau Canal docks. The NRs included in the noise assessment are illustrated in Figures 2a-p of Appendix D and outlined in Table 4.2.10-1. The approximate setbacks shown are for the ultimate track locations.

Table 4.2.10-1: Location and Descriptions of Noise Receptors

Modelled Receptor	Approximate Setback Distance to LRT Line (m)	Description
NR1 $^{M, W}$	26	National Arts Centre and Rideau Canal docks
NR2	7	Arc De Hotel
NR3	7	Albert at Bay Suites
NR4	12	470 Albert Residences
NR5 ^{M}	15	481 Slater Residences
NR6	29	Bayview Residences
NR7	71	Breezehill Residences
NR8	26	Champagne Residences
NR9	27	Norman Residences
NR10	59	Carling Residences
NR11	64	Carleton University Residences
NR12 ^{M}	31	Brookfield Residences (Junction/Sawmill)

Table 4.2.10-1: Location and Descriptions of Noise Receptors		
Modelled Receptor	**Approximate Setback Distance to LRT Line (m)**	**Description**
NR13	26	Traverse Drive Residences
NR14	40	Carleton University Engineering
NR15	59	School
NR16 [M, Y]	382	Haxby Residences
NR17 [Y]	342	Viking Residences
NR18	32	Leitrim Residence
NR19	27	Cresthaven Residences
NR20 [M]	47	Timberline Residences
NR21 [P]	n/a	Sandstone Court Residences
NR22 [P]	n/a	Wildshore Residences
NR23 [P]	n/a	Planned Residences (zoned for future use)
NR24 [P]	n/a	East Leitrim Residences

Notes: (M) denotes an ambient measurement location
(W) denotes receptor near the outlet of the Rideau Canal at the Mackenzie King Bridge. During summer months boats may dock near this location. This receptor is representative of noise impacts on these temporary boating receptors
(Y) denotes locations adjacent to maintenance and storage facility
(P) denotes locations adjacent to station parking lots
n/a Not applicable. These receptors are near Station parking lots or the rail facility, but are at significant distances to the main LRT line. These receptors are used to estimate noise from these “stationary “ noise sources.

Receivers 19-24 are located in the areas of Riverside South and Barrhaven that are planned to be redeveloped to mix-use communities in the future. The LRT system is a key piece of infrastructure required to support these developments. The noise assessment addresses potential adverse effects on existing receptors and on future receptors that are currently under construction. These receivers were chosen to demonstrate the potential adverse effects the project would have on noise levels in these areas.

There are existing noise barriers in the area of Traverse Drive, installed as pat of the original O-Train pilot project. These noise barriers will remain. See Figure A1 of Appendix D. The acoustical effects of these barriers have been considered in this analysis.

In order to quantify current ambient sound levels at the receptors, on site measurements were conducted. In June 2005, long-term sound monitors were installed at receptors NR1, NR5, NR12, NR16 and NR20. The locations were chosen on the basis of their orientation, track exposure, setback distance and existing ambient sound environment, and are representative of existing ambient noise conditions at all receptors. Measurements were conducted for a minimum 48-hour basis.

Measured ambient sound levels include contributions from rail noise, road noise, industrial noise and sounds of nature. It was not considered necessary to measure noise at each receiver given the urban nature of the area. The chosen receiver locations measured, provided a range of urban ambient sound environments. For receptor locations where no monitoring occurred, ambient sound levels from the closest measurement location or areas with a similar ambient sound environment were applied. Results from the measurements, in addition to applicable modelled receptors are presented below in Table 4.2.10-2.

Measurement results are shown graphically in Appendix D for each of the five measurement locations, along with the raw measurement data. Generally, these measured sound exposures are consistent with typical urban environments in proximity to transportation corridors.

Table 4.2.10-2: Measured Ambient Sound Levels

Measured Receptor	Other Receptors Where Same Levels Apply	Daytime Sound Levels		Night-time Sound Levels		L_{eq}(30 min) Levels [1]	
		L_{eq} (16 h)	L_{eq} (15 h)	L_{eq} (8 h)	L_{eq} (9 h)	Minimum	Peak
NR1	NR2	68	69	62	62	65	71
NR5	NR3, NR4	71	71	64	64	66	75
NR12	NR6-NR11, NR13-NR15	59	59	53	53	54	66
NR16	NR17	53	53	48	49	51	56
NR20	NR18, NR19, NR21-NR24	50	50	44	45	46	54

Notes: (1) Minimum L_{eq} (30 min) is the minimum measured 30 minute L_{eq} to occur through the entire daytime period (0700 to 2300h). Peak L_{eq} (30 min) is the highest measured 30-minute L_{eq} to occur through the entire day.

– All sound levels are presented as energy equivalent sound levels (L_{eq}), in dBA.

The sound environment at the site directly backing onto the existing O-Train line (NR12) was dominated by rail traffic noise and in the absence of rail noise, by sounds of road traffic from Airport Parkway. The sound environment of receptors in the downtown area, at close setbacks to the proposed LRT line (NR1, NR5), was dominated by the sounds of local road traffic with city buses as the most significant source. The sound environment of the receptor in close proximity to the Ottawa Central Railway facility (NR16) and Barrhaven Town Centre (NR20) was dominated by local road traffic noise and in the absence of road traffic noise by sounds of nature (birds, rustling leaves, etc.).

5.0 Environmental Effects and Mitigation

The impact assessment process was designed to meet the information requirements outlined in the Final CEAA Scoping Document (Appendix L) prepared by the Federal Environmental Assessment Team received in September 2005. The potential environmental effects outlined in this report are based on the details of the project as identified at the end a Functional Design Stage (September 2005). Potential effects as a result of known design changes since that time have also been included in this report. It should be noted that potential construction staging areas and construction accesses are currently being identified. A preliminary description of these areas is included in Section 5.1.2.18 of this report. It is recognized that detailed impact assessment has not occurred on these sites. However the City is committed to providing the necessary details on the potential effects and proposed mitigation measures as design progresses. The potential environmental effects outlined in this report are based on the details of the project as identified at the end a Functional Design (September 2005).

It is recognized that as the project proceeds through the design process additional details relating to construction staging and mitigation will be developed. The overall objective of undertaking the Federal Review at this stage of planning and design is to coordinate Federal and Provincial EA Requirements in accordance with *Canada-Ontario Agreement on Environmental Assessment Cooperation* and to allow the Responsible Authorities an opportunity to undertake a review of the project early enough in the planning process. As such it is not possible to provide final details of all the mitigation measures and all the potential effects as detail design and detailed construction staging has not been developed.

A Project Environmental Management Plan (PEMP) included in Chapter 9 of this Report outlines the process that the City of Ottawa will follow as design proceeds to ensure that the mitigation commitments outlined in this document are realized during the design and construction stages. It is also recognized that additional details will be provided at the time specific permits and approvals are sought.

The potential effects to valued ecosystem and social components identified in this chapter focuses on the following key steps:

- determine whether or not there are environmental effects and, if so, whether they are adverse;
- determine whether adverse effects are significant; and
- determine whether significant adverse environmental effects are likely based on probability of occurrence and scientific certainty.

This chapter was organized based on the factor areas identified in the Final CEAA Scoping Document (Appendix L) prepared by the Federal Environmental Assessment Team. It is recognized that some features have potential effects on various factor areas and therefore potential effects to some specific features may be documented in more than one section. An example of this would be a specific watercourse that may have potential effects to fisheries and aquatic habitat. These effects are documented in the fisheries section. In addition there may be potential effects to navigation which are documented in the navigation section. The rationale for structuring the report and impact assessment section in this manner was to mirror the information requirements outlined in the scoping document (Appendix L).

Each section includes documentation of potential effects, proposed mitigation and the significance of the potential effect. The following issues were considered when determining the significance of the potential effect:

- Direction – measure of relative effect, i.e. positive or negative;
- Geographic extent / location – spatial area affected by a project – local, regional, national, global;
- Frequency – measure of repetitions -one time, recurring;

- Duration – measure of the length of time a potential effect could last, i.e. short-term, long-term;
- Magnitude – potential severity of the effect; based on relationship to a regulation or guidelines or accepted industry standards;
- Occurrence – measure of likelihood of the effect;
- Reversibility/Mitigation – the potential for recovery and ability to avoid effect or reduce time to recover;
- Ecological – measure of the ecological impact of the effect with consideration of the relative ecological importance of the environmental component;
- Confidence – level of confidence in prediction of effect;
- Residual Effects – measure of overall effect with consideration of reversibility/mitigation;
- Cumulative Effects – measure of the net environmental effects associated with the project in combination of the environmental effects of other past, present or future projects or activities; and
- Significance – overall impact significance of the potential residual environmental effects.

This chapter is structured as follows:

- Section 5.1 outlines the potential environmental effects and proposed mitigation measures during the construction and operation/ maintenance phases of the project for the various factor areas identified in the Final CEAA Scoping Document (Appendix L). It also includes an assessment of the significance of the potential environmental effects after mitigation based on the methodology noted above;
- Section 5.2 outlines the potential environmental effects as a result of accidents and malfunctions;
- Section 5.3 outlines the potential effects of the environment on the project;
- Section 5.4 outlines the potential environmental effects of decommissioning;
- Section 5.5 outlines cumulative effects assessment; and,
- Section 5.6 provides a summary of potential effects.
- Section 5.7 provides a summary of the proposed mitigation measures and commitments to future work.

5.1 Environmental Effects Analysis, Mitigation Measures and Assessment of Significance during the Construction and Operation/ Maintenance Phases of the Project

5.1.1 Biophysical Environment

Potential natural adverse effects of the project are discussed in relation to three general project phases - Construction, Operation and Maintenance and Rehabilitation. The majority of potential adverse effects to natural features will be incurred during the initial construction phase. However, there is potential for some ongoing adverse effects to occur during the operation and maintenance of the LRT system. Finally, periodic rehabilitation activities of the tracks and associated facilities may also have minor adverse effects to natural features.

Each of these three project phases are outlined briefly below. Potential adverse effects that may occur as a result of the activities associated with each project phase are then discussed in more detail in Tables 5.1.1.1-1, 5.1.1.2-1, 5.1.1.2-2, 5.1.1.5-1, and 5.1.1.6-1. A copy of the Natural Environment Report is provided in Appendix A.

Construction

Construction is anticipated to occur primarily within the established right-of-way (ROW). Minor grading outside of this ROW may occur at a few locations along the corridor. These areas of additional grading have been included in the measurements of the area of vegetation removed.

Standard road and rail construction activities are anticipated to be used for the majority of the construction associated with the project. Implementation of mitigation measures outlined in this chapter should manage potential construction-related adverse effects to acceptable levels.

Through the downtown, construction techniques and scheduling will have to consider the day-to-day operations on the two streets. Work on the Mackenzie King Bridge is anticipated to be confined to surface work, and will not include in water work. Other site-specific construction activities include open cut for the Dow's Lake tunnel, in-water works for foundations and pier construction at both of the Rideau River/Canal crossings, and controlled rock removal through the rock cut north of Carling Avenue. These activities are discussed in relation to their potential adverse effects on the respective watercourse features in the impact assessment discussions.

Operations and Maintenance

Standard operation and maintenance activities are expected to occur once the LRT has entered into service. Operation of the LRT involves daily travel and servicing. Potential adverse effects associated with operational and maintenance activities include: 1) effects on water quality during runoff events, 2) noise and 3) salt migration from winter salting of Park and Ride Lots and cross roads. These effects can generally be managed using mitigation approaches, as outlined in this chapter.

As with any transportation facility, there is some potential for adverse effects to groundwater or surface water as a result of runoff from the railway during storm events which can in turn indirectly affect wetlands that are supported by surface or groundwater, or upland features where direct surface water runoff occurs. Potential contaminants from the railway include metals, phenols from lubricants and bacteria from run-off station, break dust, metal filings from wheel wear and sand from traction and breaking.

However, in general, the daily operation and maintenance of the LRT should have limited adverse effects given the electric power source and limited volume of runoff generated from the relatively small surface area and permeable embankment. The railway will be properly maintained and operated to minimize potential for lubricant or sewage leaks or spills.

Although winter salt application will not be used for the LRT line, localized salt application will be required at cross road locations and Park and Ride Lots and Station Platforms. While some localized adverse effects to salt sensitive vegetation species could occur due to salt laden runoff, these are expected to be very localized since salt spray should not be a major concern and only small localized areas are involved. Specific mitigation measures related to stormwater run-off includes the commitment to not permit any new outflows into the Rideau Canal and to design deck drainages capture systems on all new bridges over the Rideau Canal. These mitigation measures will ensure that no salt laden runoff enters the Rideau Canal.

Rehabilitation

Periodic rehabilitation activities will occur in future years, as required. While it is not possible to identify specific locations and timing of these works, it is anticipated that the following types of works will occur at some point in the future: 1) repairs of piers and bridge structures, 2) replacement of road surface, 3) culvert repairs and 4) repaving of parking lots. In general, these activities are similar in nature to construction activities but of smaller scale since they do not involve new construction. Potential adverse environmental effects are predictable, and should be temporary and of limited extent with the application of mitigation measures as outlined in this chapter.

The potential adverse effects of each of the three project phases on designated natural areas, fisheries and aquatic habitat, vegetation and wildlife and species of conservation concern are outlined in the following sections. Recommended mitigation measures to address potential adverse effects are also identified. Potential adverse effects and recommended mitigation measures are then outlined in detail in the accompanying sets of tables for each of the potentially affected designated natural area (Table 5.1.1.1-1), watercourse crossing and associated for fishery and aquatic habitat (Table 5.1.1.2-1 and 5.1.1.2-2), for other vegetation and wildlife habitat features (Table 5.1.1.5-1), and for rare species and Species at Risk (Table 5.1.1.6-1). Where overlap occurs between designated natural areas and vegetation units, this is noted to avoid redundancy. Potential adverse effects to species of conservation concern and Species at Risk have been discussed separately.

The potential adverse environmental effects on the four natural environmental factor areas are outlined in accordance with the three project phases, specifically 1) Construction-Related Effects, 2) Operational and Maintenance Effects and 3) Potential Effects during Rehabilitation. As previously mentioned, the majority of the potential adverse environmental effects will be incurred during the construction phase. Therefore the potential adverse effects and mitigation discussion is primarily focused on this phase. Where relevant, potential Operational and Maintenance Effects and Potential Effects during Rehabilitation are also discussed.

5.1.1.1 Designated Natural Areas

There is considerable overlap between designated natural areas and vegetation and wildlife features given that most of the vegetation and wildlife features occur within designated natural areas. Therefore, the general impact assessment and mitigation discussions below, particularly in relation to the operation and maintenance and rehabilitation project phases are relevant to all of these features generally and will not be discussed at the same level of detail in the Vegetation, Wetlands, Wildlife and Migratory Bird Section (Section 5.1.1.5).

Potential Construction Effects

Eight 'designated natural areas' will be directly affected during the construction of the project. Each of these natural areas is listed in Table 5.1.1.1-1. Details of the approximate area of vegetation removed and/or potentially effected are provided in this table and summarized below. The additional natural areas previously discussed in the report are located beyond the footprint of the alignment and will not be affected by the project. Therefore these natural areas are not discussed in this section.

'Avoidance' measures were utilized, to the extent possible, during the location of the new alignment and associated facilities (e.g. Park and Ride lots) in the southern portion of the study area. Therefore 'designated natural areas' have largely been avoided in areas where new alignment is required. Consequently, construction effects on 'designated natural areas' will be largely limited to slight edge intrusion along the already disturbed edges of natural areas bordering the existing alignment through the north portion of the project. These edge effects are relatively minor in most cases, given the common and tolerant nature of the communities adjacent to the alignment. There are three exceptions.

Vincent Massey Woods, Albion Road (Leitrim) Wetland and Chapman Mills – East Woodlot (Nepean Woods) are three of the more prominent 'designated natural areas' in the study area. The relatively higher importance and associated sensitivity of these vegetation communities results in the potential for greater effects to occur as a result of the edge intrusion. These three natural areas merit implementation of additional and/or more stringent mitigation techniques than other areas to reduce potential adverse effects.

Within the south/new alignment portion of the project, there are three cases where construction effects to designated natural areas will be greater than the edge intrusion type of effects discussed above in relation to the existing/north portion of the railway. The first is where the alignment will remove a portion of the Armstrong Road South Woods, the second is where the Lester site maintenance facility and Lester Station bus turnaround removes a small section of the Airport Parkway Natural Area and the third is the Dominion Arboretum at the Dow's Lake Tunnel. These potential adverse effects are discussed further below.

Potential effects to the more significant northern 'T' shaped forest of the Armstrong Road South Woods was avoided during planning, however the project will remove young forested swamp habitat that is part of a less significant and disconnected southern section. It will also create a new edge at the southeast corner of the 'core' section of the forest. The 1.5 ha of young forested swamp removed has the potential to provide additional forested cover to the larger woodlot in a landscape in which such forested swamp habitat is scarce. This young forest also provides a buffering function to the adjacent more mature and sensitive forested swamp habitat to the north. However, it should be noted that the Riverside South Community Design Plan proposes protecting the more significant northern 'T' shaped forest (not affected by the LRT Project) while permitting development on the less significant and disconnected southern section.. Therefore it is assumed that this south section of Armstrong Road South Woods will no longer exist. In other words, the LRT will be removing a small proportion of young forested swamp, but will not be 'fragmenting' the natural area. It is recognized that construction of the LRT could occur in advance of the land use development. Table 5.1.1.1-1 also outlines mitigation measures that will be employed to minimize adverse effects during this transitional phase.

The Riverside South Community Design Plan established the alignment in this area based a broader land use planning exercise that included consideration of natural, socio-economic and cultural objects. As part of this land use planning exercise, the City identified key natural features that should be protected when development occurs. The EA confirmed the alignment and identified the potential adverse effects and mitigation required for the LRT Project. Although potential adverse effects to the existing Armstrong Road South Woods are considered 'moderate' from a strictly natural heritage perspective, the alignment has been selected in consideration of a variety of social and transportation related factors in combination with the environmental factors. This 'balancing' of the various factors resulted in the emphasis on maintaining the 'core', most mature habitat component of the Armstrong Woods complex. The 'moderate' adverse effect must be considered in the context that the section of forest affected is not protected by the City of Ottawa and will be displaced by future land use development that would occur with or without the LRT Project. The implementation of mitigation measures outlined on Table 5.1.1.1-1 should ensure that the remaining forested habitat is maintained with minimal additional adverse effects. Table 5.1.1.1-1 identifies the potential adverse effects associated with this natural area as well as mitigation measures to address them.

While effects to the Dominion Arboretum are not considered significant from an ecological perspective due to the cultural origin of the trees, there has been considerable focus on the effects that expansion of the Dow's Lake Tunnel will have on the individual trees, and particularly the larger 'specimen' trees, from a cultural perspective. These anticipated effects have been assessed by the staff of the Dominion Arboretum and have been provided in a letter to Project Team. In brief, the open-cut construction technique will result in the removal of 28 mature trees (or trees too large for transplanting), as well as 36 younger trees and shrubs that are suitable for transplanting. The City of Ottawa has committed to work with the Dominion Arboretum to discuss site access, establish a program to identify and transplant and to protect or replace others, and explore other mitigation measures to minimize adverse effects during construction. Additional details on potential adverse environmental effects and proposed mitigation measures to the Dominion Arboretum are included in Section 5.1.2.2.

The Rideau Canal, a Canadian Heritage River and National Historic Site of Canada, will also be crossed three times by the proposed alignment. The effects to this federally designated area will be minimized due to the fact that the alignment will either be a tunnel under the waterway or fully span the waterway. The effects to the aquatic habitat and fisheries associated with this feature are discussed in more detail in the Fish and Fish habitat section (Section 5.1.1.2). Addition details on potential adverse effects to the Canal are included in Sections 5.1.1.5, 5.1.2.3, 5.1.2.4, 5.1.2.9, and 5.1.2.11.

Potential Operational and Maintenance Effects

The daily operation and maintenance of the LRT system should have limited potential adverse effects on the adjacent designated natural areas. There are some potential adverse effects to groundwater or surface water as a result of runoff from the railway during storm events that could indirectly influence health, vigour and/or character of more sensitive and particularly water-dependent vegetation. The greatest potential adverse effect from operational and maintenance activities are to designated natural areas adjacent that include wetland components and/or watercourses. This is the case in Vincent Massey Woods, the Mid-Sawmill Creek Corridor, the Airport Parkway Natural Area, Albion Road (Leitrim) Wetland, and Armstrong Road South Woods. Watercourse related aspects are discussed further in Section 5.1.1.2.

In general, however, as outlined previously, the daily operation and maintenance of the LRT system should have limited adverse effects on water quality given the electric power source and limited volume of runoff generated from the relatively small surface area and permeable embankment. The railway will be properly maintained and operated to minimize potential for lubricant or sewage leaks or spills. While some localized effects to salt sensitive vegetation species adjacent to the Park and Ride lots and road intersections could occur due to salt laden runoff, impacts are expected to be very localized since salt spray will not be a concern. Salt spray will not be a concern because vehicles will not be traveling fast enough to generate spray. Potential water quality-related effects will be mitigated by the development of stormwater management facilities as identified in Section 5.1.1.4.

More specifically, there are no particularly sensitive wetlands communities such as bogs or fens that could be altered by increased nutrient loading adjacent to the alignment. There are no Park and Ride Lots located within or immediately adjacent to a designated natural area.

Although there is some localized potential for wildlife disturbance in adjacent natural areas due to increased noise levels, these effects are also anticipated to be minor. Where the O-Train currently operates, wildlife will have already habituated to this minor disturbance. Furthermore, in general noise levels will be mitigated to the extent possible through design, and relative to other transportation facilities are of much reduced frequency and intensity generally.

Potential Effects during Rehabilitation

While general rehabilitation activities in the long term may involve track replacement through designated areas, the extent of specific rehabilitation activities within designated natural areas is anticipated to be localized. Specifically, there are no paved surfaces (e.g. Park and Ride locations or roads) located within designated natural areas that will need to be repaved.

However, there are bridge structures located within or adjacent to Vincent Massey Park and the Mid-Sawmill Creek Corridor, which may need to be repaired or replaced in the future. There may be some localized disturbance of vegetation in the associated natural areas for construction access and associated potential for temporary construction-related effects to the adjacent designated area to construct such repairs.

Similarly, culverts that are located within the Armstrong Road South Woods may need repairs and there may be localized adverse effects to vegetation in the associated natural areas required to access and repair the culverts.

In general, these adverse effects are again predictable, temporary and limited in extent, and can be managed with the implementation of standard mitigation measures.

Proposed Mitigation

Implementation of the below noted standard mitigation techniques is recommended to ensure that ‘designated natural areas’ are protected to the extent possible during construction. Of primary importance is to minimize the extent of the required intrusion into natural forest and wetland communities, and to protect the main portions of the natural areas during the construction phase. Maintaining the existing drainage regime over the short and long term is also important to ensure the sustainability of wetland vegetation communities that are dependent on specific hydrological characteristics.

i) Construction-related Mitigation Measures

Recommended construction-related mitigation includes the following general measures, which will be detailed further during the design phase as the detail design and construction aspects are refined and outlined in the PEMPs which will be reviewed by the various agencies in advance of construction:

- Sedimentation and erosion control measures will be employed throughout the construction phase. Sediment and erosion control measures will be undertaken in accordance with OPSS 577 (Temporary Sediment and Erosion Control Measures), the City of Ottawa’s documenst titled *Application of Erosion & Sediment Controls on RMOC Construction Projects*, SP D-006 (Compliance with regulations/by-laws for erosion & sediment control), and SP F-1004 (Erosion and Sediment control plan and monitoring). These will include erection and maintenance of silt fencing until all disturbed surfaces that drain to natural areas are re-stabilized and vegetated.

- Where appropriate, along the edges of natural areas that are directly adjacent to the ROW, temporary protection fencing will be installed prior to grading. This fencing will be maintained throughout construction. In many cases, it may be appropriate to integrate sediment and erosion control fencing with construction barrier fencing. Natural areas and remaining forest habitat will be protected in accordance with OPSS 565 (Construction Specifications for the Protection of Trees), OPSS 180 (Management and Storage of Excess Waste) and through any additional mitigation measures identified by a qualified landscape architect during detail design.

- Potentially unstable slopes along Sawmill Creek will be analyzed using geotechnical studies and mitigation measures will be developed in consultation with PWGSC.

- Clearing techniques will be used for all vegetation that must be removed. All vegetation cleared will be felled and removed away from the retained natural area edge. No onsite burming of materials will be permitted. Vegetation clearing will be undertaken in accordance with OPSS 201 (Clearing, Close Cut Clearing, Grubbing and Removal of Surface and Piled Boulders), OPSS 565 (Construction Specifications for the Protection of Trees) and any additional mitigation measures identified by a qualified landscape architect during detail design.

- 2:1 compensation for tree removals will be provided. This commitment does not preclude additional mitigation and/or compensation that will be negotiated with specific agencies related to land transfers or permits.

- Along natural areas where clearing will occur and new edges will be created, and particularly through the Armstrong Road South Woods and Chapman Mills – East Woodlot (Nepean Woods) where more mature forest areas will be fragmented or a new edge created, 'edge management' measures will be undertaken to better 'seal' and protect new forest edges. Specifically, native shrubs and tall, fast-growing trees already occur within the natural area will be planted along portions of the newly exposed edges that are most vulnerable to opening and exposure-related impacts (e.g. wind and sun exposure of more mature trees previously protected by adjacent buffering vegetation). Species recommended for wetland habitats (e.g. Armstrong Road South Woods) include Silver Maple, Green Ash, Black Ash, Highbush Cranberry and Bebb's Willow. Species recommended for upland habitats (e.g. Chapman Mills – East Woodlot (Nepean Woods)) include White Ash, Sugar Maple, Alternate-leaf Dogwood and Common Elderberry. Revegetation will occur in accordance with OPSS 572 (Construction Specifications for Seed and Cover) and landscape plans to be developed in detail design by a qualified landscape architect.

- The existing hydrologic regimes through wetland natural areas, specifically through the Armstrong Road South Woods, Albion Road (Leitrim) Wetland, portions of the Airport Parkway Natural Area, will be maintained. That is, drainage to or from the wetlands will not be diverted or impounded.

- Salvage of seedbanks for the small areas of wetland removed by the alignment will be considered. Seedbank material can be re-instated in adjacent areas, temporarily disturbed areas that will be re-instated, the flat-bottomed ditch lines, or used on other City of Ottawa projects.

- Any temporary dewatering that may be required during construction through the wetland areas will be properly managed and performed in accordance with the *Ontario Water Resources Act* (including Section 34, O.Reg 387/04). Discharge water will be filtered prior to release back to the natural area to prevent potential erosion, siltation and/or temporary drawdown or flooding impacts.

- All other standard construction-related practices for protection of water quality, as outlined in Section 5.1.1.3 will be implemented near natural areas and particularly wetland areas.

- All wildlife encountered during construction activities shall be protected. Consistent with the Migratory Birds Convention Act (MBCA), all active nests of migratory birds will also be protected. Construction, maintenance, operation and decommissioning activities with the potential to destroy or disturb migratory birds, such as site grubbing or vegetation clearing, should not take place in migratory bird habitat during the breeding season (May 1 – July 31). If the proponent must conduct works that could destroy migratory birds or their nests during the identified breeding season, a nest survey will be conducted by a qualified avian biologist prior to commencement of the works. The nest survey will identify and locate active nests of species covered by the *Migratory Birds Convention Act, 1994*. A mitigation plan will then be developed to address any potential adverse effects on migratory birds or their active nests, and will be reviewed by Environment Canada prior to implementation.

- All construction-related debris will be disposed of following construction in accordance with the waste management provisions included in Section 5.1.2.10.

- An environmental inspector will be retained by the Contractor to ensure all relevant mitigation measures are being properly applied throughout construction.

ii) Operational and Maintenance Mitigation Measures

The following measures are recommended to minimize potential for adverse effects to designated natural areas (and other natural features) as a result of the operation and maintenance of the project.

- The LRT system is operated by electricity, minimizing potential airborne contaminants.

- Storm water will be managed within the ROW using vegetated, flat bottom ditches that will collect and 'filter' runoff to provide informal 'cleansing'. In general, runoff volumes are not anticipated to be large, and will filter through the railway embankment, so formal stormwater management (SWM) facilities are not proposed, other than at Park and Ride lots and maintenance facilities. Where appropriate, for example at the road intersection areas, drainage from the LRT will also be designed to tie into existing SWM systems as well as those that are proposed as part of the surrounding development plans. Specific mitigation measures related to stormwater run-off include the commitment to not permit any new outflows into the Rideau Canal and to design deck drainages capture systems on all new bridges over the Rideau Canal. These mitigation measures will ensure that no salt laden runoff enters the Rideau Canal. Additional details on stormwater management are included in Section 5.1.1.4.

- SWM and 'spills prevention and management' measures will also be implemented for the proposed maintenance facility and parking lots to avoid potential adverse effects to the adjacent natural area and associated small wetland community. Additional details on stormwater management are included in Section 5.1.1.4.

- Noise levels will be mitigated to the extent possible through design and electric operation, and relative to other transportation facilities are of much reduced frequency and intensity generally.

- Use of pesticides for ROW management will be avoided wherever possible. This is consistent with the City of Ottawa's policy for pesticide use, which limits its use to situations where there is a serious risk to human or animal health, or if the survival of trees or shrubs is threatened.

iii) Future Rehabilitation Mitigation Measures

As also noted, potential adverse effects of construction activities associated with future rehabilitation activities are anticipated to involve some similar activities (e.g. bridge and culvert repair, re-paving of Park and Ride areas), however activities and associated adverse effects will be localized in duration and extent relative to the construction phase.

During any future rehabilitation activities through natural areas all relevant construction-related measures outlined above will be applied to address potential adverse effects specific to the proposed works and natural area.

Significance of Potential Effects

A detailed summary of potential adverse environmental effects and their significance is outlined on Table 5.1.1.1-1. The following summarize the major conclusions.

The greatest potential adverse effects to 'designated natural areas' will occur during the construction stage. The largest natural area affected is the Armstrong Road South Woods. Although potential adverse effects to the existing Armstrong Road South Woods are considered 'moderate' from a strictly natural heritage perspective, the adverse effect is relatively minor when considering that the section of forest affected is not protected by the City of Ottawa and will be displaced by future land use development that would occur with or without the LRT Project. It is recognized that construction of the LRT could occur in advance of the land use development. Table 5.1.1.1-1 also outlines mitigation measures that will be employed to minimize adverse effects during this transitional phase.

The potential adverse effects on the remaining designated natural areas during the construction stage will be limited to very minor edge intrusions in specific locations.

With the implementation of the mitigation measures noted above, the residual adverse effects to the retained habitat within the designated natural areas are not considered to be significant as the effects are relatively short-term in duration and effects to the more sensitive natural features were avoided during route planning.

Potential direct and indirect adverse environmental effects during operations, maintenance and rehabilitation activities, are also considered relatively minor and can be mitigated through the implementation of the measures noted above.

Table 5.1.1.1-1 Potential Adverse Effects To Designated Natural Areas (And Associated Wildlife), Proposed Mitigation And Significance Of Potential Effects						
Designated Natural Area	**Construction Effects**		**Operational and Maintenance Effects**	**Potential Effects During Rehabilitation**	**Proposed Mitigation (See Section 5.1.1.1 for more detail)**	**Significance of Potential Effects**
	Description of Area Affected	**Approximate size of natural area removed (and associated effects)**				
Le Breton Flats (NOSS ID No. 1302)	Primarily manicured lawn with some scattered planted deciduous and coniferous trees.	• ~ 1 ha of manicured lawn with possible removal of a limited number of planted trees.	**Water quality** – No watercourse or wetland communities present therefore no specific adverse effects anticipated. **Noise** – Very limited wildlife habitat value therefore no major noise-related adverse effects anticipated.	None anticipated.	• Clearing and disposal of all construction-related debris following construction.	**No significant adverse effects.** Vegetation is cultural in origin. **No significant residual adverse effects to retained areas with implementation of mitigation measures.**
Dominion Arboretum (NOSS ID No. 1101; UNA No. 133)	The Dominion Arboretum is primarily manicured lawn with a great diversity of planted deciduous and coniferous trees and shrubs. Many of the trees were planted over 100 years ago. Twenty-eight mature planted trees along with 36 young planted trees and shrubs will be impacted by the footprint of the expanded Dow's Lake Tunnel and associated construction related activities.	• ~ 0.8 ha of manicured lawn and scattered planted trees. • 28 mature planted trees will be removed. • 36 young planted trees and shrubs will be transplanted. • Potential impact to the root zones of other mature trees near the construction zone	**Water quality** – No direct runoff to Rideau Canal given tunnel. **Noise** – Very limited wildlife habitat value therefore no major noise-related impacts anticipated.	Potential for future adverse effects resulting from maintenance and/or repairs of the Dow's Lake Tunnel.	• Transplant the 36 young trees and shrubs (that have been identified to date) to another suitable location within the Dominion Arboretum. • The City of Ottawa has committed to work with the Dominion Arboretum to discuss site access, establish a program to identify and transplant and to protect or replace others, and explore other mitigation measure to minimize adverse effects during construction. Additional details on potential adverse environmental effects and proposed mitigation measures to the Dominion Arboretum are included in Section 5.1.2.2. • Employ sedimentation and erosion control measures. • Ensure existing hydrologic regime will be maintained. • Clearing and disposal of all construction-related debris following construction. • Ensure an environmental inspector is on site during construction to ensure compliance with mitigation measures. • Implement measures to protect nesting migratory birds. Timing of vegetation clearing will avoid the breeding period (May 1 to July 31). If the proponent must conduct works that could destroy migratory birds or their nests during the identified breeding season, a nest survey will be conducted by a qualified avian biologist prior to commencement of the works. The nest survey will identify and locate active nests of species covered by the *Migratory Birds Convention Act, 1994*. A mitigation plan will then be developed to address any potential adverse effects on migratory birds or their active nests, and will be reviewed by Environment Canada prior to implementation. Hereafter this mitigation measure is referenced as MBCA compliance for protection of any migratory birds.	**No significant adverse effects.** Vegetation is cultural in origin. **No significant residual adverse effects to retained areas with implementation of mitigation measures.**
Vincent Massey Woods	Forested habitat on both sides of the railway is classified as a Dry-Fresh	• ~ 14-16m of intrusion on the	**Water quality** – There is potential for run-off related impacts to	Potential for future construction-related	• Ensure intrusion into natural forest communities is minimized during the construction phase.	**Moderate adverse effect. No significant adverse**

Table 5.1.1.1-1 Potential Adverse Effects To Designated Natural Areas (And Associated Wildlife), Proposed Mitigation And Significance Of Potential Effects

Designated Natural Area	Construction Effects		Operational and Maintenance Effects	Potential Effects During Rehabilitation	Proposed Mitigation (See Section 5.1.1.1 for more detail)	Significance of Potential Effects
	Description of Area Affected	Approximate size of natural area removed (and associated effects)				
(ESA; NOSS ID No. 2704; UNA No. 136 – HIGH; NESS ID No. 107 - LOW)	Sugar Maple – Black Cherry Deciduous Forest (FOD5-7; Unit 2). North of the alignment is more sensitive with seepage at the base of the existing embankment draining northward towards important wetland communities. The north side is also a more continuous forest community.	north side. • ~ 10-13m of intrusion on the south side • Total of ~ 0.75 ha of forested habitat removed (or 4.5% of the total natural area). • New edge effects to remaining forested habitat.	groundwater that may contribute to wetland communities north of the alignment. **Noise** – Species inhabiting the adjacent communities are already habituated to noise from the O-Train therefore noise from additional train traffic will have minimal impact.	impacts at bridge pier locations if replacement or repairs are required.	• Direct runoff to vegetated ditches. • Employ sedimentation and erosion control measures. • Ensure existing hydrologic regime will be maintained. • Install temporary vegetation protection fencing prior to grading and maintain throughout construction. • Ensure the use of vegetation clearing techniques (i.e. trees to be felled away from the retained natural area) • Implement edge management to better seal and protect the new forest edge bordering the alignment (As further outlined under 'Proposed Mitigation i) Construction-related Mitigation Measures' in Section 5.1.1.1). • MBC compliance for protection of any nesting migratory birds • Clearing and disposal of all construction-related debris following construction. • Ensure an environmental inspector is on site during construction to ensure compliance with mitigation measures.	**effects.** The forest edge is already disturbed along the existing railway alignment and the proportion of the designated area that is affected is relatively small (4.5%). **No significant residual adverse effects to retained natural areas with implementation of mitigation measures.**
Mid-Sawmill Creek Corridor (NOSS ID No. 3102; UNA No. 142 – MODERATE)	Only one specific location along the linear Mid-Sawmill Creek Corridor will be directly affected by the twinning of the railway (Watercourse Crossing #4). The core sections of the natural area are separated from the tracks by the Transitway. The area directly affected is already highly disturbed with a sparse canopy dominated by Manitoba Maple, Buckthorn and Staghorn Sumac (Unit 3).	• ~ 0.1 ha of semi-natural vegetation removed (or 0.4% of the total natural area).	**Water quality** – Potential for adverse effects to water-dependant features. However, these will be limited given the electric power source and limited runoff potential from the relatively small surface area and permeable embankment. **Noise** – Species inhabiting the adjacent communities are already habituated to noise from the O-Train therefore noise from additional train traffic will have minimal impact.	Potential for future adverse effects at bridge pier locations if replacement or repairs are required.	• Ensure intrusion into natural forest communities and riparian habitat is minimized during the construction phase. • Employ sedimentation and erosion control measures. • Ensure existing hydrologic regime will be maintained. • Direct runoff to vegetated ditches. • MBCA compliance for protection of any nesting migratory birds. • Clearing and disposal of all construction-related debris following construction. • Ensure an environmental inspector is on site during construction to ensure compliance with mitigation measures.	**Low adverse effect. No significant adverse effects.** The vegetation that will be affected is young and highly disturbed. As well, the proportion of the natural area affected is very low (0.4%). **No significant residual adverse effects to retained natural area with implementation of mitigation measures.**
Airport Parkway Natural Area (NESS No. 105 - MODERATE)	Communities within the Airport Parkway Natural Area adjacent to the existing rail ROW will incur only very minor encroachment in specific locations on the <u>west</u> side of the tracks since most construction will occur within the existing ROW. Communities impacted a flooded willow thicket swamp (Unit 9a) and a Poplar Deciduous Forest (Unit 20).	• ~ 0.5 ha of deciduous forest habitat removed by edge encroachment (or 0.1% of the total natural area). • New edge impacts to remaining forested habitat.	**Water quality** - Potential for unmanaged runoff from maintenance facility to affect surface and/or groundwater. **Noise** – Potential for localized disturbance of adjacent wildlife due to increased noise from the railway.	None Anticipated	• Ensure intrusion into natural forest and wetland communities is minimized during the construction phase. • Employ sedimentation and erosion control measures. • Ensure existing hydrologic regime will be maintained. • Direct runoff to vegetated ditches. • Install temporary protection fencing prior to grading and maintain throughout construction. • Implement edge management to better seal and protect the new forest edge bordering the alignment	**Low adverse effect** (edge intrusion from alignment). **No significant adverse effects.** Adverse effects will be limited to small areas of encroachment where grading occurs beyond the existing ROW and where the bus turnaround site is located. The area impacted represents a very small

Table 5.1.1.1-1 Potential Adverse Effects To Designated Natural Areas (And Associated Wildlife), Proposed Mitigation And Significance Of Potential Effects						
Designated Natural Area	Construction Effects		Operational and Maintenance Effects	Potential Effects During Rehabilitation	Proposed Mitigation (See Section 5.1.1.1 for more detail)	Significance of Potential Effects
	Description of Area Affected	Approximate size of natural area removed (and associated effects)				
					(As further outlined under 'Proposed Mitigation i) Construction-related Mitigation Measures' in Section 5.1.1.1). • MBCA compliance for protection of any nesting migratory birds. • Clearing and disposal of all construction-related debris following construction. • Ensure an environmental inspector is on site during construction to ensure compliance with mitigation measures.	proportion of the total natural area (0.1%). **No significant residual adverse effects to retained natural areas with implementation of mitigation measures.**
Albion Road (Leitrim) Wetland (Provincially Significant ANSI; PSW; NESS ID No. 100 – MODERATE)	Where the alignment swings west, the northwest corner of the Albion Road (Leitrim) Wetland may experience some minor edge encroachment. Wetland community is a mixed swamp. The most important portions of this PSW will not be impacted.	• ~ 0.08 ha of natural vegetation removed (or 0.02% of the total wetland area). • New edge impacts to remaining forested habitat.	**Water quality** – There is potential for runoff-related impacts to groundwater that may contribute to wetland communities southeast of the alignment. **Noise** – Potential for localized disturbance of adjacent wildlife due to increased noise from the railway.	None anticipated.	• Ensure intrusion into wetland communities is minimized during the construction phase. • Ensure existing hydrologic regime will be maintained • Direct runoff to vegetated ditches. • Employ sedimentation and erosion control measures. • Install temporary protection fencing prior to grading and maintain throughout construction. • Implement edge management to better seal and protect the new forest edge bordering the alignment (As further outlined under 'Proposed Mitigation i) Construction-related Mitigation Measures' in Section 5.1.1.1). • MBCA compliance for protection of any nesting migratory birds. • Clearing and disposal of all construction-related debris following construction. • Ensure an environmental inspector is on site during construction to ensure compliance with mitigation.	**Moderate adverse effect. No significant adverse effects.** The forest edge is already disturbed along the abandoned railway alignment. The area impacted represents a very small proportion of the total natural area (0.02%). **No significant residual adverse effects to retained natural areas with implementation of mitigation measures.**
Armstrong Road South Woods (NESS No. 124 – LOW, UNA no. 101)	Area removed is a regenerating swamp habitat classified as a Swamp Maple Mineral Deciduous Swamp (SWD3-3). The community age ranges from pioneer to young with some sections supporting a mature canopy component and other areas with an open canopy but forming a swamp thicket community. The adjacent forested swamp to the north (the 'core' section of Armstrong Road South Woods) is also classified as a Swamp Maple Mineral Deciduous Swamp, however it is a more mature community with a mature tree component and a diverse ground layer. This 'core' section will be retained.	• ~ 1.5 ha of forested swamp removed (or 4% of the total natural area). However, the area affected is not within the 'core' section of the woods. • New edge impacts to the remaining forested swamp.	**Water quality** – There is potential for run-off related impacts to ground and surface water that may contribute to adjacent forested swamp communities. These potential impacts may be greater on the north side of the alignment where the swamp community is more mature. **Noise** – Potential for localized disturbance of adjacent wildlife due to increased noise from the railway.	Potential for future impacts at culvert locations if repairs are required.	• Ensure minimal intrusion into adjacent swamp communities during the construction phase. • Ensure existing hydrologic regime will be maintained. • Direct runoff to vegetated ditches. • Employ sedimentation and erosion control measures. • Install temporary protection fencing prior to grading and maintain throughout construction. • Implement edge management to better seal and protect the new forest edge bordering the alignment (As further outlined under 'Proposed Mitigation i) Construction-related Mitigation Measures' in Section 5.1.1.1). • MBCA compliance for protection of any nesting migratory birds. • Clearing and disposal of all construction-related debris following construction. • Ensure an environmental inspector is on site during	**Moderate adverse effect. No significant adverse effects.** The removal of 1.5 ha of young forested swamp and creation of a new edge is considered a moderate adverse effect. However, it should be noted that the Secondary Plan for the Riverside South Community proposes protecting the more significant northern 'T' shaped forest (not affected by the LRT Project) while permitting development on the less significant and disconnected southern

Table 5.1.1.1-1 Potential Adverse Effects To Designated Natural Areas (And Associated Wildlife), Proposed Mitigation And Significance Of Potential Effects						
Designated Natural Area	**Construction Effects**		**Operational and Maintenance Effects**	**Potential Effects During Rehabilitation**	**Proposed Mitigation (See Section 5.1.1.1 for more detail)**	**Significance of Potential Effects**
	Description of Area Affected	**Approximate size of natural area removed (and associated effects)**				
					construction to ensure compliance with mitigation measures.	section. Therefore it is assumed that this south section of Armstrong Road South Woods will no longer exist. Therefore this is not considered a significant effect. It is recognized that construction of the LRT could occur in advance of the land use development. The mitigation measures outlined in this table will be employed to minimize adverse effects during this transitional phase. **No significant residual adverse effects to retained natural areas with implementation of mitigation measures.**
Chapman Mills – East Woodlot (UNA No. 61)	Area removed at the northeast corner of the site is largely regenerating habitat with young tree saplings, shrubs and herbaceous species. This area is characterized as a Meadow Marsh, Thicket Swamp and Cultural Meadow mosaic (Unit 17c) and also supports a young Butternut tree (see Table 6.4.1.4-1 for a discussion of the potential adverse effects to this species at risk). There may be some removal of and/or indirect effects to mature trees within the core woodlot, depending on the grading limits of the ROW footprint.	• ~ 0.15ha of regenerating habitat removed (thicket swamp/ meadow marsh/ cultural meadow mosaic). • The number of mature trees that will be removed or impacted is uncertain. • Minor new edge impacts to the remaining forested habitat.	**Water quality** – There is potential for runoff related impacts to groundwater. **Noise** – Potential for localized disturbance of adjacent wildlife due to increased noise from the railway.	None anticipated.	• Ensure minimal intrusion into forest community during the construction phase. • Minimize grading and tree removal. • Employ sedimentation and erosion control measures. • Ensure storm water will be contained and treated. • Install temporary protection fencing prior to grading and maintain throughout construction. • Implement edge management to better seal and protect the new forest edge bordering the alignment (As further outlined under 'Proposed Mitigation i) Construction-related Mitigation Measures' in Section 5.1.1.1). • MBCA compliance for protection of any nesting migratory birds. • Clearing and disposal of all construction-related debris following construction. • Ensure an environmental inspector is on site during construction to ensure compliance with mitigation.	**Moderate adverse effect. No significant adverse effects**. Forest edge is already disturbed. Minor removal of vegetation relative to size of the natural area. **No significant residual adverse effects to retained natural areas with implementation of mitigation measures.**

5.1.1.2 Fish and Fish Habitat

Of the 27 watercourse crossings that were assessed during the field surveys, as outlined in the Natural Environmental Existing Conditions Report (see Appendix A), 25 will be affected as a result of the expansion of the project. A map (Figure 4.1.1-1) illustrating the crossing locations is included in the Description of Biophysical Environment section (4.1). No works are proposed at the Rideau Canal (Crossing #1) or at the Tributary of the Jock River system (Crossing #18a) where the existing tributary has been removed through recent construction.

With the exception of the few watercourses (as noted in descriptions below), watercourses along the study corridor have been classified by the MNR and RVCA as permanently or intermittently flowing with warmwater habitat. However, in case of the Sawmill Creek tributaries, RVCA has identified coldwater attributes, and the presence of sculpin species. RVCA has classified most of the smaller watercourses as Class C drains.

Each of the watercourse crossings is listed on Table 5.1.1.2-1 and the works required at each crossing and associated construction-related effects on the local existing fisheries and aquatic habitat are outlined. As well, the table summarizes potential effects that may occur during the operation and maintenance of the LRT system, as well as during rehabilitation activities, such as bridge and culvert repair works. Mitigation recommendations are summarized briefly, and the preliminary HADD determinations made by DFO and RVCA are outlined. It should be noted that these HADD determinations will be re-examined as design progresses and authorizations, under the Fisheries Act, will be obtained.

The effects of the construction, operation and maintenance and rehabilitation of the proposed project on watercourses are also summarized in the following sections, grouped generally in accordance with the type of works proposed (e.g. tunnel, structure with and without instream piers, new, extended or replaced culverts). Mitigation measures recommended to minimize potential adverse effects of the project on fish and fish habitat are then listed, and the preliminary HADD determinations, general compensation strategies summarized. Compensation Plans and formal authorization under the Fisheries Act will be obtained during Detail Design.

Potential Construction Effects

The primary effects of the project are related to the construction of extensions of the existing structures and culverts over the watercourses along the north portion of the project and construction of new crossing structures along the south portion. It should be noted that the HADD determination noted below are only preliminary and will be re-examined as design progresses and authorizations, under the Fisheries Act, will be obtained.

<u>Proposed Tunnel under the Rideau Canal (Crossing #2)</u>

With implementation of restoration measures, the effects of the proposed tunnel on the Rideau Canal will be temporary. Open-cut construction techniques are proposed to build the tunnel during winter months. This construction will result in the localized removal of riparian vegetation, which is limited to predominantly grasses with scattered deciduous trees, as well as temporary alteration of the channel banks, although east bank is presently 'hardened'/concrete. The open cut construction and associated dewatering activities during tunnel installation also pose the potential for erosion and downstream sediment release to the canal if poor construction or restoration techniques are used. If any blasting is required to construct the tunnel, potential vibration effects on fish will be addressed, as outlined in the mitigation measures.

Once construction of the tunnel is completed, the existing bed profile and substrate on the bed of the canal (above the tunnel) will be re-instated, and riparian vegetation replaced. Although there is submergent aquatic vegetation (e.g. pondweeds and Northern Water Milfoil) in the vicinity of the study corridor that would also be disturbed, this vegetation occurs in Dows Lake generally and will quickly re-establish following re-instatement of the substrates.

Therefore, the long-term effects of the tunnel construction should be nominal. However, depending on the size of the area disturbed to construct the tunnel and the duration of the disturbance, DFO has indicated that the tunnel construction may be considered a ‘disruption’ of fish habitat and therefore HADD.

Site-specific Fisheries and Aquatic Habitat Concerns – Although the aquatic habitat is not particularly necessarily sensitive at this site (flat/pooled morphology, fine substrates, concrete and boulders line banks), the system does support a relatively diverse fishery including several top level predator species such as Walleye, Muskellunge, Northern Pike, Smallmouth Bass, and Largemouth Bass, and a number of panfish, coarse fish and bait or forage fish species. American eel is also present in Dows Lake.

Proposed New Structure at the Rideau River (Crossings #3)

At the Rideau River Crossing #3, south of Carleton University the new structure proposed immediately upstream (west) of the existing five span structure will involve twinning the existing piers (with a 0.8m gap), three of which are in the water and one of which is adjacent to the south bank. Each of the three new instream piers is proposed to be 1m wide by either 4 or 8m long shafts on the channel bed, with underlying footings 2.75m wide and 0.3m longer than the shaft lengths at both ends. The piers will be set such that they are set back from the channel edges at least during lower flow conditions, avoiding encroachment into the nearshore areas that are most productive during the late spring/summer. Construction of the underlying footings will involve temporary disturbance of a larger surrounding area, however the footings will be subsurface and ‘natural’ bed conditions and associated habitat will be re-instated following construction of the footings. Therefore, the total surface area on the channel bed that will be occupied by the pier columns following construction, or the total area of habitat that is removed, is either 12 or 24 m2.

Site-specific Fisheries and Aquatic Habitat Concerns – At Crossing #3, Rock Bass and Yellow Perch nursery habitat was identified along the south shore downstream of the proposed crossing. Morphology and substrate conditions at Crossing #3 of the Rideau River are comprised of rapids with coarse substrates (e.g. rubble). These conditions may also provide spawning habitat for species such Walleye, and sucker and redhorse species.

Proposed New Structure at the Rideau Canal (Crossing #17)

Two new structures are proposed at Rideau Canal Crossing #17. In the near term, the Interim Plan for the LRT crossing of the Rideau Canal (Crossing #17) at Strandherd Road is incorporation of the track on the Municipal Engineers Association Class EA (1993, addendum 1997) approved structure for Strandherd/Armstrong Road. This structure will span the Canal so that no piers will be constructed instream, and there will be no direct runoff off the structure to the Canal. The structure will be designed to drain to a closed drainage system outletting to surface ditches at Prince of Wales Drive and River Road.

The long term/Ultimate Plan (2021) is construction of a separate structure for the LRT located approximately 20m upstream (south) of the interim structure. The proposed structure will also span the canal and will be designed to drain to a closed drainage system outletting to surface

ditches at Prince of Wales Drive and River Road. Design of both structures is subject to the approval of Parks Canada and the NCC and will be designed in accordance with the Strandherd-Armstrong Bridge Aesthetic Guidelines (du Toit Allsopp Hillier, November 2005).
Site-specific Fisheries and Aquatic Habitat Concerns – Smallmouth Bass, Yellow Perch and Logperch nursery habitat sites were identified by the City of Ottawa approximately 300m downstream of Crossing #17. Also, Northern Pike spawning habitat was identified along the west bank approximately 160m upstream of the crossing.

Proposed New Structures Spanning the Watercourse (i.e. no piers instream) at Sawmill Creek (Crossing #4) and Mosquito Creek (Crossing #12)

The existing structures at Sawmill Creek (Crossing #4) will be removed and replaced with a new structure, and Mosquito Creek (Crossing #12) will be crossed with a new structure. The proposed structure design is to fully span these watercourses, that is, there are no instream piers or bank encroachments. The existing pedestrian walkway will also be extended under the new Sawmill Creek structure. Therefore, the adverse effects of the proposed structures over Sawmill and Mosquito Creeks should be minimal. Associated direct impacts should be limited to localized removal of riparian vegetation.

There is some potential for indirect adverse effects as a result of erosion and sediment transport if poor construction or restoration techniques are used on areas draining to the watercourses. Potential indirect habitat effects due to changes in local hydrology are considered nominal since structures will be used.

Site-specific Fisheries and Aquatic Habitat Concerns – Concerns are minimal since the watercourses are spanned. In relation to potential for indirect adverse effects, neither watercourse is highly sensitive. Walleye and Northern Pike are already prevented from migrating upstream from the Rideau River along Sawmill Creek to the vicinity of the corridor by a culvert barrier near the confluence. The fish community is comprised predominantly of a small number of common, tolerant baitfish species, and substrate and morphology is not particularly diverse. However, Sculpin species, indicative of groundwater discharge, were recorded in Sawmill Creek, and it is considered to support coldwater habitat potential. Also, spawning habitat for White Sucker was identified in a riffle area located approximately 250m downstream of the crossing location.

Mosquito Creek supports a more diverse warmwater fishery, including Northern Pike, although the species are common and generally tolerant in the vicinity of the study corridor (Niblett, 1991). Substrates in the vicinity of Crossing #12 are sand-dominant (with some boulders, muck, silt and clay) and morphology is flat.

Proposed Channel Realignments Cahill Drain (Crossings 7 and 8 of Cahill Drain), and (Crossings 11a, 11b, and 11c Tributaries of Mosquito Creek)

In several areas, the proposed LRT alignment encroaches on relatively long sections of watercourse channel that flow parallel to the proposed alignment. It is proposed that these sections of watercourse channel be re-aligned away from the LRT, from their current locations parallel to and within the ROW.

Realignment of the approximately 230m section of the Cahill Drain that flows adjacent to the east side of the existing railway between Crossing #7 and Crossing #8 is required to accommodate the proposed railway widening. This section of channel will be realigned to the west side of the tracks, so that the two existing culverts can be removed.

Four sections of the Mosquito Creek Tributaries that parallel the proposed alignment of the south/new portion of the route will also require re-location. At Crossing 11a, the alignment of the LRT line encroaches on an approximately 350m long reach of the watercourse channel that parallels the east side of the alignment. At Crossing 11b, two sections of channel approximately 44m and 32m in length will have to be re-aligned along the east side of the tracks. At Crossing 11c, the LRT line crosses the watercourse at an angle. The proposed crossing configuration affects approximately 108m of channel, including the 22m culvert noted below and realignment of approximately 10m of channel downstream of the culvert and approximately 80m upstream/east.

Adverse effects of the proposed realignment of these sections of the Cahill Drain (between Crossings #7 and 8) and the Mosquito Creek Tributary channels (up and/or downstream of Crossings' 11a, b, and c) include: removal of riparian vegetation, alteration of the channel banks and bed, local disruption during the realignment, and associated potential for erosion and downstream sediment transport during periods of flow if poor construction or restoration techniques are used. Although temporary disruption of relatively long sections of channel will occur, longer term effects of the proposed works should be minor provided that the new naturalized channel sections are properly designed and constructed to replace the affected channel sections. It should also be noted that Cahill Drain flows underground for 275m downstream of Crossing #6, limiting existing fish movement and habitat connectivity upstream to the reaches proposed for realignment.

Site-specific Fisheries and Aquatic Habitat Concerns – The approximately 230m section of Cahill Drain channel proposed for realignment south of Crossing #7 and north of Crossing #8 (same realignment) supports diverse coarse substrates, with some riffle habitat although morphology is dominated by 'flats'. The Cahill Drain, a tributary of Sawmill Creek, supports a similar fish community to Sawmill Creek, generally comprised of a small number of tolerant common species. However, sculpin species are also present, and as noted, RVCA indicated Cahill Drain appears to support coldwater attributes.

There are no existing fish data for the small Mosquito Creek Tributaries, sections of which require realignment. However they are classified as Class C drains (warmwater) by RVCA, and support potential for seasonal fish use. Although the grasses along the channel sections proposed for realignment in the vicinity of the Mosquito Creek Tributary 'Crossings' 11a and 11b provide vegetative material for potential Northern Pike spawning, the volume and flow duration may not be sufficient to support spawning and successful emergence and dispersion of pike.

Proposed Extensions of Existing Culverts at Sawmill Creek (Crossing #5 and 5a) and Cahill Drain (Crossing #6 including new headwalls)

Four metre extensions of the existing culverts at Crossings #5a and 6, and a 10m extension of the existing culvert at Crossing #5 are required. Adverse effects of the proposed extension of the existing culverts, and associated channel enclosure include: local removal of riparian vegetation, alteration of the channel banks and bed, local disruption during culvert installation and associated potential for erosion and downstream sediment transport during periods of flow if poor construction or restoration techniques are used. Potential indirect habitat effects due to changes in local hydrology are considered nominal given the existing culverts and straight channel sections.

Site-specific Fisheries and Aquatic Habitat Concerns – The reaches of Sawmill Creek that include Crossings #5 and 5a are classified as coolwater fish habitat in the Sawmill Creek Subwatershed Study Update. Coarse substrates persist downstream of Crossing #5 but within the extension zones upstream of the culvert at Crossing #5 and through Crossing #5a substrates become finer and morphology is ‘flat’.

As noted above, Cahill Drain at Crossing #6 supports a similar fish community to Sawmill Creek, generally comprised of a small number of tolerant common species, although sculpin species are present, indicative of potential coldwater attributes. Substrates at the crossing site include a mix of sand (dominant) and rubble with some gravel and boulders. Morphology is mainly flats and pools with a run leading into the culvert. However, Cahill Drain flows underground for 275m downstream of the culvert before resurfacing, limiting existing fish movement and habitat connectivity upstream.

Proposed Removal of Existing Culverts and Replacement With New Longer Culverts at Sawmill Creek Tributaries (Crossing #9 and #10)

New replacement culverts that are 9 and 6m longer, respectively than the existing culverts, are proposed at Sawmill Creek Tributary Crossings #9 and #10. Adverse effects of the construction of new longer culverts and associated additional channel enclosure include: local removal of riparian vegetation, alteration of the channel banks and bed, local disruption during culvert installation and associated potential for erosion and downstream sediment transport during periods of flow if poor construction or restoration techniques are used. Potential indirect habitat effects due to changes in local hydrology are considered nominal given the existing culverts and straight channel sections.

Site-specific Fisheries and Aquatic Habitat Concerns – There are no major concerns associated with the proposed works at these tributaries, since substrates are fine and morphology flat at both crossings. Furthermore, as previously noted Walleye and Northern Pike are prevented from migrating from the Rideau Canal upstream along Sawmill Creek to the vicinity of the corridor by a culvert barrier near the confluence.

Proposed New Culverts at Crossings 11, 11b, 11c, 13, 14, 15, 16, 17a, 18, 18b, and 19 and 19a

It is anticipated that new culverts will be constructed to accommodate the watercourse crossings along the south portion of the alignment. The new culverts are anticipated to be approximately 30m long at Crossings #14, #15 and #16, 35m long at Crossing #13, and 40m long at Crossings #18 and #19 (see Table 6.4.1.2-0). At the Mosquito Creek Tributaries, a CSP approximately 18m in length is required at Crossing #11, a 22m culvert at each of Crossings 11b and 11c as well as a second culvert 19m long at Crossing #11b will be required in association with the required realignments of the associated reaches of channel outlined above.

At Crossing #17a, the downstream end of the existing culvert at Prince of Wales Drive and the first few metres of the channel reach will be enclosed by the ultimate LRT structure that will separate the LRT from Strandherd Road. However, the proposed roadway intersection works will remove the entire upstream portion of the tributary. Therefore, the incremental adverse effects of the LRT construction are nominal. A culvert may not be required at Crossing #19a given that the alignment crosses the small watercourse at its far upstream end. The tributary at Crossing 18a has been removed.

General adverse effects of the new culvert construction and associated channel enclosures at the other watercourses include: local removal of riparian vegetation, alteration of the channel banks and bed, local disruption during culvert installation and associated potential for erosion and downstream sediment transport during periods of flow if poor construction or restoration techniques are used.

Potential indirect habitat effects due to changes in local hydrology are likely to be nominal provided culverts are sized to convey the drainage, given the generally straight, ditched channel form and associated altered habitat regime. The degree of channel alteration can be reduced with implementation of mitigative design techniques (e.g. embedding and lining with natural substrate material).

Site-specific Fisheries and Aquatic Habitat Concerns – There are no major concerns with these tributaries since the majority are intermittent agricultural drainage ditches. All were dry with the exception of Crossing #19 at the time of the surveys. Substrates in the vicinity of these of these crossings are mostly comprised of muck and clay, and morphology is flat. Emergent vegetation that could provide potential Northern Pike spawning habitat is present in the vicinity of the crossings with the exception of Crossing #19, however, volume and flow duration may not be sufficient to support spawning and successful emergence and dispersion of pike.

Potential Operational and Maintenance Effects

The daily operation and maintenance of the LRT system should have limited effects on the watercourses crossed along the alignment. As with any transportation facility, there is some potential for adverse effects to groundwater or surface water as a result of runoff during storm events, which can in turn indirectly influence water quality and quantity in the watercourses.

In general, as outlined previously, railways by nature have lower potential water quality and quantity effects than large roadway facilities, and generate much less runoff given the relatively small surface area and permeable embankment. The railway will be properly maintained and operated to minimize potential for fuel or lubricant leaks or spills.

Any remediation required as a result of soil or groundwater contamination resulting from the construction, operation, maintenance and decommissioning of the site rests with the City of Ottawa on all lands that the LRT occupies and/or travels over and under.

Although winter salt application will not be used for the railway, localized salt application will occur along the new Strandherd Road crossing of the Rideau Canal (Crossing #17) and Tributary/Crossing #17a that will initially convey the LRT line across the Rideau Canal on the same new structure. Specific mitigation measures related to stormwater run-off include the commitment to not permit any new outflows into the Rideau Canal and to design deck drainages capture systems on all new bridges over the Rideau Canal. These mitigation measures will ensure that no salt laden runoff enters the Rideau Canal. As noted, both structures will be designed to drain to closed drainage systems outletting to surface ditches at Prince of Wales Drive and River Road. As also noted, the road crossing is approved. The details of the associated salt and stormwater management will be addressed as part of the road design. There are no other watercourses adjacent to road intersections, or adjacent to the Park and Ride lot locations.

Full details on stormwater management mitigation are included in Section 5.1.1.4.

Potential Effects During Rehabilitation

General rehabilitation activities in the long term may involve repair or replacement of bridge structures or culverts. The effects of such works should be limited to temporary, localized disturbances during construction of the repairs. That is, these effects are generally predictable, temporary and limited in extent, and can be managed with the implementation of the mitigation measures outlined in this chapter.

Proposed Mitigation

i) Construction-related Mitigation Measures

Based on the character of the habitat conditions and resident fisheries, implementation of the below noted standard mitigation measures to minimize construction-related effects is generally appropriate to minimize potential adverse environmental effects. Standard design measures will minimize potential adverse environmental effects for extension of existing culverts and structures. However, some specific design measures are also identified below for new and replacement culverts, as well as for the proposed channel realignments.

It should be noted that plans from the original tunnel at Dows Lake have been review. Approximate rock elevations have been estimated from those plans. Confirmatory field testing will occur during the detail design phase. The contract will contain blasting specifications which the City of Ottawa will provide to the Parks Canada Agency.

Recommended construction-related mitigation includes the following standard measures, which will be detailed further during the design phase as the detail design and construction aspects are refined and outlined in the PEMPs which will be reviewed by the various agencies in advance of construction:

- A warmwater construction-timing window restriction (between March 15 and July 1) will be used for all required instream works. This will also protect the spawning period of Mottled Sculpin that is found in the cool/potential coldwater sections of Sawmill Creek and Cahill drain.
- A sediment and erosion control plan will be implemented to prevent erosion and migration of sediment-laden runoff from the construction zone to the watercourses, including inspection and maintenance until final cover is established. A detailed sediment and erosion control plan will be prepared prior to construction.
- Bypass pumping or other means will be used to isolate the construction zone and maintain clean downstream flow in the watercourses that will require instream works (e.g. new or extended culverts, instream piers, channel realignments). Isolation of the construction zone and maintenance of clean downstream flow will be undertaken in accordance with OPSS 182, OPSS 518, and any requirements identified under the Fisheries Act in consultation with the RVCA/OMNR/DFO. If the watercourse is not flowing at the time of construction, contingency measures will be available for use in the event of rain. If temporary cofferdams or flow barriers are used, they will be constructed of non-sediment generating materials (i.e. gravel bags, clean stone with no fines). Energy dissipation measures will be used for release of flow downstream of the construction zone. Detailed flow management plans for each relevant crossing will be prepared prior to construction.
- The tunnel under the Rideau Canal will be constructed during the winter when water levels have been lowered and flows are minimal. The work will be allowed to begin once water levels have been lowered and then raised to prepare for Winterlude. All work will be completed prior to March 15 in accordance with the fishery moratorium. Construction will be completed during the winter to ensure that spring through navigation is maintained within the Rideau Canal. Dewatering plans will be

developed; incorporating cofferdams to isolate the excavation zone and dam and pump measures as outlined above, and will be implemented to prevent erosion and sediment transport to the canal.

- All water intake hoses used for temporary dewatering/flow transfer will be screened.

- Any fish stranded in the work zone will be captured and transferred up or downstream of the work zone.

- Settling and energy dissipation measures will be used for discharge of water for all temporary flow transfer and/or dewatering activities.

- A spills management plan, including spill control and absorbent materials, instructions regarding their use and notification procedures, will be developed and maintained on-site, and all site personnel will be familiar with its implementation. No storage, maintenance or refuelling of equipment will be permitted near the stream, with sufficient separation and/or containment measures so as to prevent migration of potential contaminants to the watercourses.

- No fording of the watercourses will occur without authorization by Parks Canada, MNR or RVCA.

- All culvert extensions will be designed and installed to ensure no barriers to fish movement are created (10% of culvert is embedded into the substrate to prevent a perched culvert), and the extensions are stable and will not result in development of erosion.

- All debris and potential contaminants (e.g. concrete and structural materials, paint and solvents, sand-blasting) generated from removal or rehabilitation of existing culverts or structures will be properly contained to prevent debris from entering the watercourse, and all debris will be properly disposed of off-site.

- Removal of riparian vegetation, particularly woody vegetation will be kept to the minimum necessary for the proposed LRT project.

- In areas where woody riparian vegetation is removed, replacement with native species will be required.

- All disturbed surfaces will be stabilized and re-vegetated as soon as feasible following construction.

- If blasting is required to construct the tunnel at Crossing #2 under the Rideau Canal, DFO's "Guidelines for the Use of Explosives in or near Canadian Fisheries Waters" (Wright and Hopky 1998) will be adhered to.

- A qualified environmental inspector will be on-site as required throughout construction, responsible for ensuring the sediment and erosion control measures are functioning and all of the mitigation measures are being implemented.

The following design measures pertain to those watercourses where new or replacement culverts or structures will be constructed or where channel realignment and/or re-construction is proposed:

- The existing bed profile and substrate on the bed of the Rideau Canal (above the tunnel) will be re-instated, and native riparian vegetation replaced, following construction of the twin tunnel under the canal. A copy of the documentation of the existing bed profile and substrate conditions will be provided to Parks Canada.

- Where new or replacement culverts are proposed, fish passage and habitat opportunities in the watercourses should be maintained, or enhanced in the case of existing culverts, by either using a open footing culvert or by embedding and backfilling the new culvert with granular substrate. Typical embedment depths are approximately 30 cm, however the depth and substrate size mix should be designed in consultation with a hydrologist. Substrate should consist of clean stone/rock material sized to withstand scouring velocities mixed with smaller granular to minimize interflow movement and provide substrate diversity.

- Where rock/scour protection is required for structure piers or channel banks, it should be designed and installed so as to minimize alteration of the channel profile (e.g. inset to match existing grade) and / or designed to provide fish habitat opportunities wherever possible.

- The footings for the new structures will be inset below the bed elevation and the bed substrates re-instated, so that the direct long-term removal of habitat on the channel bed is limited to the area of the pier shaft (which is much smaller than the footing).

- The proposed new channel sections along the Cahill Drain and Mosquito Creek Tributaries should be designed using naturalized channel techniques, by a qualified fluvial geomorphologist, and constructed by or with advice from qualified fisheries biologist and hydrologist.

- Habitat conditions in the existing channel sections should be replaced or potentially enhanced in the new channel sections, including substrates and morphology, and instream and overhead/riparian cover.

- The existing habitat conditions and associated functions that will be removed or temporarily removed for the channel re-alignments and tunnel construction respectively should be documented in detail during the detailed design phase of the project, so the replacement channel and habitat conditions can be properly designed and constructed.

ii) Operational and Maintenance Mitigation Measures

Standard mitigation measures associated with operation and maintenance of the proposed LRT will include a series of flat-bottomed, vegetated ditches along the LRT embankment to 'filter' runoff and provide informal cleansing. Specific mitigation measures related to stormwater run-off include the commitment to not permit any new outflows into the Rideau Canal and to design deck drainages capture systems on all new bridges over the Rideau Canal. These mitigation measures will ensure that no salt laden runoff enters the Rideau Canal. Additional details are included in Section 5.1.1.4 of this Report.

iii) Rehabilitation Mitigation Measures

The same type of construction-related mitigation measures to those outlined above will be employed for Rehabilitation activities associated with future watercourse culverts or structure replacement or repair, or any other general railway-rehabilitation works that affect areas draining to watercourses generally. Specifically all relevant construction-related measures outlined above will be identified and applied to address impacts specific to the proposed rehabilitation works and potentially affected watercourse.

Preliminary HADD Determinations

A technical fisheries meeting was held on August 26th, 2005 with the Department of Fisheries and Oceans (DFO) and the Rideau Valley Conservation Authority (RVCA) to review the potential adverse effects to fisheries and the proposed mitigation measures, and to make preliminary HADD (Harmful Alteration, Disruption or Destruction) determinations. The results of this meeting are documented in Table 5.1.1.2-1. It should be noted that these HADD determination will be re-examined as design progresses and authorizations, under the Fisheries Act, will be obtained as required.

The proposed works at the majority of the crossings are considered to result in a likely HADD, subject to confirmation based on the Detail Design and additional fisheries data collection and analysis. The preliminary determinations resulting from this meeting will be further refined when an increased level of design detail is available. As part of this process, DFO and RVCA indicated that additional fish habitat and fisheries information should be collected and incorporated, particularly in some of the small tributaries during the spring and summer to assess Northern Pike spawning and nursery habitat functions.

The specific approvals (Authorization for Works or Undertakings Affecting Fish Habitat) under the *Fisheries Act* will be obtained during Detailed Design. All works will be undertaken in compliance with the requirements of these Authorizations under the Fisheries Act.

As a component of the application for Authorization, compensation will be required to ensure 'no net loss' of fish habitat (i.e. net gain in fish habitat) as a result of the various HADDs. Rather than developing individual compensation plans at each of the watercrossings where a HADD occurs, DFO's and RVCA's preference is to develop a larger overall compensation plan. Some potential opportunities noted by DFO and RVCA include the following:

- Create embayments along the Rideau Canal as nursery habitat for Muskellunge and other species, in consultation with MNR and Muskies Canada who have identified some potential sites and completed this type of project.
- Enhance fish habitat at the mouth of Sawmill Creek at the Rideau Canal by addressing on-going sediment and erosion concerns, assessing and rehabilitating the rehabilitated Walleye spawning bed upstream (i.e. the bed may require cleaning or addition of more rock material depending on the velocities during the spawning period) and/or replacement or retrofitting of the perched culvert at Riverside Drive to allow for fish passage upstream.
- Rehabilitate the Walleye spawning bed at Carlton University if it is confirmed that Walleye are spawning at this location.
- Fence cattle out of areas along the Rideau Canal and stabilize the shoreline, where there are problems within and near the limits of the City of Ottawa.

This compensation plan will be developed by a fisheries consultant, with input from DFO, RVCA and MNR, as well as Parks Canada during Detail Design. It is imperative that the Detail Design and construction process provide sufficient time for collection and analysis of additional data and development of a compensation plan.

Significance of Potential Effects

The greatest potential for adverse effects in relation to fish habitat and watercourses occur during the construction phase. With the application of the previously noted mitigation measures and compensations plans, which will result in a net gain in fish habitat, no significant adverse effects to fish habitat is anticipated. In fact it is anticipated that there will be a benefit to fish habitat as the compensation plans required for Authorization under the Fisheries Act will result in a net gain in fish habitat.

Potential effects during the operational and maintenance phase relate primarily to increased stormwater runoff. Additional stormwater runoff is not anticipated to result in a significant adverse environmental effect as it will be mitigated by the implementation of the stormwater management measures identified in Section 5.1.1.4 of this report.

Table 5.1.1.2-1. Potential adverse effects to existing watercourses and associated aquatic habitat and fisheries, including proposed mitigation and significance of potential effects

Crossing#/ Watercourse (Assessed in field by Ecoplans - 2004 & 2005)	Construction Effects		Operational and Maintenance Effects	Potential Effects During Rehabilitation	Proposed Mitigation	Preliminary HADD Determination, Requirements For Further Review and Other Permit Requirements	Significance of Potential Effects
	Description of Watercourse-related Works	Adverse effects on Aquatic Habitat and Fisheries					
Crossing #1 Rideau Canal (39+040)	No instream works (strengthening on existing Mackenzie Bridge for LRT).	None	Potential for water quality degradation as a result of incremental runoff through the downtown/urban portion where the track is part of the roadway and associated urban stormwater system is considered nominal.	General rehabilitation activities in the long term may involve repair or replacement of the watercourse crossing structure, which may have limited adverse effects to the associated watercourses associated with these activities, or potential disturbance of areas draining to the watercourse for other general repair works. In general, these adverse effects are predictable, temporary and limited in extent, and can be managed with the implementation of standard construction-related mitigation measures (see crossing #2).	N/A	No works. An amendment to the license agreement with Parks Canada Agency is required. A permit from Parks Canada Agency is required for works in/on/over/under the Rideau Canal. Permit required from Transport Canada for approval under the *Navigable Waters Protection Act*.	**No significant adverse effect**
Crossing #2 Rideau Canal (33+500)	A tunnel will be constructed in the winter below the canal by open cut method. Cofferdams will be used to hold back the water.	Short term adverse effects during construction include local removal of riparian vegetation, alteration of the channel banks (although east bank presently is hardened – concrete) and local disruption during tunnel installation and associated potential for erosion and downstream sediment transport if poor construction or restoration techniques are used. Minimal long term adverse effects of the tunnel construction due to the reinstatement of the substrate on the bed of the canal (above the tunnel) and reinstatement of riparian vegetation. Throughout the study corridor the affected reach of the Rideau Canal exhibits a flat morphology. Substrate throughout the nearshore areas is mostly muck and sand, and the bed and channel have been modified historically. Submergent vegetation (e.g. Northern Water Milfoil, pondweeds) provide instream cover. There is little riparian vegetation along the east bank (lawn/parkland back from concrete edge). Along the west bank there are mainly grasses with large Crack Willow, White Ash and Sumac and planted trees within the Dominion Arboretum further back. Supports diverse warmwater fish community.	No direct runoff given tunnel.	It is not anticipated that rehabilitation works associated with the tunnel will involve any inwater works.	All relevant standard mitigation measures prevent construction-related adverse effects to the watercourse will be implemented, including: • proper timing windows • sediment and erosion control measures • bypass pumping/flow management measures • transfer of any isolated fish • settling and energy dissipation measures • fish passage and substrate maintenance in new or replacement culvert • spills management plans • minimization of riparian vegetation removal • stabilization of disturbed surfaces following construction • replace/enhance riparian vegetation that is removed during construction • re-instating existing bed and substrate conditions following construction • adherence to DFO blasting guidelines if blasting required • use of a qualified inspector • consult with agencies regarding any specific protection requirements for American Eel . • See Section 5.1.1.5 of the report for greater detail. Site specific measures include proper design and re-instatement of existing habitat conditions following construction of	Preliminary determination from DFO - works may not be considered HADD but DFO will need to see detailed design and construction techniques (including are of impact and duration of in-water construction) before a final determination can be made. To be confirmed in consultation with Parks Canada Agency. A license agreement with Parks Canada Agency is required. No *Construction, Fill and Alteration to Waterways (CFAW)* permit required from RVCA since federal waterbody. A permit from Parks Canada Agency is required for works in/on/over/under the Rideau Canal. Permit required from Transport Canada for approval under the *Navigable Waters Protection Act*.	**Low-moderate significance.** Flat morphology, muck and sand substrate, historically modified banks and channel; conditions can be re-instated following construction of the tunnel. Therefore adverse effects should be temporary. **No significant residual effects with proper implementation of mitigation measures and re-instatement of pre-construction habitat conditions.**

Table 5.1.1.2-1. Potential adverse effects to existing watercourses and associated aquatic habitat and fisheries, including proposed mitigation and significance of potential effects							
Crossing#/ Watercourse (Assessed in field by Ecoplans - 2004 & 2005)	**Construction Effects**		**Operational and Maintenance Effects**	**Potential Effects During Rehabilitation**	**Proposed Mitigation**	**Preliminary HADD Determination, Requirements For Further Review and Other Permit Requirements**	**Significance of Potential Effects**
	Description of Watercourse-related Works	**Adverse effects on Aquatic Habitat and Fisheries**					
					the tunnel.		
Crossing #3 Rideau River (32+200)	The new structure proposed immediately upstream (west) of the existing five span structure will involve twinning the existing piers (with a 0.8m gap), three of which are in the water and one of which is adjacent to the south bank. Each of the three new instream piers will be 1m by either 4 or 8m wide shafts on the bed, with underlying footings 2.75m wide and 0.3m longer than the shaft lengths at both ends. Construction of the underlying footings will involve temporary disturbance of a larger surrounding area, however the footings will be subsurface and 'natural' bed conditions and associated habitat will be re-instated following construction of the footings. Therefore the total surface area on the channel bed that will be occupied by the piers is either 12 or 24m^2.	Impacts of the pier construction at Crossing #3 include: local removal of riparian vegetation, alteration of the channel banks and removal of three small sections of channel bed, local disruption during pier installation and associated potential for erosion and downstream sediment transport (including potential for indirect impacts to downstream nursery habitat and potential downstream spawning habitat) if poor construction or restoration techniques are used. Throughout the study corridor the affected reaches of the Rideau River exhibit a morphology of rapids. Substrate throughout the nearshore area includes boulders and rubble. Riparian vegetation along the north bank (back from amourstone) is mainly mowed lawn and planted trees associated with the Carleton University campus. Along the south bank more woody species prevail including Crack Willow, Manitoba Maple, White Ash, White Elm, Sugar Maple, White Pine and shrub willow.	As with any transportation facility, there is some potential for adverse effect to groundwater or surface water as a result of runoff from the railway during storm events which can indirectly influence water quality in the watercourses. However, in general, the daily operation and maintenance of the LRT should have limited effects given the electric power source and limited runoff potential from the relatively small surface area and permeable embankment. The railway should be properly maintained and operated to minimize potential for leaks or spills of potential contaminants such as lubricants, sewage, and metals. No 'unique' issues	See Crossing #1	All relevant standard mitigation measures prevent construction-related adverse effects to the watercourse will be implemented- see Crossing #2 above. Site specific measures include: • Stringent containment of instream activities to protect downstream nursery habitat. • Use of coffer dams to confine instream pier construction zones • Proper containment of debris if existing structure is removed • Sensitive design of any rock protection to maintain channel profile and/or integrate fish habitat. During operation, runoff will filter through the railway embankment and be collected and 'filtered' in vegetated ditches that will provide informal cleansing.	Preliminary determination from DFO - works would be considered HADD since pier columns occupy area of river bed; require *Authorization for Works* under *Fisheries Act* from DFO. Compensation would be required. *CFAW* permit likely required. Permit required from Transport Canada for approval under the *Navigable Waters Protection Act*.	**Moderate significance.** Minor area of bed removed for pier columns (either 12 or 24m^2). Rapids, coarse substrate, potential spawning habitat for Walleye, sucker and redhorse species and nursery sites (Rock Bass, Yellow Perch) located downstream. **No significant residual effects with proper implementation of mitigation measures, including stringent containment of instream activities to protect downstream nursery habitat.**
Crossing #4 Sawmill Creek (30+680)	A replacement structure is proposed immediately east (downstream) of the existing structure that will span the creek with no piers/abutments located instream. The existing structure will be removed.	With the proposed four span structure, adverse effects of the new structure on Sawmill Creek through the crossing area are minimal since there are no instream works. Impacts are limited to local removal of riparian vegetation and potential adverse effects during removal of the existing structure. Riparian vegetation in the vicinity of the study corridor includes Reed Canary Grass and other grasses, old field herbs (e.g. goldenrod sp., Wild Carrot, aster sp.), milkweed, Purple Loosestrife, Spotted Joe Pye-Weed, and occasional White Ash and Elm, and Buckthorn. The affected reach of the watercourse in the vicinity of the new structure crossing area exhibits a riffle morphology beneath the existing structure and further downstream for approximately 40m. Further upstream and downstream there is a flat morphology. Substrate includes 55% rubble, 20% gravel, 10% boulders and 15% silt/sand. The fines could be susceptible to downstream transport during periods of flow, if poor construction or restoration techniques are used.	See Crossing #3 No 'unique' issues	See Crossing #1	All relevant standard mitigation measures prevent construction-related adverse effects to the watercourse will be implemented- see Crossing #2 above. • Site specific measures include: • Proper containment of debris to remove existing structure • Sensitive design of any rock protection to maintain channel profile and/or integrate fish habitat	Preliminary determination from DFO - works would not be considered HADD; RVCA would likely issue *Letter of Advice* unless there was Federal funding and then DFO would issue it. RVCA agreed in follow-up consultation with DFO. *CFAW* permit may be required for extension of pedestrian walkway through structure if there are any flooding/hydraulic implications (i.e. not fill regulated); requires review/final determination from RVCA.	**Low Significance**. Watercourse spanned. **No significant residual effects with proper implementation of mitigation measures**

Table 5.1.1.2-1. Potential adverse effects to existing watercourses and associated aquatic habitat and fisheries, including proposed mitigation and significance of potential effects

Crossing#/ Watercourse (Assessed in field by Ecoplans - 2004 & 2005)	Construction Effects		Operational and Maintenance Effects	Potential Effects During Rehabilitation	Proposed Mitigation	Preliminary HADD Determination, Requirements For Further Review and Other Permit Requirements	Significance of Potential Effects
	Description of Watercourse-related Works	Adverse effects on Aquatic Habitat and Fisheries					
Crossing #5 and 5A **Sawmill Creek** (28+830)	At Crossing #5 the existing concrete culvert will be extended 10m on the east (u/s) side. At Crossing #5a, the existing crossing will be extended approximately 4m on the north (d/s) side.	Impacts of the extension/enclosure at Crossing #5 and 5a include: local removal of riparian vegetation, alteration of the channel banks and bed, local disruption during culvert installation and associated potential for erosion and downstream sediment transport during periods of flow if poor construction or restoration techniques are used. Potential indirect habitat effects given existing culverts, straight channel and generally altered habitat regime. At Crossing #5 and 5a the affected reaches of the watercourse within the extension zones exhibits a "flat" morphology and a drain profile. Substrate in this area is dominated fines (sand/silt) with some gravel, rubble and occasional boulders. The fines could be susceptible to downstream transport during periods of flow, if poor construction or restoration techniques are used. Potential for erosion downstream of extended outfall at Crossing #5a since channel bends. Riparian vegetation in the affected reach at Crossing #5 along the north bank includes grasses, old field herbs (e.g. goldenrod sp., Wild Carrot, aster sp.) and a few ash and aspen plantings. Along the south bank riparian vegetation includes old field grasses and herbs and some Manitoba Maple, Buckthorn, shrub willow and raspberry around the culvert. Riparian vegetation in the affected reach at Crossing #5a is dominated by woody species including Manitoba Maple, shrub willow, Crack Willow, Green Ash, alder, White Elm and Buckthorn and some herbaceous species including Spotted Joe Pye-Weed and old field grasses and herbs further up the bank.	See Crossing #3 No 'unique' issues	See Crossing #1	All relevant standard mitigation measures prevent construction-related adverse effects to the watercourse will be implemented- see Crossing #2 above. Site specific measures include: • Design and install extensions to ensure fish passage is maintained and extension is stable/erosion will not develop. • Assess potential to create erosion downstream of extended outfall at Crossing #5a, and address with 'naturalized ' erosion protection measures as required.	Preliminary determination from DFO – culvert extension works would be considered HADD. RVCA agreed in follow-up consultation with DFO. Compensation required. *CFAW* permits likely required. Permit/approval requirements to be finalized based on detailed design.	**Low to Moderate Significance.** Flat morphology, drain profile, mostly fine substrate. Coolwater/potential coldwater fish habitat with sculpin. **No significant residual effects with proper implementation of mitigation measures**
Crossing #6 **Cahill Drain** (27+660)	The existing culvert (approximately 1.5m diameter CSP) will be extended approximately 4m on the west side and new headwalls will be installed. Watercourse flows underground on east (d/s) side.	Impacts of the extension/enclosure and new headwalls at Crossing #6 include: local removal of riparian vegetation, alteration of the channel banks and bed, local disruption during culvert installation and associated potential for erosion and downstream sediment transport during periods of flow if poor construction or restoration techniques are used. Potential indirect habitat effects due to changes in local hydrology are considered nominal due minor extension of existing culvert, straight channel and generally altered habitat regime. The affected reach of the watercourse within the extension area exhibits a "flat" morphology. Substrate in this area is a mix of rubble and sand (dominant) with some gravel and boulders. The fines could be susceptible to downstream transport during periods of flow, if poor construction or restoration techniques are used. Riparian vegetation in the affected includes some Reed Canary Grass along the banks, Wild Grape, raspberry and some woody shrubs and trees including Buckthorn, Sumac, shrub willow, Red-osier Dogwood and Crack Willow.	See Crossing #3 No 'unique' issues	See Crossing #1	All relevant standard mitigation measures prevent construction-related adverse effects to the watercourse will be implemented- see Crossing #2 above. Site specific measures include: • Design and install extensions to ensure fish passage is maintained and extension is stable/erosion will not develop.	Preliminary determination from DFO – culvert extension works may be considered HADD. RVCA agreed in follow-up consultation with DFO, depending on length of the original culvert. Compensation required. Probably better to do compensation elsewhere since a section of this drain flows underground downstream of site. *CFAW* permit likely required. Permit/approval requirements to be finalized based on detailed design.	**Moderate Significance.** Flat, run, pool morphology, sand dominant substrate, coolwater/potential coldwater habitat; fish community samling included sculpin, in addition to range of other bait and forage species. **No significant residual effects with proper implementation of mitigation measures**

Table 5.1.1.2-1. Potential adverse effects to existing watercourses and associated aquatic habitat and fisheries, including proposed mitigation and significance of potential effects

Crossing#/ Watercourse (Assessed in field by Ecoplans - 2004 & 2005)	Construction Effects		Operational and Maintenance Effects	Potential Effects During Rehabilitation	Proposed Mitigation	Preliminary HADD Determination, Requirements For Further Review and Other Permit Requirements	Significance of Potential Effects
	Description of Watercourse-related Works	Adverse effects on Aquatic Habitat and Fisheries					
Crossing #7 **Cahill Drain** (27+050)	Re-alignment of approximately 230m of the existing channel that flows down the east side of the tracks between Crossing #7 and Crossing #8) is proposed to accommodate the LRT widening. The channel will be realigned to the west side of the ROW so that the existing culvert crossing can be removed. Also, the storm sewer presently located north of crossing on east side will be replaced.	Impacts of the proposed realignment of approximately 230m of channel between 'Crossings #7 and #8 include: removal of riparian vegetation, alteration of the channel banks and bed, local disruption during the realignment, associated potential for erosion and downstream sediment transport during periods of flow if poor construction or restoration techniques are used. Potential indirect habitat effects due to changes in local hydrology are considered nominal provided similar channel conditions are re-instated. No unique habitat conditions or functions that will be difficult to re-create. Any local groundwater influx should be maintained since new channel section is close to existing channel. With proper design and construction of new channel section no long-term permanent habitat effects should occur. The morphology in the affected reach of the watercourse reach upstream of Crossing #7 (north portion of reach) is mainly flats with a few riffles. The morphology in the affected reach of the watercourse downstream of Crossing #8 (south portion) is a flat. Substrates upstream of Crossing #7 include 65% gravel, 25% rubble and 10% boulders. Substrate in the channel downstream of Crossing #8 are mainly sand, silt, muck and some rubble. The substrate in the new channel could be susceptible to downstream transport during periods of flow, if poor construction or restoration techniques are used. Riparian vegetation along the north portion of the affected reach/ upstream of Crossing #7 includes grasses and old field herbs (e.g. goldenrod sp., Wild Carrot, aster sp.), along with shrubs and trees including, Buckthorn, shrub willow, White Ash, White Elm, shrub willow and Cedar. Riparian vegetation in the south portion/downstream of Crossing #8 is mainly Reed Canary Grass along with woody species (White, Sugar Maple, White Elm, Cedar) further upstream around the beaver pond. Downstream of the existing structure, riparian vegetation includes Reed Canary Grass and woody species (Buckthorn, shrub willow, White Ash, White Elm, Basswood).	See Crossing #3 Potential indirect effects of surface or groundwater effects associated with any unmanaged runoff or spills from proposed maintenance facility located south of the watercourse.	See Crossing #1	All relevant standard mitigation measures prevent construction-related adverse effects to the watercourse will be implemented- see Crossing #2 above. Site specific measures include: • Proper design and construction of naturalized habitat channel section to replace and enhance if possible existing habitat conditions and functions, including substrates and morphology, and instream and overhead cover. . Requires design and construction inspection input from qualified fluvial geomorphologist. • Design and implement spills containment and SWM measures for operation of proposed maintenance facility located to south of drain crossings. Assess groundwater conditions along the new channel alignment prior to relocation to confirm local groundwater discharge will continue.	Preliminary determination from DFO – realignment and culvert works would be considered HADD. Rationale/ justification for length of re-alignment proposed, including documentation of alternatives considered, is required. Preliminary rationale- Shifting widening to opposite of tracks to avoid this realignment would require even longer channel realignment since downstream section of channel parallels opposite side of tracks for longer distance to north (i.e. between Crossings # 7 & #6). DFO will require naturalized replacement channel properly designed by fluvial geomorphologist. *CFAW* permit required. Likely also require *Lakes and Rivers Improvement Act* permit from MNR. Permit/approval requirements to be finalized based on detailed design.	**Moderate Significance** Flat morphology with some riffles, coarse substrate, possible coldwater habitat; fish community samling included sculpin, in addition to range of other bait and forage species. **No significant residual effects with proper implementation of mitigation measures and naturalized channel realignment**
Crossing #8 **Cahill Drain** (26+840)	The existing culvert will be removed. See Crossing #7 above regarding proposed realignment of reach between Crossings #7 & 8). The existing culvert at Crossing #8 will also be removed.	See Crossing #7	See Crossing #3	See Crossing #1	See Crossing #7 above	See Crossing #7	See Crossing #7 above.

Table 5.1.1.2-1. Potential adverse effects to existing watercourses and associated aquatic habitat and fisheries, including proposed mitigation and significance of potential effects

Crossing#/ Watercourse (Assessed in field by Ecoplans - 2004 & 2005)	Construction Effects		Operational and Maintenance Effects	Potential Effects During Rehabilitation	Proposed Mitigation	Preliminary HADD Determination, Requirements For Further Review and Other Permit Requirements	Significance of Potential Effects
	Description of Watercourse-related Works	Adverse effects on Aquatic Habitat and Fisheries					
Crossing #9 Tributary of Sawmill Creek (25+410)	The existing CSP culvert (5m) will be removed and replaced with a CSP culvert (14m length, 600mm diameter) Extension on west (u/s) side = 8m Extension on east side = 1m	Impacts of the extensions/enclosures at Crossing #9 include: local removal of riparian vegetation, alteration of the channel banks and bed, local disruption during culvert installation and associated potential for erosion and downstream sediment transport during periods of flow if poor construction or restoration techniques are used. Potential indirect habitat effects due to changes in local hydrology are considered nominal due to the altered habitat regime. The affected reaches of the watercourse within the extension area exhibit a flat morphology. Substrate in this area is dominated by silt and muck. The fines could be susceptible to downstream transport during periods of flow, if poor construction or restoration techniques are used. Riparian vegetation upstream of the existing crossing includes grasses, shrub willow, Speckled Alder and Buckthorn. Downstream of the road, riparian vegetation includes Reed Canary Grass, some cattail, Jewelweed, and occasional Buckthorn, shrub willow and Red-osier Dogwood. Old field species exist further back.	See Crossing #3 Potential indirect effects of surface or groundwater effects associated with any unmanaged runoff or spills from proposed maintenance facility located north of the watercourse.	See Crossing #1	All relevant standard mitigation measures prevent construction-related adverse effects to the watercourse will be implemented- see Crossing #2 above. Site specific measures include: • Embed and backfill new culvert with native substrate to maintain fish passage and habitat opportunities. Design and implement spills containment and SWM measures for operation of proposed maintenance facility.	Preliminary determination from DFO – culvert extension works would be considered HADD. RVCA agreed in follow-up consultation with DFO. Compensation required. *CFAW* permit likely required. Permit/approval requirements to be finalized based on detailed design.	**Low Significance**. Flat morphology, fine substrates **No significant residual effects with proper implementation of mitigation measures**
Crossing #10 Tributary of Sawmill Creek (25+190)	The existing CSP culverts will be removed and replaced with a concrete box culvert (27m length, 2.4x1.1) Extension on west (u/s) side = 8m East side will be 2m shorter with localized tie-in to 're-open' channel. Net extension of 6m.	Impacts of the extension/enclosure and potential localized tie-in at Crossing #10 include: local removal of riparian vegetation, alteration of the channel banks and bed, local disruption during culvert installation and associated potential for erosion and downstream sediment transport during periods of flow if poor construction or restoration techniques are used. Potential indirect habitat effects due to changes in local hydrology are considered nominal due to the altered habitat regime and the short extension involved. The affected reaches of the watercourse within the extension and realignment areas exhibit a flat morphology. Substrate in this area is dominated by silt and muck. The fines could be susceptible to downstream transport during periods of flow, if poor construction or restoration techniques are used. Riparian vegetation upstream of the road and rail crossings includes Reed Canary Grass, Jewelweed, raspberry, Beggar's Ticks, Wild Grape, shrub willow, Buckthorn and Manitoba Maple. Downstream, riparian vegetation includes is the same as upstream with more shrubs and trees and additional species including Red and Silver Maple, Balsam Poplar.	See Crossing also #3 Potential indirect effects of surface or groundwater effects associated with any unmanaged runoff or spills from proposed maintenance facility located north of the watercourse.	See Crossing #1	All relevant standard mitigation measures prevent construction-related adverse effects to the watercourse will be implemented- see Crossing #2 above. Site specific measures include: • Embed and backfill new culvert with native substrate to maintain fish passage and habitat opportunities. Design and implement spills containment and SWM measures for operation of proposed maintenance facility.	Preliminary determination from DFO – culvert extension works would be considered HADD. RVCA agreed in follow-up consultation with DFO. Compensation required. *CFAW* permit likely required. Permit/approval requirements to be finalized based on detailed design.	**Low Significance**. Flat morphology, fine substrates **No significant residual effects with proper implementation of mitigation measures**

Table 5.1.1.2-1. Potential adverse effects to existing watercourses and associated aquatic habitat and fisheries, including proposed mitigation and significance of potential effects							
Crossing#/ Watercourse (Assessed in field by Ecoplans - 2004 & 2005)	Construction Effects		Operational and Maintenance Effects	Potential Effects During Rehabilitation	Proposed Mitigation	Preliminary HADD Determination, Requirements For Further Review and Other Permit Requirements	Significance of Potential Effects
	Description of Watercourse-related Works	Adverse effects on Aquatic Habitat and Fisheries					
Crossings #11, 11a, b, c Tributaries of Mosquito Creek #11 (19+190) #11a (from 19+900 to 20+250) 11b (19+240, 19+536 to 19+600, 19+320 to 19+352, 19+320) 11c (from 18+910 to 19+010)	A new CSP approx. 18m in length (3m diameter) will be required at Crossing #11 (19+190). At Crossing 11a, the LRT alignment encroaches on an approximately 350m reach of the watercourse along its east side. This section (from 19+900 to 20 +250) will have to be realigned. At Crossing 11b, a 22m culvert (2m diameter) is proposed at station 19+240. In addition, two sections of channel approximately 44m (19+536-19+600) and 32m (19+320-19+352) long will be re-aligned along the east side of the tracks. The latter reach will then drain into a culvert (at 19+320) approximately 19m in length (2m diameter), draining under the tracks to the west. At Crossing 11c, the LRT crosses the watercourse at an angle. The proposed 'crossing' configuration affects approximately 108m of channel, and includes a 22m culvert (3m diameter, at 19+000) under the tracks, with realignment of approximately 10m of channel downstream of the culvert and approximately 80m upstream (east) from 18+910 to 19+010.	Impacts of the enclosures and realignments at Crossings #11, 11a, b and c include: local removal of riparian vegetation, alteration of the channel banks and bed, local disruption during culvert installation and construction of realignments and associated potential for erosion and downstream sediment transport during periods of flow if poor construction or restoration techniques are used. Potential indirect habitat effects due to changes in local hydrology are considered nominal due to the straight channels and altered habitat regime. Throughout the study corridor these features are small, intermittent agricultural drainage ditches with dense instream vegetation (mostly dense sedges and rush species) and no defined channels The affected reaches of the watercourses within the enclosure and realignment areas probably exhibit a flat morphology. Substrate throughout the area is dominated by muck and clay. The fines could be susceptible to downstream transport during periods of flow, if poor construction or restoration techniques. Riparian vegetation includes grasses, old field herbs and patches of Silver Maple and shrub willow in the vicinity of the Crossings 11, 11b and 11c. At Crossing 11a the riparian vegetation includes more moist meadow species of grasses, sedges and rush species, Meadowsweet with occasional shrub willow, White Elm and Silver Maple.	See Crossing #3 No 'unique' issues	See Crossing #1	All relevant standard mitigation measures prevent construction-related adverse effects to the watercourse will be implemented- see Crossing #2 above. Site specific measures include: • Embed and backfill new culvert with native substrate to maintain fish passage and habitat opportunities. • Proper design and construction of naturalized habitat channel section to replace and enhance if possible existing habitat conditions and functions, including substrates and morphology, and instream and overhead cover. Requires design and construction inspection input from qualified fluvial geomorphologist.	Preliminary determination from DFO – realignment and culvert works would be considered HADD. RVCA agreed in follow-up consultation with DFO. Compensation required. Rationale/justification for length of re-alignment proposed, including documentation of alternatives considered, is required. Preliminary rationale- Alignment bends to south and therefore there is limited flexibility to alter location of bend based on alignment through Secondary Plan area to west. Furthermore, the network of small ditched agricultural tributaries extends throughout the area generally, so likely affected regardless of alignment. Affected reaches crossed are far upstream and altered/ditched agricultural features. DFO will require naturalized channel properly designed by fluvial geomorphologist. Additional fisheries assessment work is required on these tributaries to Mosquito Creek especially in the early spring to assess Northern Pike spawning and later in the summer to assess if there is nursery habitat. There is currently not adequate fisheries data. If spawning determined, replace spawning habitat. If downstream barriers to migration, consider barrier removal as part of compensation. *CFAW* permit required. Likely also require *Lakes and Rivers Improvement Act* permit from MN R. Permit/approval requirements to be finalized based on detailed design.	**Low Significance**. Agricultural drainage ditches, fine substrates. Grasses provide potential pike spawning material, however flow volume and duration may not be sufficient to support successful spawning and channel definition may be insufficient for access of adults this far 'upstream'. **No significant residual effects with proper implementation of mitigation measures and naturalized channel realignment**
Crossing #12 Mosquito Creek (18+100)	A new four span structure is proposed over Mosquito Creek. No piers proposed instream. The closest piers to the watercourse are located in the floodplain but approximately 3 to 5m back on the west side of the creek and 10m back on the east side.	Impacts of the structure on Mosquito Creek through the crossing area are minimal due to the creek being spanned (no instream piers). Adverse effects are limited generally to local removal of riparian vegetation and potential for indirect impacts during adjacent construction. Riparian vegetation in the vicinity of the study corridor includes Reed Canary Grass and other grasses, old field herbs (e.g. goldenrod sp., Wild Carrot, aster sp.), milkweed, Purple Loosestrife, Spotted Joe Pye-Weed, and occasional White Ash and Elm, and Buckthorn.	See Crossing #3 No 'unique' issues	See Crossing #1	All relevant standard mitigation measures prevent construction-related adverse effects to the watercourse will be implemented- see Crossing #2 above.	Preliminary determination from DFO - works may be considered a HADD if the fisheries assessment indicates that Northern Pike are using the floodplain area for spawning in the spring; RVCA agrees that it may be a HADD. *CFAW* permit may be required if there are any flooding/hydraulic implications of new structure (i.e. not fill regulated); requires review/final determination from RVCA. Review potential for floodplain to be used for Northern Pike spawning to confirm channel invert is 'disconnected' from floodplain. If channel not fully disconnected and potential exists, conduct spawning survey during Detailed Design.	**Low Significance.** Structure will span the watercourse. **No significant residual effects with proper implementation of mitigation measures**

Crossing#/ Watercourse (Assessed in field by Ecoplans - 2004 & 2005)	Construction Effects		Operational and Maintenance Effects	Potential Effects During Rehabilitation	Proposed Mitigation	Preliminary HADD Determination, Requirements For Further Review and Other Permit Requirements	Significance of Potential Effects
	Description of Watercourse-related Works	Adverse effects on Aquatic Habitat and Fisheries					
Crossing #13 Tributary of Mosquito Creek (17+350)	A CSP approximately 35m in length will be required at Crossing #13.	Impacts of the enclosure at Crossing #13 include: local removal of riparian vegetation, alteration of the channel banks and bed, local disruption during culvert installation and associated potential for erosion and downstream sediment transport during periods of flow if poor construction or restoration techniques are used. Potential indirect habitat effects due to changes in local hydrology are considered nominal due to the straight ditched channel and altered habitat regime. Throughout the study corridor this feature is a small, flat bottom agricultural drainage ditch (with dense instream Reed Canary Grass) with no defined channel. The affected reach of the watercourse within the enclosure area probably exhibits a flat morphology (was dry at time of survey). Substrate throughout the area is dominated by muck and clay. The fines could be susceptible to downstream transport during periods of flow, if poor construction or restoration techniques. Riparian vegetation is dominated by Reed Canary Grass.	See Crossing #3 No 'unique' issues	See Crossing #1	All relevant standard mitigation measures prevent construction-related adverse effects to the watercourse will be implemented- see Crossing #2 above. Site specific measures include: • Embed and backfill new culvert with native substrate to maintain fish passage and habitat opportunities.	Preliminary determination from DFO – new culvert works would be considered HADD **assuming** there is direct seasonal fish use given far upstream reaches (i.e. if indirect fish habitat contribution only, works not likely HADD with mitigation). RVCA agreed in follow-up consultation with DFO. *CFAW* permit likely required. Conduct Northern Pike spawning and fish sampling during spring to determine in any seasonal use by forage species during Detailed Design and/or assess presence of barriers to fish migration/movement from permanent habitat downstream. Permit/approval requirements to be finalized based on additional information and detailed design.	**Low Significance.** Agricultural drainage ditch, fine substrates. Grasses provide potential pike spawning material, however flow volume and duration may not be sufficient to support successful spawning and channel definition may be insufficient for access of adults this far 'upstream.' **No significant residual effects with proper implementation of mitigation measures**
Crossing #14 Tributary of Mosquito Creek (Thomas Gamble Municipal Drain) (16+000)	A CSP approximately 30m in length will be required at Crossing #14.	Impacts of the enclosure at Crossing #14 include: local removal of riparian vegetation, alteration of the channel banks and bed, local disruption during culvert installation and associated potential for erosion and downstream sediment transport during periods of flow if poor construction or restoration techniques are used. Potential indirect habitat effects due to changes in local hydrology are considered nominal due to the ditched altered channel and habitat regime. At the crossing location, the channel flows through a maple (silver and red) deciduous swamp (riparian vegetation). The affected reach of the watercourse is located at an existing farm lane (no culvert) crossing. The upstream portion of the crossing reach is a small, flat bottom agricultural drainage ditch (with dense instream Reed Canary Grass, cattail) with no defined channel. Morphology is flat and substrate throughout the area is dominated by muck and clay. The fines could be susceptible to downstream transport during periods of flow, if poor construction or restoration techniques.	See Crossing #3 No 'unique' issues	See Crossing #1	All relevant standard mitigation measures prevent construction-related adverse effects to the watercourse will be implemented- see Crossing #2 above. Site specific measures include: • Embed and backfill new culvert with native substrate to maintain fish passage and habitat opportunities.	Preliminary determination from DFO – new culvert works would be considered HADD. **assuming** confirmation that existing fish use the affected reaches seasonally. Fish caught approximately 250-300m downstream of affected reach (Niblett 1994), but require confirmation of direct seasonal fish use of affected reach; if indirect fish habitat contribution only, works not likely HADD with mitigation. RVCA agreed in follow-up consultation with DFO that it may be a HADD depending on results of fisheries assessment. *CFAW* permit likely required. Conduct Northern Pike spawning and fish sampling during spring to determine in any seasonal use by forage species during Detailed Design and/or assess presence of barriers to fish migration/movement from permanent habitat downstream. Permit/approval requirements to be finalized based on additional information and detailed design.	**Low Significance.** Agricultural drainage ditch, fine substrates. Grasses provide potential pike spawning material, however flow volume and duration may not be sufficient to support successful spawning and channel definition may be insufficient for access of adults this far 'upstream'. **No significant residual effects with proper implementation of mitigation measures**
Crossing #15 Tributary of Mosquito Creek (15+295)	A CSP approximately 30m in length will be required at Crossing #15.	Impacts of the enclosure at Crossing #15 include: local removal of riparian vegetation, alteration of the channel banks and bed, local disruption during culvert installation and associated potential for erosion and downstream sediment transport during periods of flow if poor construction or restoration techniques are used. Potential indirect habitat effects due to changes in local hydrology are considered nominal due to the altered, ditched channel and habitat regime. Throughout the study corridor this feature is a small, flat bottom agricultural drainage ditch/swale with no defined	See Crossing #3 No 'unique' issues	See Crossing #1	All relevant standard mitigation measures prevent construction-related adverse effects to the watercourse will be implemented- see Crossing #2 above. Site specific measures include: • Embed and backfill new culvert with native substrate to maintain fish passage and habitat opportunities.	Preliminary determination from DFO – new culvert works would be considered HADD **assuming** there is direct seasonal fish use given far upstream reaches and closest confirmed fish use is 500m downstream (i.e. if indirect fish habitat contribution only, works not likely HADD with mitigation). RVCA agreed in follow-up consultation with DFO. Compensation may be required. *CFAW* permit likely required. Conduct Northern Pike spawning and fish sampling during spring to determine in any seasonal use by	**Low Significance.** Agricultural drainage ditch, fine substrates. Grasses provide potential pike spawning material, however flow volume and duration may not be sufficient to support successful spawning and channel definition may be insufficient for access of adults this far 'upstream'.

Table 5.1.1.2-1. Potential adverse effects to existing watercourses and associated aquatic habitat and fisheries, including proposed mitigation and significance of potential effects

Table 5.1.1.2-1. Potential adverse effects to existing watercourses and associated aquatic habitat and fisheries, including proposed mitigation and significance of potential effects

Crossing#/ Watercourse (Assessed in field by Ecoplans - 2004 & 2005)	Construction Effects		Operational and Maintenance Effects	Potential Effects During Rehabilitation	Proposed Mitigation	Preliminary HADD Determination, Requirements For Further Review and Other Permit Requirements	Significance of Potential Effects
	Description of Watercourse-related Works	Adverse effects on Aquatic Habitat and Fisheries					
		channel. The affected reach of the watercourse within the enclosure area probably exhibits a flat morphology (was dry at time of survey). Substrate throughout the area is dominated by muck and clay. The fines could be susceptible to downstream transport during periods of flow, if poor construction or restoration techniques. Riparian vegetation downstream (north) of the study corridor includes mainly woody species - White Elm and Ash, Basswood, Manitoba Maple and Buckthorn. Upstream riparian (and instream) vegetation includes grasses, old field herbs (e.g. goldenrod sp., Wild Carrot, aster sp.), and patches of woody species (White Ash and Elm, Buckthorn, Manitoba Maple).				forage species during Detailed Design and/or assess presence of barriers to fish migration/movement from permanent habitat downstream. Permit/approval requirements to be finalized based on additional information and detailed design.	**No significant residual effects with proper implementation of mitigation measures**
Crossing #16 Tributary of the Rideau Canal (14+280)	A CSP approximately 30m in length will be required at Crossing #16.	Impacts of the enclosure at Crossing #16 include: local removal of riparian vegetation, alteration of the channel banks and bed, local disruption during culvert installation and associated potential for erosion and downstream sediment transport during periods of flow if poor construction or restoration techniques are used. Potential indirect habitat effects due to changes in local hydrology are considered nominal due to the altered/field swale habitat regime. Through the study corridor, this feature is an agricultural field swale with dense instream vegetation (Common Cattail and Reed Canary Grass, sedge and rush spp., and Purple Loosestrife), which ranges in width from 8 to 15m. No defined channel. The affected reach of the watercourse within the enclosure area probably exhibits a "flat" morphology (was dry at time of survey). Substrate throughout the area is dominated by muck and clay. The fines could be susceptible to downstream transport during periods of flow, if poor construction or restoration techniques. Riparian vegetation includes Reed Canary Grass, old field herbs (e.g. goldenrod sp., Wild Carrot, aster sp.). Soybeans further back.	See Crossing #3 No 'unique' issues	See Crossing #1	All relevant standard mitigation measures prevent construction-related adverse effects to the watercourse will be implemented- see Crossing #2 above. Site specific measures include: • Embed and backfill new culvert with native substrate to maintain fish passage and habitat opportunities.	Preliminary determination from DFO – new culvert works would be considered HADD **assuming** there is direct seasonal fish use given far upstream reaches. RVCA agreed in follow-up consultation with DFO it is probably a HADD but need to review once Fisheries Assessment to confirm whether or not there is direct seasonal use is completed. *CFAW* permit likely required. Conduct Northern Pike spawning and fish sampling during spring to determine in any seasonal use by forage species during Detailed Design and/or assess presence of barriers to fish migration/movement from permanent habitat downstream. Permit/approval requirements to be finalized based on additional information and detailed design.	**Low Significance.** Agricultural drainage ditch, fine substrates. Grasses provide potential pike spawning material, however flow volume and duration may not be sufficient to support successful spawning and channel definition may be insufficient for access of adults this far 'upstream'. **No significant residual effects with proper implementation of mitigation measures**
Crossing #17 Rideau Canal (13+700)	Interim Plan is incorporation of LRT on EA-approved structure for Strandherd Road. Ultimate Plan (2021) is construction of separate structure for the railway located approximately 20m upstream (south) of interim structure. New structures will span the canal with no instream piers.	Impacts associated with construction of the EA-approved interim structure and the Ultimate LRT structure (2021) include: local removal of riparian vegetation, potential disturbance of channel bank zones and associated potential for erosion and downstream sediment transport if poor construction or restoration techniques are used. Potential for indirect disturbance to nursery habitat (Smallmouth Bass, Yellow Perch and Log Perch) located approximately 300m downstream if poor construction practices are used. Throughout the study corridor the reaches of Rideau Canal in vicinity of both structure locations exhibit a flat morphology. Substrate throughout the nearshore areas includes a mix of sand, gravel, rubble and boulders. Riparian vegetation along the west bank includes mainly woody species including Crack Willow, shrub willow, Manitoba Maple, Green Ash, White Elm, Sugar Maple,	See Crossing #3 No 'unique' issues No direct drainage off structure. Runoff directed to closed drainage system discharging to ditches along Prince of Wales Drive and Riverside Road.	See Crossing #1	All relevant standard mitigation measures prevent construction-related adverse effects to the watercourse will be implemented- see Crossing #2 above, including stringent containment of instream activities to protect downstream nursery habitat. Site specific measures include: • Proper containment of debris if structure removed Sensitive design of any rock protection to maintain channel profile and/or integrate fish habitat	Preliminary determination from DFO - works would be considered HADD since instream pier originally proposed; requires confirmation from DFO that span structures now proposed will not be considered HADD. Parks Canada Agency license agreement required. *CFAW* permit likely required. Additional information also required during detailed design regarding need for temporary access road to site and related construction techniques. Design consultation with, and approval from NCC and Parks Canada Agency. A permit from Parks Canada Agency is required for works in/on/over/under the Rideau Canal.	**Low Significance.** Structures will span the canal. Mitigation will protect nursery habitat (Smallmouth Bass, Yellow Perch and Log Perch) located approximately 300m downstream. **No significant residual effects with proper implementation of mitigation measures.**

Crossing#/ Watercourse (Assessed in field by Ecoplans - 2004 & 2005)	Construction Effects: Description of Watercourse-related Works	Construction Effects: Adverse effects on Aquatic Habitat and Fisheries	Operational and Maintenance Effects	Potential Effects During Rehabilitation	Proposed Mitigation	Preliminary HADD Determination, Requirements For Further Review and Other Permit Requirements	Significance of Potential Effects
		White Pine, White Cedar and Buckthorn. There is a cottage on the east bank with a manicured riparian area- mainly mowed grass, but similar woody species further upstream and downstream along the bank.				Permit required from Transport Canada for approval under the *Navigable Waters Protection Act.*	
Crossing 17a Tributary of the Rideau Canal (13+520)	At Crossing #17a, the downstream end of the existing culvert at Prince of Wales Drive and the first few metres of the channel reach will be enclosed by the ultimate (2021) LRT structure that will separate the LRT from Strandherd Road. However, the approved roadway intersection works will remove the entire upstream portion of the tributary. Therefore, incremental impacts of LRT construction are nominal.	Impacts of the additional enclosure at Crossing #17a include: local removal of riparian vegetation, alteration of the channel banks and bed, local disruption during culvert installation and associated potential for erosion and downstream sediment transport during periods of flow if poor construction or restoration techniques are used. Potential indirect habitat effects due to changes in local hydrology are considered nominal due to the altered habitat regime. The reach upstream of Prince of Wales Drive that will be removed with the intersection works is small 20m defined section of ditch fragmented by fill from field swale reaches further upstream. The reach downstream of Prince of Wales Drive is an undefined Reed Canary Grass swale; the channel becomes more defined at outlet into Rideau Canal. The affected reaches of the watercourse exhibit a “flat” morphology (was dry at time of surveys). Substrate throughout the reach is dominated by muck and clay with some placed boulders upstream of the road. The fines could be susceptible to downstream transport during periods of flow, if poor construction or restoration techniques. Riparian vegetation includes Green Ash, White Elm, grasses and old field species.	See Crossing #3 No ‘unique’ issues	See Crossing #1	All relevant standard mitigation measures prevent construction-related adverse effects to the watercourse will be implemented- see Crossing #2 above. Site specific measures include: • Embed and backfill new culvert with native substrate to maintain fish passage and habitat opportunities.	Preliminary determination from DFO – culverts and intersection enclosure works would be considered HADD **assuming** there is direct seasonal fish use. RVCA agreed in follow-up consultation with DFO. Compensation probably required. *CFAW* permit likely required. During Detailed Design and prior to construction: - Conduct Northern Pike spawning survey during spring and/or assess presence of barriers to fish migration/movement from canal downstream to confirm whether or not spawning is possible. - Conduct fish sampling during spring/early summer to determine if any direct seasonal use by bait or forage species occurs Permit/approval requirements to be finalized based on additional information and detailed design.	**Low Significance** Ditch drainage upstream of Prince of Wales Drive, mostly fine substrates. **No significant residual effects with proper implementation of mitigation measures**
Crossing #18, 18a and 18b Tributaries of Jock River 18 (11+675) 18a (11+400) 18b (11+140)	Crossing #18 – a 40m CSP will be required. Crossing #18a – watercourse has been removed with recent construction. Crossing #18 – a 40m CSP will be required.	Impacts of the enclosures at Crossing #18 and 18b include: local removal of riparian vegetation, alteration of the channel banks and bed, local disruption during culvert installation and associated potential for erosion and downstream sediment transport during periods of flow if poor construction or restoration techniques are used. Potential indirect habitat effects due to changes in local hydrology are considered nominal due to the altered habitat regime. There will be no adverse effects at Crossing #18a as the watercourse was removed by recent construction at the time of the 2005 survey. Throughout the study corridor these features are small agricultural drainage ditches with dense instream vegetation (mostly dense sedges and rush species at 18a along with grasses at 18b), flat bottoms and no defined channels. The affected reaches of the watercourses within the enclosure areas probably exhibit a “flat” morphology (were dry at time of surveys). Substrate throughout the area is dominated by muck and clay. The fines could be susceptible to downstream transport during periods of flow, if poor construction or restoration techniques. Riparian vegetation in the vicinity of the crossing areas includes grasses and old field herbs (e.g. goldenrod sp., Wild Carrot, aster sp.) along with a patch of Hawthorn scrub at Crossing #18	See Crossing #3.	See Crossing #1.	All relevant standard mitigation measures prevent construction-related adverse effects to the watercourse will be implemented- see Crossing #2 above. Site specific measures include: • Embed and backfill new culvert with native substrate to maintain fish passage and habitat opportunities.	Preliminary determination from DFO – new culvert works would be considered HADD **assuming** there is direct seasonal fish use given far upstream reaches (i.e. if indirect fish habitat contribution only, works not likely HADD with mitigation). During Detailed Design and prior to construction: - Conduct Northern Pike spawning survey during spring and/or assess presence of barriers to fish migration/movement from river downstream to confirm whether or not spawning is possible. - Conduct fish sampling during spring/early summer to determine if any direct seasonal use by bait or forage species occurs Associated permit/approval requirements to be reviewed further based on MDP and further agency consultation.	**Low Significance** Agricultural drainage ditches, fine substrates. Grasses provide potential pike spawning material, however flow volume and duration may not be sufficient to support successful spawning and channel definition may be insufficient for access of adults this far ‘upstream.’ **No significant residual effects with proper implementation of mitigation measures**

Table 5.1.1.2-1. Potential adverse effects to existing watercourses and associated aquatic habitat and fisheries, including proposed mitigation and significance of potential effects							
Crossing#/ Watercourse (Assessed in field by Ecoplans - 2004 & 2005)	Construction Effects		Operational and Maintenance Effects	Potential Effects During Rehabilitation	Proposed Mitigation	Preliminary HADD Determination, Requirements For Further Review and Other Permit Requirements	Significance of Potential Effects
	Description of Watercourse-related Works	Adverse effects on Aquatic Habitat and Fisheries					
		and small shrubs and trees at Crossing #18b (Hawthorn, White Elm, cherry).					
Crossing #19 and 19a Tributary of Jock River 19 (10+880) 19a (10+740)	Crossing #19 – a 40m CSP or concrete culvert will be required. Crossing #19a –no CSP proposed given LRT crosses far upstream end of the ditch feature.	Impacts of the enclosure at Crossing #19 and removal of a section at 19b include: local removal of riparian vegetation, alteration of the channel banks and bed, local disruption during culvert installation and associated potential for erosion and downstream sediment transport during periods of flow if poor construction or restoration techniques are used. Potential indirect habitat effects due to changes in local hydrology are considered nominal due to the altered habitat regime. At Crossing #19 the affected reach of the watercourse within the enclosure area exhibited "run" morphology at the time of survey due to a rain event. Crossing #19a was dry with some standing water. Crossing 19a is the upstream end of a small branch (swale) on the west side of the main watercourse at #19. Substrate throughout the area is dominated by muck and clay. The fines could be susceptible to downstream transport during periods of flow, if poor construction or restoration techniques. Riparian vegetation includes a mix of old field grasses and herbs (goldenrod, aster species, thistle, vetch, daisy) and some young woody trees and shrubs (cherry, aspen, Red-osier Dogwood).	See Crossing #3, however watercourses proposed for removal under MDP so longer term effects not applicable.	See Crossing #1, however watercourses proposed for removal under MDP so longer term effects not applicable.	All relevant standard mitigation measures prevent construction-related adverse effects to the watercourse will be implemented- see Crossing #2 above. If any portions of watercourses are retained as open systems, site specific measures include: • Embed and backfill new culvert with native substrate to maintain fish passage and habitat opportunities.	Preliminary determination from DFO – new culvert works would be considered HADD **assuming** there is direct seasonal fish use given far upstream reaches (i.e. if indirect fish habitat contribution only, works not likely HADD with mitigation). During Detailed Design and prior to construction: - Conduct Northern Pike spawning survey during spring and/or assess presence of barriers to fish migration/movement from river downstream to confirm whether or not spawning is possible. - Conduct fish sampling during spring/early summer to determine if any direct seasonal use by bait or forage species occurs Associated permit/approval requirements to be reviewed further based on MDP and further agency consultation.	**Low Significance** Agricultural drain, fine substrates. Pike spawning habitat limited but may be used as a corridor to areas further upstream. **No significant residual effects with proper implementation of mitigation measures**

5.1.1.3 Surface and Ground Water

The primary source of freshwater supply for much of urban Ottawa comes from the Ottawa River and major tributaries, whereas in the rural areas, freshwater is obtained from bedrock and overburden aquifers. Groundwater can be found as shallow as 0.5 to 2.0 metres below grade in the area north of Macdonald-Cartier International Airport, though all of this area is municipally serviced for potable water. For much of the area south of the airport (south of Leitrim Road) groundwater can be found at approximately 2.0 metres below grade. The direction of shallow groundwater flow is approximately west to east, though surface water features will influence the direction of groundwater movement on a local scale. The overburden geology in the south section of study area consists mostly of deposits of clay and silt interspersed with pockets and/or buried lenses of sand and gravel. Clays and silts have low permeability and will restrict the movement of groundwater, whereas sands and gravels have a high permeability and can result in groundwater flow of several metres a day. Since the overburden thickness throughout much of the preferred LRT corridor ranges from 10-25 metres, there is the potential that several overburden aquifers may be found in one location at different depths; and may be encountered during construction. This will likely occur in areas of topographic highs (i.e. groundwater recharge zones) corresponding to the following locations: Barrhaven Town Centre and the High Road area. Other small-scale areas of groundwater recharge may include: Claridge; Beatrice; and Newland. Groundwater is typically discharged to topographic lows such as steams, lakes and rivers. Areas within the LRT corridor where groundwater discharge may be encountered include the following: Rideau River; Mosquito Creek; and the area south of Bronson Avenue (creek). It is important to note that variations in overburden geology and permeability will likely occur on a localized scale.

Potential Construction Effects

The removal of trees and stumps, and other vegetation from the right-of-way (ROW), particularly south of Macdonald-Cartier International Airport may result in increased surface water runoff and result in a decrease in water infiltration into the subsurface. This can affect groundwater quantities (i.e. recharge) in the shallow aquifer system. Watercourses may also be affected, due to an increase in the amount of suspended particles carried by surface water runoff.

The use of heavy equipment to “cut” and “fill” the original topography within the LRT corridor (to grades specified in contract drawings) can have an affect on groundwater. Excavations made into shallow aquifers can result in a temporary or permanent change in groundwater flow patterns, and could result in the need for dewatering of excavations and trenches. Dewatering activities (e.g. discharging to an alternate location) may change the supply of water to abstractions and spring-fed surface watercourses; lead to the settlement of the ground surface; and/or change the quality of groundwater before discharging it. Areas requiring significant cutting (i.e. 4.0 metres or greater) include the following: Barrhaven Town Centre station; Cresthaven Road; River Road; High Road; Bayview Area Station (Wellington Street at the LeBreton escarpment); and a section of the airport connection. Areas requiring filling (i.e. 3.0 metres or greater) include the following: Longfields; Claridge, Prince of Wales Drive, and a section of the airport connection.

Embankments, foundations, footings, abutments, and piers constructed for bridges can obstruct groundwater (base flow) to surface watercourses. Major surface water crossings within the LRT corridor which may be affected include the following: Rideau River/Canal (two crossings); Mosquito Creek; and the Rideau Canal.

Water wells associated with private, municipal, and domestic supply may be adversely effected by construction activities associated with the LRT corridor, in areas of cut only. This may include a decrease in groundwater supply, or contamination of well water. Potential contaminants that may be encountered during construction activities include petroleum hydrocarbons, polycyclic aromatic hydrocarbons, benzene, toluene, ethylbenzene, xylenes, vinyl chloride, and heavy metals. The area south of Macdonald-Cartier International Airport is most susceptible to water well impacts resulting from construction activities (i.e. cut).

Proposed Mitigation

The following outlines the proposed mitigation and commitments to future work required to mitigate potential adverse effects to groundwater resources during clearing and grubbing of the LRT corridor, where required:

- Vegetative cover will be preserved for as long as possible to promote natural water infiltration/recharge to the aquifer system;
- Buffer strips will be maintained between the construction area and surface watercourses to promote the dissipation of water energy during runoff events, and to aid in the removal of suspended particulate matter; and
- To support proper/natural water infiltration to the aquifer system, disturbed areas will be replanted as soon as possible after disturbance has stopped, not after construction is completed.
- Additional erosion control and stormwater management mitigation is outlined in Section 5.1.1.4.

The following outlines the proposed mitigation and commitments to future work required to mitigate potential adverse effects to groundwater resources as a result of cuts/excavations and grading activities:

- Construction on all temporary and permanent drainage ditches and culverts will be completed as soon as possible and in accordance with OPSS 182 (Environmental Protection fo Construction in Waterbodies and on Waterbanks) to maintain natural drainage conditions, and drainage ditches will be designed to minimize adverse effects on existing watercourses and groundwater by avoiding large cuts, incorporating protection against scour, and avoiding discharges to unprotected watercourses. Stormwater management procedures will be put into place to mitigate surface water runoff and drainage effects during construction. Specific details are outlined in Section 5.1.1.4.
- Disruption of groundwater (e.g. infiltration) will be minimized through the use of fill material (e.g. quarried rock containing no fine soil) during grading activities. Newly graded slopes will be protected against erosion (e.g. berms, rip-rap, aggregate cover, seeding, mulching, sodding, etc.), so as not to result in sediment transport through surface water runoff. Any dewatering of cuts/excavations required as a result of groundwater interception will be done in accordance with approved control measures. The groundwater will be discharged to a vegetated area at least 15 m from a surface watercourse, or into a water containment area to dissipate water energy and minimize the potential for accumulation of suspended particulate matter. Any breach of the aquifer system (i.e. shallow or deep) will be mitigated by plugging or lining the breach using impervious material such as clay to ensure the breach does not continue discharging appreciable quantities of groundwater, and to minimize dewatering requirements.

- The impact of any temporary disruption in groundwater supply by construction related dewatering operations will be reduced through (a) advanced notification of potentially affected users and provision of alternate supply if needed, (b) rapid completion of construction activities, and (c) the application of effective erosion control at outfalls. Extraction of more than 50 m3 (50,000 litres) per day will require a Permit to Take Water (PTTW) from the MOE, particularly for areas of cut south of the Macdonald-Cartier International Airport, including: Barrhaven Town Centre; High Road; Claridge; Beatrice; and Newland.

The following outlines the proposed mitigation and commitments to future work required to mitigate potential adverse effects to groundwater resources as a result of bridge crossings:

- Bridge design will minimize the use of instream or nearstream substructures which may raise the water table or the surrounding area, or impede base flow to surface watercourses; and
- Channel modification (i.e. alteration of surface water flow pattern) may result in changes in groundwater flow patterns. Channel modification will be minimized where possible to avoid potential disruption of the streambed and banks, and groundwater base flow.

The following outlines the proposed mitigation and commitments to future work required to mitigate potential adverse effects to domestic, private and municipal water wells during construction (including conducting a an inventory of wells in the vicinity of construction and monitoring effects during and post construction):

- A groundwater monitoring program (GMP) will be implemented prior to construction to collect information on groundwater levels and conditions in the vicinity of cuts and excavations, particularly south of the Macdonald-Cartier International Airport. The GMP will involve installing monitoring wells in proximity to construction activities to monitor any adverse effects on groundwater resources, which may influence groundwater flow to surface watercourses, or private and municipal wells. Piezometers will be installed near surface watercourses to measure water levels and baseflow conditions. In addition, a well monitoring strategy will be developed and implement from private wells in the vicinity of construction. This will include preparing an inventory of wells in the vicinity of construction and monitoring effects during construction. If any of the wells are impacted such that there is insufficient water to meet the local residential water demand and/or the quality is impaired such that it is unsuitable for human consumption then a suitable alternative water supply will be provided. A map of potable water wells will be created as part of the GMP.

Potential Operational and Maintenance Effects

Potential operational and maintenance effects to groundwater features are limited to effects associated with stormwater run-off. Mitigation for these potential effects is discussed in Section 5.1.1.4.

Significance

Potential adverse construction effects include the disruption/alteration of groundwater flow, alteration of natural drainage and increased surface water runoff. With the implementation of above noted mitigation measures potential for adverse effects can be minimized and no significant residual effects should occur.

Potential adverse operational effects are outlined below in Section 5.1.1.4.

5.1.1.4 Stormwater Management

Potential Construction Effects

The above section on potential effects to surface and groundwater features outline the potential effects and proposed mitigation measures to manage stormwater during construction.

Potential Operational and Maintenance Effects and Proposed Mitigation

In order to mitigate the potential adverse effects of stormwater run-off on the existing sewer and natural aquatic systems, special efforts will be employed along the track and at each of the stations, parking lots and proposed maintenance and storage facilities.

The following outlines the measures that will be used for water quality and quantity control. Details regarding these facilities will be developed as part of the detail design phase. All stormwater management facilities will be designed to meet Ontario Ministry of the Environment requirements for both quality and quantity control. These facilities will be sized with adequate capacity to handle the spring melt water. Drainage design has been undertaken to meet current engineering standards and to address the City of Ottawa and Conservation Authority requirements. Receiving waters generally consist of habitats to which "normal" protection, as defined by the Ministry of the Environment Stormwater Management Planning and Design Manual (2004), is applied. Where sensitive aquatic habitats exist "enhanced" protection must be provided.

Note: Details of the existing conditions, stormwater management alternatives and recommended strategies are provided in an appended report by Robinson Consultants, North-South Corridor Project, July 2005. (Appendix B)

MOE Requirements for Stormwater Discharge

Water quality requirements for drainage are based on MOE objectives for water quality and the type of fish habitat of the receiving water course. Provincial Water Quality Objectives (PWQO) are as follows:

Parameter	Units	PWQO
▪ Total phosphorous	mg/l	0.03
▪ Phenolics	mg/l	0.001
▪ Lead	mg/l	0.025
▪ Silver	mg/l	0.0001
▪ Copper	mg/l	0.005
▪ Nickel	mg/l	0.025
▪ Zinc	mg/l	0.030
▪ Cadmium	mg/l	0.0002
▪ E.Coli	Count/100ml	100

To achieve the objectives, the MOE has published the "Stormwater Management Planning and design Manual (March 2003) (available online at http://www.ene.gov.on.ca/envision/gp/

4329eindex.htm). This manual provides a series of Stormwater Management Practices (SWMP) for the treatment of storm water under various development conditions. In general, the techniques outlined in the manual provide for the removal of suspended solids from storm runoff. Removal of suspended solids results in lower values of the parameters listed previously. The techniques are aimed at a percentage removal which does not necessarily mean that the PWQO values are met.

MOE recognizes three levels of fish habitat protection: Basic, Normal, and Enhanced. The suspended solids criteria for these three levels are 60%, 70%, and 80% removal respectively.

Other areas of concern to MOE are E.Coli (fecal coliform) levels and water temperature. E.Coli primarily affects recreational use and temperature affects fish habitat. Control of E.Coli is achieved through the elimination of cross-connections, bird control, etc. Where water temperature is critical, specific SWMPs should be employed to minimize temperature increases (i.e. infiltration techniques or underground storage).

The level of protection required for a given water course is normally determined on the basis of investigations that are carried out as part of Watershed/Subwatershed Plans, Environmental Management Plans or general research that may be performed by Conservation Authorities or municipalities. Stream classification is usually established by a Conservation Authority or the Ontario Ministry of Natural Resources in consultation with the Department of Fisheries and Oceans.

In addition to surface discharge, the MOE also promotes infiltration as a treatment alternative. Infiltration techniques require pre-treatment to minimize suspended solids levels.

Rail Line (Track Embankments)

Runoff from new rail embankments is not expected to result in a significant increase over pre-development levels, with the exception of where the track will run along or cross streets.

In locations where the LRT runs on impervious surfaces (i.e. roadways), runoff will be directed to existing or future municipal drainage systems.

No additional outflows will be permitted to the Rideau River/Canal to avoid additional discharges to the river. All runoff will be diverted to avoid direct discharge into the Rideau River/Canal. This includes deck drains for the new crossing. The structures will be designed to direct run-off to the storm sewer system on the adjacent roads.

Where the LRT runs on the existing rail corridor, grass swales (ditch) will be provided to provide quality and quantity control. A properly designed swale will provide both quantity and quality control to meet MOE and City of Ottawa requirements.

Stations

The thirty-four (34) stations proposed under the current EA will mainly be composed of largely impermeable platforms. However, their relatively small footprint and proximity to grassed swales for quality treatment preclude significant adverse effects on existing runoff conditions.

Station developments are expected to have a negligible adverse effect on stormwater quantity. As such, no specific stormwater management efforts are required. Where necessary, existing swales will be widened to accommodate additional flows.

Park and Ride Lots

The Park and Ride lot facilities to be provided at a number of the LRT stations will consist of significant impervious areas that will require peak flow attenuation and water quality control.

Quality control at the parking lots will be provided through ‘end-of-pipe’ solutions such as stormwater management ponds, oil/grit separators and stormceptors. The facilities will be designed to meet Ontario Ministry of the Environment and City of Ottawa requirements for quality control.

Mitigation of stormwater quantity effects from the parking lot facilities will be carried out in accordance with the Master Drainage Plans or Servicing Studies for the areas in which they are located. Within developed urban areas, and where available, runoff will be directed to the existing stormsewer systems. For flows greater than the five-year peak storm, water will be held on-site and gradually discharged to the local system. Storage will be designed for the 100 year storm event. In rural and developing communities, it is recommended that stormwater be held on-site and gradually discharged into local stormwater facilities for controlled release.

Maintenance Facility

The impervious surfaces and maintenance/cleaning operations that will take place at the maintenance and storage facilities will have impacts both on the quantity and quality of runoff. The specific water quality issues are related to an increase in discharged hydrocarbons and detergents.

Impacts on the quantity and quality of runoff from the storage and maintenance facilities will be mitigated through the use of technologies such as oil/grit separators or stormcepters, diversion to existing or new stormwater management ponds (SWMP) and improved ditching. Oil/grit separators and stormceptor basins are installed as part of the storm sewer system. Through a series of baffles and filters they effectively remove both fine and coarse grit, as well as petroleum products. It is recommended that water passing through the separators and/or stormceptors be outlet into existing SWMPs. Improved ditches will provide additional treatment and attenuation for water not captured by the storm water sewer system (i.e. from permeable surfaces). In an effort to conserve water and reduce adverse effects on the environment, recycling of washwater should be investigated.

The following mitigation measures are proposed to minimize adverse effects on the quality of the surface waters:

- Establish a spills action plan;
- Undertake a detailed drainage investigation of the site;
- Employee “Best Practices” for drainage design;
- Construct SWM ponds to ensure the quality and control flows;
- Use oil and grit collectors;
- Control areas of refilling; and
- Monitor/record spill clean up.

Significance

As discussed above, the new facilities will result in an increased of runoff from impervious surfaces during the operational and maintenance phases. With the implementation of the above noted mitigation measures potential for adverse effects can be minimized and no significant residual effects are anticipated.

5.1.1.5 Vegetation, Wetlands, Wildlife and Migratory Birds

As noted in Section 5.1.1.1, there is considerable overlap between designated natural areas and vegetation and wildlife features given that most of the predominant vegetation and wildlife features occur within designated natural areas. However, additional vegetation features and their associated wildlife habitat that are not mapped as part of a 'designated natural area' were reviewed during the course of the study. It is these features that are discussed below.

In general, the adverse effect discussions outlined in the Designated Natural Areas section (Section 5.1.1.1) in relation to the operation and maintenance and rehabilitation project phases are relevant to vegetation and wildlife generally. As well, the standard mitigation measures, as outlined in detail in the Designated Natural Areas section, are also all relevant to the non-designated vegetation features discussed in Table 5.1.1.5-1. Therefore, the reader is referred to Section 5.1.1.1 for a summary of the proposed standard mitigation measures and to Table 5.1.1.5-1 for those measures that apply to the specific vegetation units.

Potential Construction Effects

Potential adverse effects to 'non-designated' vegetation communities and their associated wildlife habitat are outlined in detail in Table 5.1.1.5-1. The anticipated effects to these features during the construction of the project are considered relatively minor. In general, most of the vegetation affected is either cultural in origin, young, or highly disturbed and is therefore either considered to have no significant adverse effect (area is cultural in origin) or have relatively limited ecological value (community is young and/or highly disturbed). As well, adverse effects to these features are largely limited to minor edge encroachment in specific locations along the existing ROW.

More substantial vegetation removal will occur in Park and Ride Lots at the Leitrim and Bowesville Stations (Within Vegetation Units 13 and 14). In these locations the vegetation removal is considered to be a moderate effect, based primarily on the size of the area removed (approximately 11 ha and 2.3 ha, respectively). While the vegetation removed is primarily young regenerating forest habitat, thicket swamp and cultural meadow habitat, these areas do contribute to local forest cover and wildlife habitat.

It should be noted that the City has committed to a tree replacement strategy that will include a replacement ratio of 2:1. This will result in an overall net gain for the project. This commitment does not preclude additional mitigation and/or compensation that will be negotiated with specific agencies related to land transfers or permits.

A third area that is considered to be moderately affected by the alignment is the riparian vegetation at the Rideau Canal Crossing (Crossing #17, Vegetation Unit #16). While it is anticipated that only approximately 1.8 hectares of natural/semi-natural vegetation will be removed, this is considered a moderate effect given the scarcity of riparian vegetation remaining along the Rideau Canal. However, no pier or other portions of the bridge will be on canal lands therefore there will be no adverse effect to vegetation on canal property. It should be noted that the City of Ottawa has committed to work with Parks Canada and NCC during the detail design process and it is possible that this potential effect can likely be further reduced or eliminated.

Wildlife movement will not be adversely affected by the construction of the new tracks along the active sections of the proposed alignment (i.e. no new fencing or additional movement impeding structures will be constructed north of Greenboro Station). South of Greenboro Station, along the existing alignment (Through Sector 3) and along the new alignment through Sectors 4 and 5, new security fencing is proposed. This fencing will be primarily paige wire fencing that is permeable to wildlife (i.e. small animals can go through or under it and White-tailed Deer can jump over it). Additional small sections of chain-linked fence are proposed at Park and Ride lots and station locations. While these small fenced sections will pose a greater direct barrier to wildlife than the paige wire fencing, the chain-linked portions will not be continuous and wildlife will be able to move around them.

Potential Operational and Maintenance Effects

Similarly, the potential effects and mitigation measures outlined in Section 5.1.1.1 for vegetation and wildlife associated with designated natural areas are relevant for other/non-designated vegetation and wildlife features generally. As outlined, the daily operation and maintenance of the LRT system should have limited effects on adjacent vegetation features and wildlife habitat.

The greatest potential for adverse effects from operational and maintenance activities are to wetlands and to vegetation features that are adjacent to watercourses, specifically Vegetation Units 5, 12, 14, 16, and 18. Watercourse related effects are discussed further in the Fisheries and Fish Habitat Section (Section 5.1.1.2).

As outlined above in the Designated Natural Areas Section (5.1.1.1), vegetated flat-bottomed ditches will be used to manage runoff and minimize potential effects to adjacent more sensitive features such as the wetlands. Although limited salt application to Park and Ride lots as well as in cross road locations may affect salt-sensitive vegetation immediately adjacent to these areas, no highly sensitive features are present, and migration and salt spray are not of concern in these areas. Salt spray will not be a concern because vehicles will not be traveling fast enough to generate spray.

Operation of the LRT is anticipated to have minimal effects on wildlife. There will likely be some direct mortality; however, it is not anticipated to be significant. Train frequency will be many times less than the frequency of vehicular traffic on roadways within the same vicinity therefore it is anticipated that direct mortality from trains will be only a small proportion of total transit-related mortality. In fact, the total transit-related wildlife mortality may decrease if the number of cars on the roads is reduced through LRT ridership.

Potential Effects during Rehabilitation

There are no major potential adverse effects to non-designated vegetation communities and wildlife habitat anticipated during rehabilitation activities. While general rehabilitation activities in the long term may involve track replacement through natural vegetation communities, the extent of specific rehabilitation activities is anticipated to be localized in extent and temporary in duration.

Potential future effects will occur where bridge, culvert and tunnel repair or replacement works may require localized disturbance and/or removal of vegetation for construction access and/or temporary construction-related activities. Works where associated riparian and valley vegetation will most likely be affected include potential future repairs to the Dow's Lake Tunnel, or works at the Rideau River/Canal bridges, or Sawmill or Mosquito Creek bridges.

As well vegetation surrounding the Stations and Park and Ride lots may be locally affected during future repairs or repaving of these impermeable surfaces.

In general, these potential adverse effects are predictable, temporary and limited in extent, and can be managed with the implementation of standard mitigation measures described previously.

Proposed Mitigation

Standard mitigation techniques (described previously) are recommended to ensure that vegetation communities and their associated wildlife habitat are protected to the extent possible during Construction, Operations and Maintenance and Rehabilitation phases of the project. Specifically, application of the mitigation measures outlined for the designated natural areas in Section 5.1.1.1 will be applied for other non-designated vegetation and wildlife habitat features.

The reader is referred to this section (Section 5.1.1.1) for details of the recommended mitigation measures, as well as to Table 5.1.1.5-1 for measures relevant to the specific vegetation communities.

Significance of Potential Effects

As previously noted, none of the potential adverse effects to the non-designated vegetation features and their associated wildlife habitat is considered a high impact. The greatest potential for adverse effects will be where the Bowesville and Leitrim Station Park and Ride Lots are constructed, as well as at the crossing of the Rideau Canal (Crossing # 17). These potential effects are considered 'moderate'. Given the relatively small areas effected, residual effects can be mitigated with the application of the above noted mitigation measures. The remaining works are considered to have low to negligible adverse effect on the 'natural' vegetation communities and their associated wildlife.

With the proper implementation of the mitigation measures, there should not be any significant residual adverse effects to retained vegetation and wildlife.

Table 5.1.1.5-1 Potential Adverse effects To Vegetation Communities And Associated Wildlife, Including Proposed Mitigation And Significance Of Potential Effects

Vegetation Unit (Areas assessed in the field by Ecoplans Limited in 2004 & 2005)	Construction Effects		Operational and Maintenance Effects	Potential Effects During Rehabilitation	Proposed Mitigation	Significance of Potential Effects
	Description of Area Adversely Effected	Approximate size of natural area removed (and associated adverse effects)				
Unit 1 - Carleton University	A disturbed woodland/hedgerow alongside the tracks just south of the Dows Lake Tunnel. Feature occurs on an artificially steep slope	• Some potential for edge encroachment to existing disturbed hedgerow, however no adverse effects anticipated beyond the existing ROW.	Noise – Not a specific concern given absence of important wildlife habitat. As well, species inhabiting the adjacent communities are already habituated to noise from the O-Train therefore noise from additional train traffic will have minimal adverse effect.	Potential for future adverse effects during tunnel repairs.	• MBCA compliance for protection of any nesting migratory birds. • Clearing and disposal of all construction-related debris following construction. • Ensure an environmental inspector is on site during construction to ensure compliance with mitigation measures.	**Low adverse effect**. Very minimal edge encroachment to an already disturbed hedgerow community. **No significant residual adverse effects to retained areas with implementation of mitigation measures.**
Unit 2 - Vincent Massey Woods	*Discussed in Table 5.1.1.1-1 (See Impacts to Vincent Massey Woods)*					
Unit 3 - Sawmill Creek Crossing #4	*Discussed in Table 5.1.1.1-1 (See Impacts to Mid-Sawmill Creek Corridor)*					
Unit 4 - Walkley Road	A hedgerow of planted trees and shrubs along the west side of the existing tracks, between the tracks and the Transitway. Species include Norway Maple, White Ash, English Elm, Staghorn Sumac and Manitoba Maple with a ground cover of old field species.	• Expansion of ROW may result in the loss of a few planted trees.	Noise – Not a specific concern given absence of important wildlife habitat. As well, species inhabiting the adjacent communities are already habituated to noise from the O-Train therefore noise from additional train traffic will have minimal adverse effect.	None anticipated.	• MBCA compliance for protection of any nesting migratory birds. • Clearing and disposal of all construction-related debris following construction.	**No significant adverse effect**. Vegetation is cultural in origin. **No significant residual adverse effects to retained areas with implementation of mitigation measures.**
Unit 5 - Sawmill Creek Crossing #5	A disturbed cultural woodland area composed of young Manitoba Maple, White Elm and Crack Willow with clumps of Staghorn Sumac and Buckthorn also noted. Railway will also intrude on a small shallow marsh community that is found between existing railway embankments.	• ~ 0.1 ha of disturbed cultural woodland vegetation • ~ 0.1 ha of tolerant shallow marsh wetland habitat	Water quality – See Table 6.4.1.2-1 regarding potential for water-related adverse effects to Sawmill Creek. Noise – Not a specific concern given absence of important wildlife habitat. As well, species inhabiting the adjacent communities are already habituated to noise from the O-Train therefore noise from additional train traffic will have minimal adverse effect.	Potential for future adverse effects during culvert repairs.	• Employ sedimentation and erosion control measures. • MBCA compliance for protection of any nesting migratory birds. • Clearing and disposal of all construction-related debris following construction. • Ensure an environmental inspector is on site during construction to ensure compliance with mitigation measures. • Direct stormwater to vegetated ditches.	**Low adverse effect.** Vegetation is young and/or highly disturbed. **No significant residual adverse effects to retained areas with implementation of mitigation measures.**
Unit 6 - Greenboro Station	*There will be no impacts to this vegetation unit as no construction is anticipated along the east-west railway spur.*					
Unit 7 - CNR Line	*There will be no impacts to the CNR Line vegetation community and Designated Natural Area as no construction is anticipated along the east-west railway spur.*					

Table 5.1.1.5-1 Potential Adverse effects To Vegetation Communities And Associated Wildlife, Including Proposed Mitigation And Significance Of Potential Effects						
Vegetation Unit (Areas assessed in the field by Ecoplans Limited in 2004 & 2005)	**Construction Effects**		**Operational and Maintenance Effects**	**Potential Effects During Rehabilitation**	**Proposed Mitigation**	**Significance of Potential Effects**
	Description of Area Adversely Effected	**Approximate size of natural area removed (and associated adverse effects)**				
Unit 8 – Airport Parkway Natural Area (part of the NCC Greenbelt, North of Lester Road) (See also Table 5.1.1.1-1)	There will be minor edge intrusion into two communities on the west side of the alignment. These are a young to mid-aged Sugar Maple – Lowland Ash Deciduous Forest with a fern-rich ground-layer (Unit 8a), and a Cultural Meadow with scattered small trees and Staghorn Sumac thickets (Unit 8b).	• ~ 0.1 ha of maple-ash lowland deciduous forest habitat. • ~ 0.2 ha of cultural meadow habitat	Water quality – See Table 5.1.1.2-1 regarding potential for water-related adverse effects to small tributaries to Sawmill Creek. Noise – Potential for localized disturbance of adjacent wildlife due to increased noise from the railway.	Potential for future adverse effects during culvert repairs.	• Ensure intrusion into natural forest communities is minimized during the construction phase. • Employ sedimentation and erosion control measures. • Ensure existing hydrologic regime will be maintained. • Install temporary protection fencing prior to grading and maintain throughout construction. • Implement edge management to better seal and protect the new forest edge bordering the alignment. • MBCA compliance for protection of any nesting migratory birds. • Clearing and disposal of all construction-related debris following construction. • Ensure an environmental inspector is on site during construction to ensure compliance with mitigation measures. • Implement SWM and spills management measures for operation of maintenance facility.	**Low adverse effect.** Vegetation is relatively young and area adverse effected is small. **No significant residual adverse effects to retained areas with implementation of mitigation measures.**
Unit 9 - Lester Station (Note: Unit 9a is mapped within Airport Parkway Natural Area and is discussed in Table 5.1.1.1-1. Units 9b and 9c are on the east side of the alignment and will not be impacted. Therefore only unit 9c is discussed here)	There will be very minor edge intrusion into a small, disturbed, Fresh-Moist White Elm Lowland Deciduous Forest along a small watercourse (Unit 9c). The forest is dominated by Balsam Poplar with White Elm and Manitoba Maple also common.	• ~ 0.1 ha of disturbed White Elm lowland deciduous forest.	Water quality – See Table 5.1.1.2-1 regarding potential for water-related adverse effects to small tributaries to Sawmill Creek. Noise – Potential for localized disturbance of adjacent wildlife due to increased noise from the railway.	Potential for future adverse effects during culvert repairs.	• Ensure intrusion into natural forest communities is minimized during the construction phase. • Employ sedimentation and erosion control measures. • Ensure existing hydrologic regime will be maintained. • Install temporary protection fencing prior to grading and maintain throughout construction. • MBCA compliance for protection of any nesting migratory birds. • Clearing and disposal of all construction-related debris following construction. • Ensure an environmental inspector is on site during construction to ensure compliance with mitigation measures. • Direct runoff to vegetated ditches.	**Low adverse effect.** Vegetation is relatively young and disturbed and area adverse effected is small. **No significant residual adverse effects to retained areas with implementation of mitigation measures.**
Unit 10 - Airport Parkway Natural Area (south of Lester Road, north of Leitrim Road)	*Unit 10 is located on the east side of the abandoned railway alignment and therefore will not be by the new LRT, which will expand to the west.*					

Table 5.1.1.5-1 Potential Adverse effects To Vegetation Communities And Associated Wildlife, Including Proposed Mitigation And Significance Of Potential Effects

Vegetation Unit (Areas assessed in the field by Ecoplans Limited in 2004 & 2005)	Construction Effects: Description of Area Adversely Effected	Construction Effects: Approximate size of natural area removed (and associated adverse effects)	Operational and Maintenance Effects	Potential Effects During Rehabilitation	Proposed Mitigation	Significance of Potential Effects
Unit 11 - Leitrim Station (Part of Uplands Golf Course Woods) (Note: Units 11a and 11b will not be adverse effected by the alignment. Unit 11a occurs on the east side of the abandoned railway ROW and Unit 11b occurs west of Unit 11c, beyond the footprint of the expanded ROW.)	There will be very minor edge intrusion into a young, Fresh-Moist Poplar Deciduous Forest dominated by Trembling Aspen with Green Ash, Balsam Poplar, Red Maple and Manitoba Maple (Unit 11c).	• ~ 0.7 ha of young poplar deciduous forest	Noise – Potential localized disturbance of wildlife in the adjacent communities	None anticipated.	• Ensure intrusion into natural forest communities is minimized during the construction phase. • Employ sedimentation and erosion control measures. • Install temporary vegetation protection fencing prior to grading and maintain throughout construction. • Ensure the use of vegetation clearing techniques (i.e. trees to be felled away from the retained natural area). • MBCA compliance for protection of any nesting migratory birds. • Clearing and disposal of all construction-related debris following construction. • Ensure an environmental inspector is on site during construction to ensure compliance with mitigation measures. • Direct stormwater to vegetated ditches.	**Low adverse effect.** Vegetation is relatively young and area adverse effected is small. **No significant residual adverse effects to retained areas with implementation of mitigation measures.**
Unit 12 - Airport Link	Two small areas of vegetation will be removed by the airport link. The first of these is a pioneer poplar forest dominated by Trembling Aspen (Unit 12a). The second is a disturbed deciduous forest/deciduous swamp mosaic (Unit 12b).	• ~ 0.5 ha of pioneer forest removed. • ~ 0.6 ha of disturbed deciduous forest/deciduous swamp mosaic removed.	Noise – Potential localized disturbance of wildlife in the adjacent communities.	None anticipated.	• Employ sedimentation and erosion control measures. • MBCA compliance for protection of any nesting migratory birds. • Clearing and disposal of all construction-related debris following construction. • Ensure an environmental inspector is on site during construction to ensure compliance with mitigation measures. • Direct stormwater to vegetated ditches.	**Low adverse effect.** Vegetation is young and/or highly disturbed. **No significant residual adverse effects to retained areas with implementation of mitigation measures.**
Unit 13 - Transport Canada Lands	This area is generally described as a rolling upland mosaic of old field habitat, regenerating deciduous forests, mixed forests and pine plantations. Forested communities range from pioneer to mid-aged.	• ~ 1 ha of deciduous forest removed by alignment (edge encroachment) • ~ 11 ha of deciduous forest/ mixed forest/ cultural meadow habitat removed by the Leitrim Station Park and Ride Lot.	Noise – Potential localized disturbance of wildlife in the adjacent communities	Potential for future adverse effects during repaving of Park and Ride lots.	• Ensure intrusion into natural forest communities is minimized during the construction phase. • Employ sedimentation and erosion control measures. • Install temporary vegetation protection fencing prior to grading and maintain throughout construction. • Ensure the use of vegetation clearing techniques (i.e. trees to be felled away from the retained natural area). • Implement edge management to better seal and protect the new forest edge bordering the alignment and the Park and Ride Lot. • MBCA compliance for protection of any nesting migratory birds. • Clearing and disposal of all construction-related debris following construction.	**Moderate adverse effect.** Removal of forest and meadow habitat (not part of a designated natural area, but contributes to local forest cover and wildlife habitat). **No significant residual adverse effects to retained areas with implementation of mitigation measures.**

Table 5.1.1.5-1 Potential Adverse effects To Vegetation Communities And Associated Wildlife, Including Proposed Mitigation And Significance Of Potential Effects

Vegetation Unit (Areas assessed in the field by Ecoplans Limited in 2004 & 2005)	Construction Effects: Description of Area Adversely Effected	Construction Effects: Approximate size of natural area removed (and associated adverse effects)	Operational and Maintenance Effects	Potential Effects During Rehabilitation	Proposed Mitigation	Significance of Potential Effects
					• Ensure an environmental inspector is on site during construction to ensure compliance with mitigation measures. • Direct stormwater to vegetated ditches and provide SWM for Park and Ride lot.	
Unit 14 - Bowesville Station (part of Bowesville Road Woods)	Disturbed Fresh-Moist Poplar Deciduous Forest (FOD8-1) that is currently pastured with cattle thereby reducing regeneration in the understory and severely limiting native flora health and diversity in the ground layer. Some pooling water was observed, indicating imperfect to poor local drainage characteristics. The deciduous forest grades into a thicket swamp at the west side of Bowesville Road.	• ~1.7 ha of forest and swamp thicket habitat removed by the alignment. • ~ 2.3 ha of forest and swamp thicket habitat removed by the Bowesville Station Park and Ride Lot.	Water quality – Potential for indirect water-related adverse effects to adjacent wetland. Noise – Potential localized disturbance of wildlife in the adjacent communities.	Potential for future adverse effects during repaving of Park and Ride lots.	• Ensure intrusion into natural forest communities is minimized during the construction phase. • Ensure existing hydrologic regime will be maintained. • Employ sedimentation and erosion control measures • Ensure the use of vegetation clearing techniques (i.e. trees to be felled away from the retained natural area). • MBCA compliance for protection of any nesting migratory birds. • Clearing and disposal of all construction-related debris following construction. • Ensure an environmental inspector is on site during construction to ensure compliance with mitigation measures. • Direct stormwater to vegetated ditches and provide SWM for Park and Ride lot.	**Moderate adverse effect.** Removal of regenerating forest and thicket swamp habitat (not part of a designated natural area, but contributes to local forest cover and wildlife habitat). **No significant residual adverse effects to retained areas with implementation of mitigation measures.**
Unit 15 - Armstrong Road South Woods	*Discussed in Table 1 (See Impacts to Armstrong Road South Woods)*					
Unit 16 - Rideau Canal Crossing #17	The west side of the Rideau Canal is part of the Chapman Mills Conservation Area and is characterized by Cultural Meadow (CUM1-1) and Lowland Ash/Elm forest mosaic (FOD7-2). A small deciduous swamp may also be impacted. The east side of the Rideau Canal is characterized by a steep forested slope classified as a White Cedar – Poplar mixed forest. Some disturbance and manicuring associated with an existing residence has disturbed that natural forest community in some sections. Note: There will be no piers or other portions of the bridge on canal lands or in the water. Therefore no aquatic or wetland vegetation along the shoreline or in the water will be impacted.	• ~ 1.1 ha of natural habitat on the west side of the Rideau Canal removed by Strandherd Road and adjacent railway ROW. • ~ 0.7 ha of natural forested habitat on the east side of the Rideau Canal (including some areas that have been manicured around existing residence). • Note: The City of Ottawa has committed to work	Water quality – See Table 5.1.1.2-1 regarding potential for water-related impacts to Rideau Canal. Noise – Potential localized disturbance of wildlife in the adjacent communities.	Future repair and replacement of bridge piers may effect surrounding vegetation.	• Ensure intrusion into natural forest communities is minimized during the construction phase. • Consult with Parks Canada during the detail design process to examine opportunities to further reduce or eliminate vegetation displacement. • Employ sedimentation and erosion control measures. • Install temporary protection fencing prior to grading and maintain throughout construction. • Ensure the use of vegetation clearing techniques (i.e. trees to be felled away from the retained natural area). • MBCA compliance for protection of any nesting migratory birds. • Clearing and disposal of all construction-related debris following construction. • Ensure an environmental inspector is on site during construction to ensure compliance with mitigation measures. • Direct stormwater to vegetated ditches.	**Moderate adverse effect.** Removal of natural forest habitat and riparian vegetation along the Rideau Canal is considered a moderate impact given relative scarcity of natural vegetation communities along this watercourse. **No significant residual adverse effects to retained areas with implementation of mitigation measures.**

Table 5.1.1.5-1 Potential Adverse effects To Vegetation Communities And Associated Wildlife, Including Proposed Mitigation And Significance Of Potential Effects						
Vegetation Unit (Areas assessed in the field by Ecoplans Limited in 2004 & 2005)	**Construction Effects**		**Operational and Maintenance Effects**	**Potential Effects During Rehabilitation**	**Proposed Mitigation**	**Significance of Potential Effects**
	Description of Area Adversely Effected	**Approximate size of natural area removed (and associated adverse effects)**				
		with Parks Canada during the detail design process and it is possible that these potential effects can likely be further reduced or eliminated.				
<u>**Unit 17** - Chapman Mills – East Woodlot</u>	*Discussed in Table 5.1.1.1-1 (See Impacts to Chapman Mills – East Woodlot)*					
<u>**Unit 18** - Chapman Mills – West Woodlot</u>	No adverse effect to core natural area (Unit 18a) (therefore not discussed in Table 1). Area south of the woodlot has recently been cleared of regenerating habitat and is now a mix of old field species and saplings (Unit 18b). Low-lying areas support pockets of cattails and other wetland species.	• ~ 0.8 ha of recently cleared habitat removed.	Water quality – Water quality – Potential for indirect water-related adverse effects to adjacent wetland pockets. Noise – Potential localized disturbance of wildlife in the adjacent communities.	None anticipated.	• MBCA compliance for protection of any nesting migratory birds. • Clearing and disposal of all construction-related debris following construction. • Ensure an environmental inspector is on site during construction to ensure compliance with mitigation measures. • Direct stormwater to vegetated ditches.	**Low adverse effect** Core habitat area is not directly impacted by the alignment. **No significant residual adverse effects to retained areas with implementation of mitigation measures.**
<u>**Unit 20** – Proposed Maintenance Facility</u> (Note: Southern portions of this unit are mapped as part of the Airport Parkway Natural Area and impacts to this natural area are discussed in Table 5.1.1.1-1)	The southern half of the proposed maintenance facility site is a low-lying, young to mid-aged forest described as a Fresh-Moist Poplar Deciduous Forest. The remaining northern half of the area is rolling upland cultural meadow with scattered trees, shrubs, Staghorn Sumac thickets and hedgerows (Unit 8b). The southern half of this facility is located within the Airport Parkway Natural Area.	• ~ 0.5 ha of regenerating pioneer forest habitat. • ~ 0.7 ha of maple-ash lowland deciduous forest habitat • ~ 1.3 ha of cultural meadow habitat. • ~ 6.8 ha of poplar deciduous forest habitat (part of Airport Parkway Natural Area). • ~ 0.7 ha of flooded willow thicket swamp habitat (part of Airport Parkway Natural Area).	Water quality – Potential for water-related adverse effects small wetland community. Noise – Potential localized disturbance of wildlife in the adjacent communities.	Potential for future adverse effects from culvert repairs.	• Ensure intrusion into natural forest communities is minimized during the construction phase. • Ensure existing hydrologic regime will be maintained. • Direct stormwater to vegetated ditches. • Employ sedimentation and erosion control measures. • Install temporary vegetation protection fencing prior to grading and maintain throughout construction. • Ensure the use of vegetation clearing techniques (i.e. trees to be felled away from the retained natural area). • Implement edge management to better seal and protect the new forest edge. • MBCA compliance for protection of any nesting migratory birds. • Clearing and disposal of all construction-related debris following construction. • Ensure an environmental inspector is on site during construction to ensure compliance with mitigation measures.	**Moderate adverse effect.** Removal of regenerating forest, cultural meadow and thicket swamp habitat. **No significant residual adverse effects to retained areas with implementation of mitigation measures.**

5.1.1.6 Species of Conservation Concern and Species at Risk

Specific potential adverse effects and recommended mitigation measures, as they relate to rare species and species at risk (SAR), are detailed in Table 5.1.1.6-1 and summarized below. In general, the potential adverse effects are considered to be low, and manageable with implementation of the mitigation measures outlined in this section.

Potential Construction Effects

In many cases, particularly with rare fauna, known or current habitat use cannot be verified or pinpointed to a specific area since records are either historical, very general in their habitat description or the specific area where the species was observed was not recorded. Therefore the construction effects that are discussed are general and often refer to the removal of 'potential' habitat. Furthermore, this removal of 'potential' habitat is localized; no known significant habitats or specialized habitat areas are removed, and no potentially important wooded habitat blocks are fragmented. In general, 'potential' suitable habitat, to the extent that it currently exists, will be retained for species known to occur in the area generally.

As outlined in the wildlife and SAR existing conditions sections, the one specific habitat area that is crossed by the new alignment is the Bowesville-Armstrong Meadow, which is an area known to provide winter foraging habitat for Short-eared Owl and Rough-legged Hawk. As well, this area is recognized as providing nesting habitat for the Short-eared Owl, with recent nesting also noted. The LRT alignment will cut through the western edge of this habitat area, removing approximately 2.5 ha of cultural meadow/ agricultural (cash crop) lands. As noted in Section 4.1, no Short-eared Owls were observed by Ecoplans Limited and the last record of a breeding pair was in 2000 (Brunton, pers. comm., 2005). Furthermore, due to its nomadic tendencies, mate and site fidelity for the Short-eared Owl are very low. Breeders tend to wander until they find areas with high densities of prey before settling to breed and may therefore select sites in other areas of the surrounding landscape in future years. In light of these characteristics, identifying past nesting sites is not a reliable way to assess potential adverse effects.

In addition, most of the habitat displaced by the project is actually agricultural (cash crop) fields that are only suitable for foraging, not nesting therefore it is highly unlikely that the project will affect nesting habitat. Furthermore, this small habitat removal represents a very small proportion (2%) of the whole Bowesville-Armstrong Meadow habitat area, which is approximately 124 ha and the open character of the vegetation system is by nature, not specifically sensitive to fragmentation. Therefore, the project should not affect the overall habitat quality. To mitigate potential adverse effects during construction vegetation clearing in this area will be timed to avoid the identified breeding period for all open country birds, consistent with the Migratory Birds Convention Act (MBCA). If the breeding window cannot be avoided, nest surveys will be conducted to ensure that there are no active nests in the affected areas prior to clearing. All active nests of migratory birds, including the Short-eared Owl will be protected.

Potential adverse effects during construction are more quantifiable for rare flora. Specifically, the LRT alignment will remove some regionally rare Foxtail Sedge recorded during the field surveys. However, surrounding suitable habitat will be retained and it is likely that this species is also found further from the observed location.

In the case of the Butternut trees, two of the locations where trees were observed (Unit 2 - Vincent Massey Woods and Unit 17 - Chapman Mills – East Woodlot) will be directly affected (removed) by the alignment (resulting in the removal of three trees). None of these trees occur on Federal lands. Although Vincent Massey Woods is owned by the NCC, the Butternut trees affected are located at the toe-of-slope on the east side of the rail embankment within the existing right-of-way. The minor widening in this area is fully within the existing right-of-way. The third location where Butternut trees were observed (the core area of the Armstrong Road South Woods) will not be impacted.

The three individual trees that will be removed were all considered young trees (≤ 20 cm DBH) and all had evidence of the fatal Butternut Canker that is causing the decline of this species. At these locations, the forest removal is also considered loss of 'potential Butternut habitat'. 'Potential Butternut habitat' is defined for the purpose of this assessment as habitat where it would be possible for future Butternut germination to occur if the habitat were to be retained. This is based on the assumption that existing trees prove that the habitat is suitable (even if the site characteristics don't match the description of ideal 'Butternut habitat') and that there are seed sources nearby. The loss of 'potential Butternut habitat' is considered to be very minor given that the 'potential habitat' removed is only a small proportion of the 'potential habitat' that will remain within each of the natural areas where Butternut was observed.

Potential Operational and Maintenance Effects

In general operation and maintenance activities are not expected to have a significant adverse effect on rare species or SAR. The potential effects to vegetation and associated habitat as outlined for designated natural areas are generally relevant in relation to the potential habitat for rare species. As outlined previously, the greatest potential for operation and maintenance effects to rare species is in wetland habitats, in relation to potential for water quality effects. Specifically, runoff from storm events, which has the potential to carry contaminants into surrounding wetland habitats, could degrade these areas over time and reduce the habitat quality for rare species including the Eastern Red Damsel, Black-crowned Night-heron and Blanding's Turtle. However, as also outlined above, the water quality-related effects of the LRT project are not anticipated to be significant.

Potential Effects during Rehabilitation

Adverse effects to rare flora and fauna during rehabilitation activities are not anticipated to be significant. No rare species were identified in the majority of the locations where more intrusive potential rehabilitation activities could occur (e.g. bridge pier and culvert repairs, re-paving of Park and Ride lots). Furthermore, as outlined above, these effects are predictable, temporary and limited in extent, and can be managed with the implementation of standard mitigation measures.

Additional Field Work Completed in 2006

Additional field work to identify amphibian and reptile species were conducted in May 2006 by Marshall, Macklin, Monahan (MMM). The following outlines the results of this field work. Additional details on methodology, mapping and the results of future investigations will be provided to Environment Canada when available.

Amphibians

Seven species of amphibians have been designated as a Species at Risk in Ontario: Northern Cricket Frog (*Acris crepitans*), Jefferson Salamander (*Ambystoma jeffersonianum*), Small-mouthed Salamander (*Ambystoma texanum*), Tiger Salamander (*Ambystoma tigrinum*), Fowler's Toad (*Bufo fowleri*), Northern Dusky Salamander (*Desmognathus fuscus*), and Spring Salamander (*Gyrinophilus porphyriticus*). None of these species has been recorded in the City of Ottawa.

Five species of amphibians have been designated as a federal Species at Risk (SARA, Schedule 1): Jefferson Salamander, Small-mouthed Salamander, Tiger Salamander, Fowler's Toad, and Spring Salamander. None of these species has been recorded in the City of Ottawa.

Five species of amphibians have been designated as Not at Risk in Ontario and are not deemed to be protected species in Ontario: Four-toed Salamander (*Hemidactyllium scutatum*), Mud Puppy (*Necturus maculosus*), Northern Leopard Frog (*Rana pipiens*), Pickerel Frog (*Rana palustris*), and Western Chorus Frog (*Pseudacris triseriata*). Each of these species has been recorded in the City of Ottawa.

Armstrong South Woods

At Armstrong South Woods, breeding habitat is present in ephemeral pools for Northern Leopard Frog and Western Chorus Frog. Fourteen (14) ephemeral pools with standing water >25 cm deep were observed by Marshall Macklin Monaghan (MMM) on 3 May 2006. Pools of this depth were considered to be the minimum depth necessary to permit metamorphosis. Four of the pools are located on or adjacent to the LRT alignment. Ephemeral pools <25 cm deep occupied approximately 25% to 50% of the forest floor in the vicinity of the alignment. These pools may provide breeding habitat for early-season transforming species such as Western Chorus Frog but not for late-season transforming species such as Northern Leopard Frog. Over-wintering habitat for Northern Leopard Frog (permanent waters) was confined to two municipal drains that lie to the south of the alignment at the south end of the woods. These drains are presently in flood condition owing to the presence of a beaver dam at their confluence. Three American Toads were heard calling from one of these drains during the survey period (2 pm to 6 pm).

The preferred habitat for Four-toed Salamander (woodland ponds, springs or creeks with mosses, rotting logs and overhanging grasses and sedges), Mudpuppy (permanent waters such as rivers, reservoirs, inland lakes), and Pickerel Frog (cool, clear waters, especially places where inlet streams and ground water discharge to bogs, marshes and weedy ponds), were not observed at Armstrong Woods.

Leitrim Wetland

The LRT alignment borders the wetland for approximately 50m to 60m. The vegetation that occurs on and adjacent to the right of way is Fresh-Moist Poplar Deciduous Forest (FOD8-1). No standing water was observed during the site visit conducted 2 May 2006. Based on this assessment, there is no breeding habitat for amphibians on or adjacent to the LRT alignment.

<u>Reptiles</u>

Seven species of reptiles in the Ottawa area have been designated as a Species at Risk in Ontario: Spiny Softshell (*Apalone spinifera*), Spotted Turtle (*Clemmys guttata*), Blanding's Turtle (*Emydoidea blandingii*), Wood Turtle (*Glyptemys insculpta*), Northern Map Turtle (*Graptemys geographica*), Milksnake (*<u>Lampropeltis triangulum</u>*), and Eastern Ribbonsnake (*Thamnophis sauritius*). One additional species has been designated as Not at Risk in Ontario: Common Watersnake (*Nerodia sipedon sipedon*).

Five species of reptiles in the Ottawa area have been designated as a federal Species at Risk: Spiny Softshell, Spotted Turtle, Northern Map Turtle, Milksnake and Eastern Ribbon Snake.

The recorded locations for four of the seven Species at Risk are remote from the LRT alignment: Wood Turtle (NW Ottawa), Northern Map Turtle (Ottawa River), Milksnake (NW and NE Ottawa), Eastern Ribbonsnake (west Ottawa). Three species have been recorded in the general vicinity of the LRT alignment: Spiny Softshell, Spotted Turtle and Blanding's Turtle.

Leitrim Wetland

At the Leitrim wetland, the LRT alignment borders the western limit of the Leitrim PSW for approximately 50m to 60m. The vegetation that occurs on and adjacent to the right of way is Fresh-Moist Poplar Deciduous Forest (FOD8-1). No standing water was observed during the site visit conducted 2 May 2006. Based on this assessment, there is no aquatic or wetland habitat for Spiny Softshell, Spotted Turtle, or Blanding's Turtle on or adjacent to the right of way.

The embankment of the rail bed may, however, provide marginal nesting habitat for Spotted Turtle and Blanding's Turtle. Accordingly, a late summer survey for turtle eggshells will be conducted along the portion of the LRT alignment that lies within 500 m of the wetland boundary. The survey area will include both forested and old field habitats.

Lester Wetland and Cahill Drain

The flooded thicket swamp that borders the LRT alignment northerly from Lester Road, and the impounded portion of the Cahill Drain that borders the LRT alignment south of Hunt Club Road, provide apparent habitat for Blanding's Turtle and Spotted Turtle. A field survey for basking turtles was conducted under ideal viewing conditions on 1 May 2006. Twelve Midland Painted Turtles were observed at the edge of the Lester wetland during the 5 hour survey. No species at risk were observed.

The embankment of the rail bed may, however, provide marginal nesting habitat for Spotted Turtle and Blanding's Turtle. Accordingly, a late summer survey for turtle eggshells will be conducted along the rail embankment and wetland edge to verify the presence/absence of nesting of Species at Risk.

Proposed Mitigation

The standard mitigation measures recommended for the protection of 'designated natural areas', vegetation communities and fisheries and aquatic habitat are again relevant and applicable to the protection of potential habitat for rare species and SAR. Some additional species specific measures are noted below:

- In relation to the Monarch Butterfly, native seed mixes containing Common Milkweed (*Asclepias syriaca*) will be used when re-establishing vegetation within disturbed areas of the ROW in the Greenbelt area. This will mitigate the loss and/or disturbance of cultural meadow habitat required for construction.

- In general, the use of pesticides associated with weed control will be limited or eliminated, and natural regeneration of old-field communities should be encouraged within the LRT ROW. These measures help minimize potential effects to the Bowesville-Armstrong Meadow raptor habitat as well as Monarch Butterfly habitat. Pesticide management is consistent with the City of Ottawa's policy for pesticide use, which limits its use to situations where there is a serious risk to human or animal health, or if the survival of trees or shrubs is threatened.

- Although there are no recent records of Blanding's Turtle in the study area, it is recommended that the existing railway bed be visually checked as part of the field work conducted during the detailed design phase (timed during the nesting season- May to September), to confirm that this species is not using the railway bed for nesting. If any nests are located, the Ministry of Natural Resources and Environment Canada should be consulted to assist in the relocation of nestlings and/or eggs.

- The Foxtail Sedge should be transplanted or rootmats/seedbank relocated prior to construction.

- As noted, seed salvage is not appropriate for Butternut, since the affected trees are not healthy specimens. The loss of three trees is not considered a significant adverse effect to the overall viability of Butternut in Ontario given that this species is widespread and common across the province. Retained habitats, including habitat where Butternut was observed (e.g. Armstrong Road South Woods) will continue to provide habitat for this species in the surrounding area. Therefore no specific mitigation measures are recommended for this species.

Significance of Potential Effects

Potential adverse effects to rare species and SAR and their potential habitats are not generally considered to be of concern in relation to the LRT project.

Although the proposed alignment traverses the west edge of the Bowesville-Armstrong Meadow, which provides winter foraging habitat for Short-eared Owl and Rough-legged Hawk and 'potential' nesting habitat for the Short-eared Owl, the overall potential adverse effect is considered to be low. As noted in Section 4.1, no Short-eared Owls were observed by Ecoplans Limited and the last record of a breeding pair was in 2000 (Brunton, pers. comm., 2005). Furthermore, due to its nomadic tendencies, mate and site fidelity for the Short-eared Owl are very low. Breeders tend to wander until they find areas with high densities of prey before settling to breed and may therefore select sites in other areas of the surrounding landscape in future years. The area that is removed is a small edge portion of the overall habitat (2.5 ha of 124 ha or 2%), most of which is actually agricultural (cash crop) fields that is only suitable for foraging, not nesting. By nature, this open habitat is not specifically sensitive to fragmentation, and therefore the alignment should not greatly affect the overall habitat quality.

Butternut is listed as an endangered species; however, it is currently widespread and common across Ontario, including the Ottawa area. Therefore the removal of three trees for the construction of the LRT is deemed a very minor impact to the overall viability of Butternut in Ontario (regardless of their health status). The affect on 'potential Butternut habitat' is also deemed to be very minor given that the 'potential habitat' removed is only a small proportion of the 'potential habitat' that will remain within each of the natural areas where Butternut was observed. In other words, adjacent protected habitats will continue to provide 'potential Butternut habitat' and there will be no significant residual adverse effects to this 'potential' habitat with the implementation of mitigation measures.

Only one regionally rare sedge species was documented as being directly affected. However it is expected to occur in off alignment areas, and salvage measures are recommended.

While several other species are documented in the area generally, no confirmed habitats or unique or potentially specialized habitats are affected, and habitats are well represented in the area generally.

General application of previously noted mitigation measures will minimize adverse effects to SAR and their ‘potential’ habitat. With the implementation of the standard and specific mitigation measures identified, there should not be any significant residual effects to species at risk or their retained ‘potential’ habitat features.

Species	Construction Effects: Description of known or potential habitat removed	Construction Effects: Approximate size of known or potential habitat removed	Operational and Maintenance Effects	Potential Effects During Rehabilitation	Proposed Mitigation	Significance of Potential Effects
Species of Conservation Concern						
Foxtail Sedge (Regionally Significant)	Foxtail Sedge was recorded in Unit 4, at Watercourse Crossing #4. This known habitat location is described as a lowland ash deciduous forest within the riparian habitat of Sawmill Creek. Currently this location is highly disturbed with a sparse canopy dominated by Manitoba Maple, Green Ash, White Elm and Crack Willow, with the area immediately surrounding the crossing location supporting Buckthorn and Staghorn Sumac. This species is known to prefer 'seasonally saturated soils in wet meadows, openings in alluvial woods, stream banks, particularly on calcareous substrates'.	• ~ 0.1 ha of semi-natural vegetation removed, including observed Foxtail Sedge. • Habitat potential will remain in adjacent retained habitat.	There is potential for run-off related adverse effects to adjacent 'suitable/potential' habitat for Foxtail Sedge.	Potential for adverse effects to 'suitable/potential' habitat if future replacement or repairs of bridge piers disturbs adjacent vegetation.	• See proposed mitigation measures recommended for the Mid-Sawmill Creek Corridor in Table 5.1.1.1-1. • Survey affected habitat area prior to construction and salvage and/or transplant plants, root mats and/ or seedbank to adjacent habitat or other locations as determined by a qualified landscape architect in detail design.	**Low-Moderate adverse effect**. Known location of regionally rare sedge will be removed; however suitable habitat still exists nearby. **No significant residual adverse effects with implementation of mitigation measures.**
Eastern Red Damsel (S3)	This species inhabits "spring-fed seeps, streams, boggy-edged pools and ditches" (Lam, 2004) and has been recorded in the Albion Road (Leitrim) Wetland within the fen community. Only minor edge encroachment is anticipated to the northwest corner of the larger wetland and there will be no adverse effects to the fen community.	• No known habitat will be removed or adverse effected. • Some 'potential' general habitat may be adverse effected ('streams and ditches') however this habitat is widespread throughout the study area.	No adverse effects anticipated, except possibly through indirect effects to water quality in adjacent wetland habitat.	None anticipated.	• See proposed mitigation measures recommended for the Albion Road (Leitrim) Wetland in Table 5.1.1.1-1.	**No significant adverse effect**. Core habitat area will not be adverse effected by the alignment and there will only be minimal intrusion into the larger wetland area. **No significant residual adverse effects to retained habitat with implementation of mitigation measures.**
Black-crowned Night-heron (S3B, SZN)	Generally this species inhabits and forages in a variety of wetland habitats such as swamps, streams, rivers, marshes, mud flats and the edges of lakes that support rushes and cattails. They are also colonial nesters usually found in heronries with other species like Great Blue Herons and Double-crested Cormorants. In Ontario this species prefers to nest in sparsely or heavily treed islands; but will utilize wooded riverbanks, swamps and cattail marshes (Peck, 1983). General foraging habitat requirements exist along the study corridor in areas including the 3-Cell Wetland, stream corridors (Sawmill Creek, Mosquito Creek), along the Ottawa River and along the Rideau River/Canal. The proposed LRT route follows a pre-existing rail bed for much of its length and therefore habitat infringement on these associated habitats will be minimal. In the southern	• Some 'potential' foraging habitat generally in areas along the alignment, however such habitat is widespread throughout the study area. • Habitat where this species was observed (McCarthy Woods) and locations of 'potential' breeding habitat will be retained.	No adverse effects to main habitat areas where 'potential' nesting habitat may be present. Localized 'potential' for water quality adverse effects to potential foraging habitat in wetlands adjacent to the alignment.	None anticipated	• General mitigation measures for protection of vegetation and wetland habitats to protect 'potential' foraging habitat for this species, including MBCA compliance.	**No significant adverse effect**. Core habitat areas will not adverse effected by the alignment and there will only be minimal intrusion into 'potential' foraging habitat. **No significant residual adverse effects to retained 'potential' habitat with implementation of mitigation measures.**

Table 5.1.1.6-1 Potential Adverse Effects To Species Of Conservation Concern And Species At Risk (SAR), Including Proposed Mitigation And Significance Of Potential Effects						
Species	Construction Effects		Operational and Maintenance Effects	Potential Effects During Rehabilitation	Proposed Mitigation	Significance of Potential Effects
	Description of known or potential habitat removed	Approximate size of known or potential habitat removed				
	section of the study corridor where a new alignment is proposed, adverse effects to stream corridors and the Rideau River/Canal will be limited to specific crossing locations. No Black-crowned Night-heron colonies occur in these areas.					
Rough-legged Hawk (S1B, SZN, COSEWIC-NAR, MNR – NAR)	Rough-legged Hawks are primarily found nesting in the Northern Arctic Tundra and can also be found inhabiting Southern Arctic Cliffs and along the Taiga Shield Rocky areas (Peck, 1983). However, this species is known to overwinter in southern parts of Ontario relying on open fields and abandoned agricultural lands where abundant rodent populations are vital for survival. The Bowesville-Armstrong Meadow is considered a winter foraging habitat for this species where they have been recorded on several occasions. This area generally consists of open cultural meadow/pasture lands with agricultural land also likely used for foraging. Adjacent forested habitats also provide winter roosting habitat. Only a small portion of the meadow near the west edge encompassing primarily agricultural lands will be affected.	• ~ 2.5 ha of cultural meadow/agricultural (cash crop) lands (potential foraging habitat) removed. (Note: The Bowesville-Armstrong Meadow is approximately 124 ha therefore the area removed is only a small proportion [2%] of the entire habitat).	Operation of the LRT is not anticipated to have a large impact on this species although there may be some very limited potential for direct mortality from trains or noise-related disturbance. However, existing habitat is open and portions are actively used for agriculture. Potential for localized encroachment into the meadow habitat for vehicle access for maintenance purposes.	Potential for localized encroachment into the meadow habitat for access for track rehabilitation purposes.	• General mitigation measures for protection of vegetation and wetland habitats (Section 5.1.1.5) to protect 'potential' foraging habitat for this species, including minimizing intrusion into meadow habitat and installation of temporary protection fencing prior to grading to prevent intrusion into surrounding habitat. • Limit or eliminate the use of pesticides associated with weed control and allow the natural regeneration of old-field communities within the LRT ROW.	**Low adverse effect**. The adverse effect is limited to the removal of a very small portion of a large area of potential foraging habitat (2.5 ha of 124, or 2%). The open and agricultural nature of the vegetation and habitat system is not specifically sensitive to fragmentation or noise. **No significant residual adverse effects to retained habitat with implementation of mitigation measures.**
Species at Risk						
Butternut (S3?, SARA-Endangered, MNR-Endangered)	Butternut trees were observed in three of the designated natural areas reviewed during Ecoplans Limited fieldwork in 2005. However, Butternut trees will only be removed in two of these locations. Neither of these locations are on Federal Lands. Observations at these two locations were as follows: <u>Vincent Massey Woods</u> - Two young trees (~20 cm DBH) were noted close to existing tracks (on north side) and will be removed by the expansion of the railway embankment through this natural area. Both trees had evidence of canker. <u>Chapman Mills - East woodlot</u> - 1 young tree (<10cm DBH) was noted at the northeast edge of the forest and will be removed by the alignment. This tree also had evidence of canker. Habitat for Butternut is generally described as rich, moist, well-drained loams, and is often found along stream banks or in shallow valleys. Butternut trees are intolerant of shade.	<u>Vincent Massey Woods</u> • Two young trees recorded along the east side of the tracks will be removed. • ~ 0.75 ha of forested habitat ('potential Butternut habitat') will be removed from this natural area. This represents only 4.5% of the total natural area. <u>Chapman Mills – East Woodlot</u> • One young tree will be removed by the	No specific operational effects anticipated.	None anticipated.	• General measures for protection of forest habitat (Section 5.1.1.5), including minimizing intrusion into adjacent forested areas. • No specific seed salvage recommended due to young age of trees and evidence of canker infection on the affected trees.	**Low adverse effect** Despite the fact that Butternut is listed as an endangered species, it is currently widespread and common across Ontario, including the Ottawa area. Therefore the removal of three trees for the construction of the LRT is deemed a very minor adverse effect to the overall viability of Butternut in Ontario (regardless of their health status). The adverse effect to 'potential Butternut habitat' is also considered to be very minor given that the 'potential habitat' removed is only a small

Table 5.1.1.6-1 Potential Adverse Effects To Species Of Conservation Concern And Species At Risk (SAR), Including Proposed Mitigation And Significance Of Potential Effects						
Species	Construction Effects		Operational and Maintenance Effects	Potential Effects During Rehabilitation	Proposed Mitigation	Significance of Potential Effects
	Description of known or potential habitat removed	Approximate size of known or potential habitat removed				
	However, for the purposes of this assessment, 'potential Butternut habitat' refers to habitat where it would be possible for future Butternut germination to occur if the habitat were to be retained. This is based on the assumption that existing trees prove that the habitat is suitable (even if the site characteristics don't match the description of ideal 'Butternut habitat' described above) and that there are seed sources nearby. (Note: Butternut is listed as endangered, but is not regulated in Ontario [Ontario Endangered Species Act does not apply]. However, it is listed on Schedule 1 of the Species at Risk Act (SARA). This species is not at risk due to habitat loss, nor is it particularly rare, but rather is experiencing marked declines due Butternut Canker.	alignment (not located on federal land). • Total of ~ 0.15ha of regenerating habitat ('potential Butternut habitat') on the edge of the forest will be removed.				proportion of the 'potential habitat' that will remain within each of the natural areas where Butternut was observed. In other words, adjacent protected habitats will continue to provide 'potential Butternut habitat'. **No significant residual adverse effects to retained habitat or 'potential' habitat with implementation of mitigation measures.**
Blanding's Turtle (S3, SARA – Threatened, MNR-Threatened)	There are no recent records for this species within the study area; however the species has historically been recorded in the general area. Blanding's Turtles inhabit areas of shallow water, usually in large marshes or shallow lakes. They are often found wandering on land, but not usually very far from water except when nesting (MacCulloch, 2002). There are no large marshes or lakes within the immediate vicinity of the study corridor, limiting potential habitat for this species. There were, however, some areas of open water observed within the Greenbelt Sector of the study corridor, particularly surrounding Lester Road. This area may have the potential to serve as marginal habitat for Blanding's Turtle. The Albion Road (Leitrim) Wetland also has potential to serve as suitable habitat. High mobility of the Blanding's Turtle makes it vulnerable to a variety of development threats (specifically roads); there is some limited potential for mortality of adults migrating to wetland sites across the rail line, and inadvertent destruction of nests can occur along road and railway embankments during construction. However, adverse effects are anticipated to be relatively minor given the narrow corridor and relatively low frequency of train versus car traffic, and that this species has not been recorded recently in the study area.	• No known habitat will be removed or adverse effected and study area records are historical/not recent. • Some limited areas of 'potential' habitat will be removed and/or adverse effected by the alignment, however this will largely be limited to minor edge encroachment in the area of the existing railway ROW.	Limited potential for water quality adverse effects to potential adjacent wetland habitats.	None anticipated, unless potential nesting along embankment.	• See proposed mitigation measures recommended for the Airport Parkway Natural Area and Albion Road (Leitrim) Wetland in Table 5.1.1.1-1. • Although there are no recent records of this species in the study area, it is recommended that the existing railway bed be visually checked as part of the field work conducted during the detailed design phase (timed during the nesting season-May to September), to confirm that this species is not using the railway bed for nesting. If any nests are located, the Ministry of Natural Resources and Environment Canada should be consulted to assist in the relocation of nestlings and/or eggs.	**No significant adverse effect.** Core 'potential' habitat areas are not adverse effected by the alignment. Limited potential for adverse effects into marginal 'potential' habitat and for potential mortality during the operation if species still persists in study area. **No significant residual adverse effects to retained 'potential' habitat with implementation of mitigation measures.**

Table 5.1.1.6-1 Potential Adverse Effects To Species Of Conservation Concern And Species At Risk (SAR), Including Proposed Mitigation And Significance Of Potential Effects						
Species	Construction Effects		Operational and Maintenance Effects	Potential Effects During Rehabilitation	Proposed Mitigation	Significance of Potential Effects
	Description of known or potential habitat removed	Approximate size of known or potential habitat removed				
Short-eared Owl (S3S4B, SZN, SARA-Special Concern, MNR-Special Concern)	The Bowesville-Armstrong Meadow is considered a winter and summer foraging habitat for Short-eared Owl and recent nesting has also occurred here (in 2000). This area generally consists of open cultural meadow/pasture lands as well as agricultural (cash crop) land (only suitable for foraging, not nesting). Only a small portion of the western edge of the identified 'Bowesville-Armstrong Meadow' (encompassing primarily agricultural [cash crop] lands) will be affected. Due to its nomadic tendencies, mate and site fidelity for the Short-eared Owl are very low. Breeders tend to wander until they find areas with high densities of prey before settling to breed and may therefore select sites in other areas of the surrounding landscape in future years. In light of these characteristics, identifying past nesting sites is not a reliable way to assess potential adverse effects.	• ~ 2.5 ha of cultural meadow/agricultural (cash crop) lands (primarily potential foraging habitat) removed. (Note: The Bowesville - Armstrong Meadow is approximately 124 ha. therefore the area removed is only a small proportion [2%] of the entire potential habitat).	Operation of the LRT is not anticipated to have a large adverse effect on this species although there may be some very limited potential for direct mortality from trains or noise-related disturbance. However, existing habitat is open and portions are actively used for cash crop agriculture. Potential for localized encroachment into the meadow habitat for vehicle access for maintenance purposes.	Potential for localized encroachment into the meadow habitat for access for track rehabilitation purposes.	• General mitigation measures for protection of vegetation and wetland habitats (Section 5.1.1.5) to protect 'potential' foraging habitat for this species, including minimizing intrusion into meadow habitat and installation of temporary protection fencing prior to grading to prevent intrusion into surrounding habitat. • Consistent with the Migratory Birds Convention Act (MBCA), vegetation clearing in this area will be timed to avoid the identified breeding period for all open country birds. If the breeding window cannot be avoided, nest surveys will be conducted to ensure that there are no active nests in the affected areas prior to clearing. All active nests of migratory birds, including the Short-eared Owl will be protected. • Limit or eliminate the use of pesticides associated with weed control and allow the natural regeneration of old-field communities within the LRT ROW.	**Low adverse effects**. The adverse effect is limited to the removal of a very small portion of a large area of potential foraging and nesting habitat (2.5 ha of 124 ha or 2%). The open and agricultural nature of the vegetation and habitat system is not specifically sensitive to fragmentation or noise and the majority of the area impacted is not suitable for nesting. **No significant residual adverse effects to retained habitat with implementation of mitigation measures.**
Red-shouldered Hawk (S4B, SZN, SARA-Special Concern, MNR–Special Concern)	The proposed LRT route will not adverse effect any known breeding locations for this species. As well, no construction is anticipated in good quality examples of their preferred breeding habitat (i.e. large deciduous or mixed wood forests containing shade-tolerant hardwood trees close to wetland areas), or in areas were they have been observed before (Blossom Park Woods).	• No known habitat or good quality 'potential' habitat removed.	None anticipated.	None anticipated.	• Not applicable	**No significant adverse effects**. No known breeding records or breeding habitat is present along the LRT corridor. **No significant residual adverse effects.**
Monarch Butterfly (S4, SARA-Special Concern, MNR–	Monarchs have been recorded in the Greenbelt area within the central potion of the study area. However, there is potential for this species to be present wherever suitable	• Localized removal of potential old-field habitat with	None anticipated.	Potential for future localized encroachment into	• Native seed mixes containing Common Milkweed (*Asclepias syriaca*) should be used when re-	**Low adverse effects**. This species and its larval host plant are both common

Table 5.1.1.6-1 Potential Adverse Effects To Species Of Conservation Concern And Species At Risk (SAR), Including Proposed Mitigation And Significance Of Potential Effects

Species	Construction Effects		Operational and Maintenance Effects	Potential Effects During Rehabilitation	Proposed Mitigation	Significance of Potential Effects
	Description of known or potential habitat removed	Approximate size of known or potential habitat removed				
Special Concern)	meadow habitat occurs. Meadow habitat is generally common and abundant within the study corridor, and throughout much of the southern rural-agricultural portion of the study area. The meadow/old field habitats along the railway bed that support milkweed species provide suitable breeding and foraging habitat.	milkweed, however such habitat is generally widespread.		the meadow habitat for track rehabilitation purposes.	establishing vegetation within disturbed areas of the ROW. This will compensate for the loss of cultural meadow habitat required for construction. • Limit or eliminate the use of pesticides associated with weed control and allow the natural regeneration of old-field communities within the LRT ROW.	in Ontario and elsewhere in the species' Canadian range. Disturbances associated with the LRT may actually enhance habitat protection along the alignment corridor. **No significant residual adverse effects with implementation of mitigation measures.**

5.1.1.7 Air Quality

Potential Operational and Maintenance Effects

The project is not expected to result in adverse air quality effects either locally or regionally during the operations phase, as the preferred technology is electric LRT.

The existing air quality environment in the Ottawa area is dominated by emissions from automobiles, as opposed to heavy industry. There are major commuter arteries including Highway 417 which bring automobile traffic in to the City of Ottawa core from Kanata and other suburban areas. Future residential expansion within the City of Ottawa will be to the south and southwest, including developments south of the airport as far as Barrhaven Centre. These developments will occur regardless of the approval of the LRT project. In the absence of the north-south LRT links, there will be a significant increase in commuter traffic from these developments into the downtown core.

It is anticipated that the project will likely have local and regional air quality benefits during the operations phase, as it will eliminate the use of diesel O-Train vehicles along the existing rail corridor, reduce the number of diesel buses required to provide the same service of the LRT and reduce the dependency of automobile use within the City of Ottawa. The projected 60,000 to 70,000 riders per day on the system will have benefits to both local and regional air quality as those riders would either be using cars or diesel buses if the LRT system was not constructed.

Potential Construction Effects and Proposed Mitigation

Construction activities may result in the creation of dust. Dust impacts will be mitigated by ensuring that proper watering and/or other dust suppressant techniques (e.g. OPSS 506) are used during the construction phase. Following construction, any open, unpaved areas will be seeded. The PEMP in Chapter 9 outlines the City of Ottawa's commitment to develop specific mitigation measures during detail design when addition design and construction staging details are know.

In addition to potential adverse dust effects there is the potential for increased emissions from construction equipment. To mitigate these potential adverse effects, the contractor will be required to keep equipment in good operating conditions and efforts will be made to minimize the idling of equipment, especially during smog alerts. When smog advisories are issued, the City of Ottawa will discuss the scheduled activities with the Contractor to determine what steps can be taken to further limit air emissions without unduly affecting the Contractor's schedule.

Construction effects to air quality are not anticipated to be significant as they are relatively short term in duration and can be effectively mitigated through the use of standard construction mitigation measures.

Significance

As discussed above, the project is not expected to result in any adverse long term local and regional air quality effects during operations. In fact, air quality will likely be improved when compared to a future situation that does not include the LRT system as part of the transportation network.

There is the potential for adverse environmental effects to air quality during construction as a result of dust and emissions from construction equipments. However these adverse effects are relatively short term and with the implementation of mitigation measures, adverse effects during construction can be minimized and no significant residual effects should occur.

5.1.2 Socio-Economic Environment

5.1.2.1 Landuse

Overview

The approximately 31 km North-South LRT Project Study Corridor traverses several residential communities between its northern terminus at the Rideau Centre and its southern terminus at the future Barrhaven Town Centre. These communities include low through high-density residential areas at all stages, from well-established neighbourhoods to those that exist only as design plans. The preferred route will have minor visual, vibration and noise effects on numerous residences during construction and operation. Three residences will be displaced by the construction of this project. These residences are located at the east abutment of the proposed Strandherd/Armstrong Bridge. These residences were identified in the Rideau River Bridge Location Feasibility Study: Strandherd Drive/Armstrong Road Environmental Study Report (MRC, 1993) and Addendum (RMOC/City of Ottawa, 1997). The extent of the aforementioned impacts will be mitigated through the measures further described below.

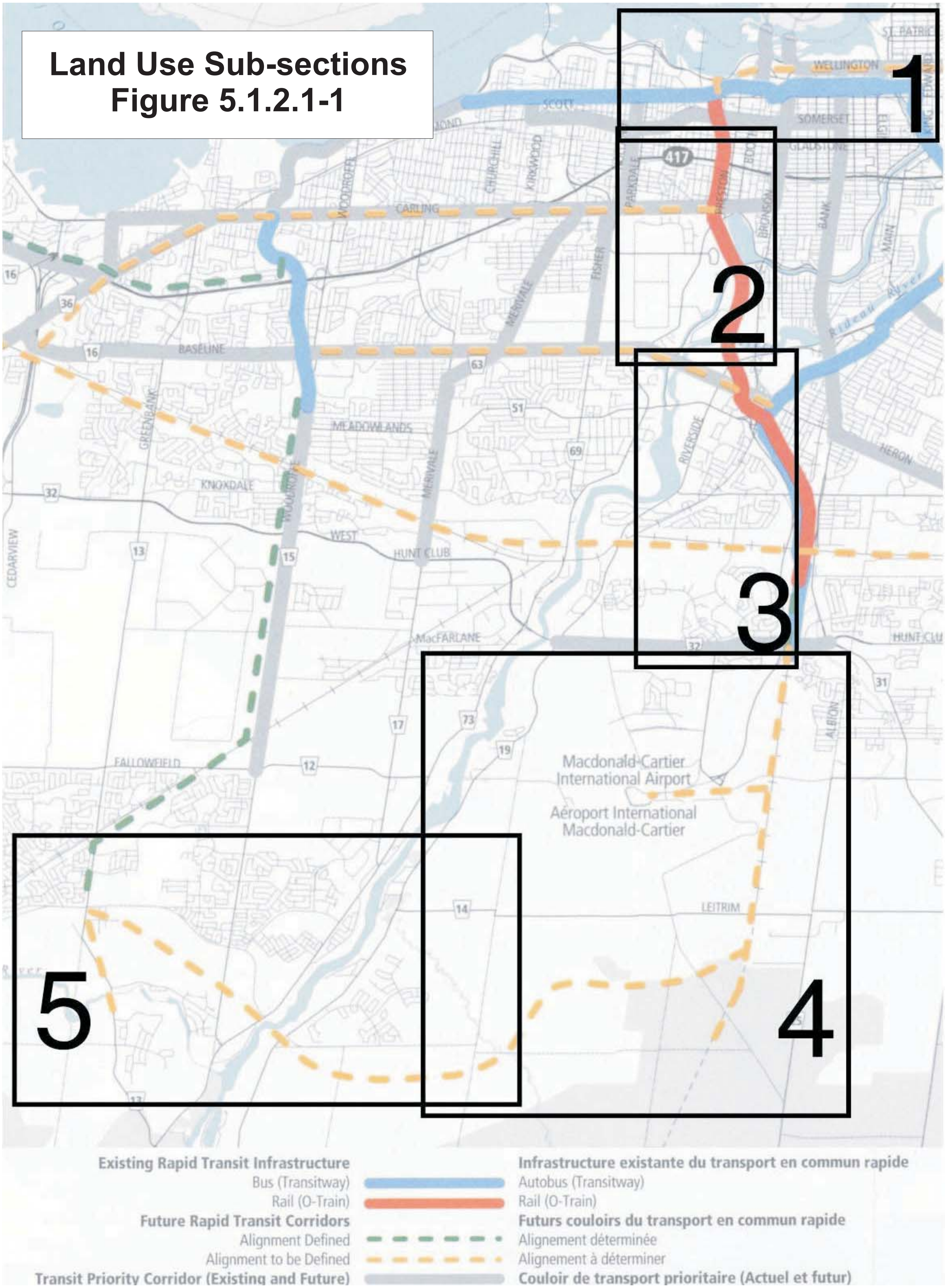
In order to determine the nature and extent of the communities impacted, the existing land use conditions within the study corridor were examined. The results of the study is summarized in a final report completed in May 2005 and entitled "Existing Land Use Conditions: North South Corridor LRT Project – Environmental Assessment" (see Appendix C). The report provides detailed information regarding land use within all sections of the study corridor; with reference to site specific, municipal and provincial policies and plans (including zoning and land and transportation master and secondary plans).

For the purpose of determining existing land uses, the corridor was broken down into five sections, which are shown in Figure 5.1.2.1-1:

- Section 1*: King Edward Avenue to Somerset St. West
- Section 2: Somerset St. West to Riverside
- Section 3: Riverside to South Keys
- Section 4: South Keys to Limebank (including the Macdonald-Cartier International Airport Lands and Greenbelt)
- Section 5: Limebank (including the Macdonald-Cartier International Airport Lands and Greenbelt) to Greenbank (Barrhaven)

The main communities within each of these segments are summarized within Table 5.1.2.1-1.

Land Use Sub-sections
Figure 5.1.2.1-1



City of Ottawa Official Plan Schedule D - Primary Transit Network

Table 5.1.2.1-1 Major Communities Within Each Section of the North-South Corridor			
Section No.	**Communities**	**Existing Land Uses Adjacent to the Preferred LRT Alignment**	**Special Considerations**
1	Lowertown, Centretown, Hintonburg, Chinatown	Commercial, office, transportation, open space, medium density residential.	Two major LRT bus transfer station to be located near the community. LeBreton Flats being redeveloped
2	Preston/Champagne (Little Italy), Confederation Heights	Commercial, industrial, communications, low and medium density residential, institutional, green space.	3 LRT stations to service community
3	Riverside Park, South Keys	Office, low and medium density residential, commercial, industrial and green space.	Potential site for maintenance facility is located at Walkley (existing facility location), access to 3 LRT stations
4	Uplands, Leitrim	Vacant land; agriculture; airport; recreational; industrial; employment; low, medium and high-density residential; green space.	Potential location for maintenance and storage facility near the Windsor Park Village, Emerald Woods and Blossom Park or Leitrim Community neighbourhoods. Access to 3 new LRT stations
5	Riverside South, Barrhaven South, South Nepean	Low and medium density residential, vacant land, recreational, commercial, institutional.	The Riverside South and South Nepean communities are in the early phases of development. Some impacts may be mitigated through adjustments to the community plans. Access to 9 LRT stations and 2 Park and Ride lots

The highest concentration of potential adverse residential effects will occur in the Preston/Champagne (Little Italy), Confederation Heights and the proposed Riverside South and South Nepean (Barrhaven) communities as a result of the fact that residential properties within these areas currently/will directly abut the LRT line. The Preston/Champagne and Confederation Heights neighbourhoods will be affected during both the construction and operations phases, despite the fact that the O-Train currently runs through these areas. The existing track will be twinned and upgraded to accommodate the new, more frequent, electric trains. The residents in these neighbourhoods may see an improvement in air quality as a result of the switch from diesel to electric. Potential effects on Riverside South and South Nepean (Barrhaven) during construction are dependant on the level of community development at the time of the LRT construction.

Through the existing rail corridor the historic use of the alignment has been rail based and thus compatible with the existing development. Through LeBreton Flats, Riverside South and Barrhaven planned communities the development has been planned around the transit facility. The southern community plans have been planned to incorporate the LRT as an urban transportation element. This LRT in the urban area can be considered as a railway line in an exclusive right of way and only requires setbacks related to normal City of Ottawa street design. It should be noted that CN and CP guidelines on proximity of residential areas to mainline tracks do no prohibit new residential developments within a similar setback distance.

The CN and CP guidelines do require that noise studies by conducted for proposed residential land uses within 300 m of their rights-of-way and within 1000m of maintenance yards. The purpose of the studies is to ensure that applicable noise guidelines will be met and that the proposed developments will have adequate acoustical environments.

Noise and vibration emitted by a heavy diesel freight train or heavy commuter train (for example a GO Transit train or a VIA passenger train) will be substantially higher than those from the LRT system being proposed here. Noise emissions from heavy trains will be at lease 10 dB louder than the maximum noise emission of the LRT trains. Thus, smaller setback distances can be used to maintain the required noise environment.

The Ottawa Official Plan supports compact urban development in proximity to rapid transit facilities. In the new Riverside South and Barhaven communities, residential lands (in most cases rear yard areas) directly abut the LRT right-of-way with higher densities located at planned LRT stations. In the planned "town centre" districts, the LRT corridor will have abutting motor vehicle lanes with "fronting" development on either side. This urban form of development is consistent with the policies of the Ottawa Official Plan. The assumption in the planning for land use distribution and building setbacks from the LRT right-of-way in the Riverside South CDP was that standard residential lot depths of 32 metres abutting a 30 metre wide LRT right-of-way would mitigate effects both of train noise and vibration on dwellings. Subsequent to the approval of the CDP, noise and vibration specialists on the North-South LRT EA team confirmed that 14 metres is the minimum required dwelling setback based on the now planned-for 20 metre wide LRT corridor. The resultant minimum lot depth abutting the LRT corridor is 38 metres, a lot depth which is common for residential uses abutting major transportation corridors in typical urban development scenarios. The Ottawa Official Plan requires that detailed site specific noise and vibration studies accompany all development applications in proximity to LRT facilities. Adjustments to the lot depths abutting the LRT corridor, if required, will be carried out in accordance with these detailed studies as required through the development approval process.

The potential residential and community effects can be categorized according to the lifecycle phase in which they take place: construction, operations, and maintenance. The mitigation techniques for each of these phases are summarized in Table 5.1.2.1-2. An in-depth discussion of potential adverse environmental effects and their mitigation for noise and vibration is provided in Section 5.1.2.6 and Section 5.1.2.7.

Additional Landuse Planning Information - Riverside South

The Riverside South community is within the Urban Area of the City of Ottawa and is comprised, in terms of Official Plan land use categories, of General Urban and Employment lands as well as Major Open Space and Urban Natural Features designations. The northwest quadrant of the community is presently developed or is subject to immanent development approvals providing for a total of approximately 8,000 residents. The balance community, divided into six neighbourhoods for planning purposes, is expected to be fully built-out over the next 20 to 25 years based on current market demand and have a total population of approximately 52,000 residents.

As of the spring of 2006, the City has received preliminary submissions for subdivision approval for the entire Neighbourhood One (N1) area which will provide approximately 3,300 homes and a population of about 8,700. The LRT alignment bisects the N1 area east of Limebank Road and north of Earl Armstrong Road. A trunk sanitary sewer pipe is being constructed through N1 in 2006 that will set the stage for phased development approvals. In addition to anticipated residential approvals, a school board has indicated that it needs to open a high school in N1 in September 2008 and the City is projecting need to construct a major recreation complex adjacent to the LRT alignment in N1 in 2011.

The City has also received preliminary submissions for subdivision approval on two sites that abut the LRT alignment in Neighbourhood 2 (N2) south of Earl Armstrong Road. The LRT alignment traverses the northerly part of N2. The completion of approvals related to the LRT and finalisation of the Master Servicing Study for Riverside South later in 2006 will enable approvals of these submissions and is expected to be a significant catalyst for future applications for development in proximity to LRT facilities.

The land use planning process that resulted in the approval of the Riverside South Community Design Plan (CDP) in June 2005 included preparation of a series of supporting master studies including commercial space demand, transportation, water, sanitary sewer, storm water management and Significant Woodlot Study Update (Niblett 2005). Among other guidelines and legislated study approval processes, the supporting studies and CDP are consistent with the Natural Heritage conservation requirements of the Provincial Policy Statement and were carried out in accordance with the City of Ottawa Official Plan environmental protection policies. Also, representatives from the Rideau Valley Conservation Authority (RVCA), which by contract also represent matters of Provincial interest to MNR and which has the ability to recommend bump-up to DFO, were part of the study team for the CDP land use plan.

The Significant Woodlot Study Update recommended retention of the "T" shaped portion of the Armstrong South Woods. This woodlot area is identified as having natural feature values important relative to other natural features in urban Ottawa and is designated in the Ottawa Official Plan as an Urban Natural Feature. It was retained as greenspace in the CDP design with the intent to protect it from development. The southerly "tail" to the "T" shaped woodlot was not identified as containing significant plant species and no thretened or endangered species were identified as being present by the RVCA. As a result, this part of the woodlot is to be developed in the future for housing, public roads and will contain the right-of-way for the LRT.

The City of Ottawa has two processes aimed at the preservation of natural features that will apply as individual development applications are received within the future Riverside South community and throughout the City. All applications for development located within 30 metres from the boundary of all designated Urban Natural Features, such as the Armstrong Road South Woods, must be accompanied by an Environmental Impact Statement (EIS). The preparation of an EIS is guided by detailed Environmental Impact Statement Guidelines prepared by the City of Ottawa in accordance with the Natural Heritage Reference Manual for Policy 2.3 - Natural Heritage of the Provincial Policy Statement (1997), as prepared by the Ministry of Natural Resources. An EIS is prepared by an environmental consultant and must include:

a) A map drawn to scale identifying the location and extent of the feature, a description of the environmental values within the environmental feature or designation which could potentially be adversely affected by the proposed development, a description of the terrain/topography, vegetative cover and types, soil type and depth, and surface water movement patterns;
b) A description of the proposed development;

c) A description of the impacts on the environmental feature that might reasonably be expected to result from the proposed development;
d) A description of the actions that may be reasonably required to prevent, change, minimize or mitigate impacts on the environmental feature as a result of the proposed development, including the identification of opportunities for ecological restoration, enhancement and long-term conservation of the feature;
e) A description of the flora and fauna present on the site and how the development may impact on the flora and fauna within the site or natural feature and proposed mitigation measures to be taken during and after construction;
f) An evaluation of the cumulative effects that the proposed development (in light of other known projects or activities in the area) may have following mitigation measures on the natural features and ecological functions identified in the area;
g) A professional opinion on whether negative effects on the natural features and ecological functions will occur, and the significance of these impacts in the context of the evaluation of the natural area (i.e., the natural features and functions for which the area was originally identified as significant and the residual impact of the proposed development on the general significance rating of the larger natural area);
h) Identification of monitoring needs and recognition of parties to be responsible for assessing and reporting on these needs over a prescribed period of time.

The amount to detail and requirements for each individual EIS is scoped by the City planner and Conservation Authority staff based on the characteristics of each site. Once submitted, a technical review of the EIS is undertaken on behalf of the City of Ottawa by staff of the appropriate Conservation Authority, while City of Ottawa staff review of the EIS to ensure that it is consistent with all City of Ottawa policies. Conservation Authority staff identify any inaccuracies and deficiencies in the EIS, and may require that additional work be undertaken. Once accepted, conditions of development approval are written directly into the subdivision and site plan agreements that reflect the mitigation and monitoring measures as proposed in the Environmental Impact Statement.

In addition to Environmental Impact Statements, the City requires the preparation of a Tree Preservation and Protection Plan to support all site plan and subdivision applications in support of the City's Official Plan objective to achieve a target of 30% forest cover throughout the City. Development applications will be required to preserve vegetative cover to the greatest extent possible, or replace it where removal cannot be avoided. The Plans are intended to retain as much natural vegetation as possible, with particular emphasis on high quality or rare vegetative communities. These plans must, among other things:
a) Identify individual trees or stands of trees that warrant retention;
b) Outline measures for their protection during construction and over the long term;
c) Describe the area and nature of the tree loss and compensation measures proposed;
d) Investigate the appropriateness of of the use of native species in tree planting strategies;
e) Provide a reference document for future residents on the importance and care of trees on their property; and
f) Where there is substantial alteration of the natural vegetation cover on the site, identify how the impact on the fauna or rare species during and after construction will be considered and propose mitigation measures.

As with the results of Environmental Impact Statements, the requirements for Tree Preservation and Protection Plans are incorporated into landscape plans and other conditions of development, and included in subdivision and site plan agreements as required.

Potential Construction Effects

The construction phase is anticipated to take approximately 3 years, impacting different stretches of the corridor over that period of time. Potential adverse environmental effects include noise, dust, loss of property access, detours, potential erosion, drainage bypassing, and vibration. All of these are associated with the use of heavy equipment for demolition, clearing and construction operations. The PEMP will ensure that mitigation is implemented to minimize potential adverse environmental effects. Sections 5.1.2.6 and 5.1.2.7 outline a construction code of practice to mitigate potential noise and vibration adverse effects. Section 5.1.2.13 provides additional details on potential affects associates with traffic operations, detours and access.

Potential Operational and Maintenance Effects

Potential long-term effects are those characterized by the operations phase. Mitigation of operational effects is considered key, as they will have the largest effect on residential communities and transit patrons. Potential adverse environmental effects expected during the operational phase include Station and Park and Ride security; visual; community safety; and increased traffic on-route to Park and Ride lots. As noted in Sections 5.1.2.6 and 5.1.2.7 no significant noise and vibration effects are anticipated. Changes in technology may result in reduced impacts over the lifetime of system operation. However with the mitigation outlined in Table 5.1.2.1-2, these adverse environmental effects can be effectively mitigated

The project is anticipated to result in benefits to the community in that it helps to achieve the growth management strategy set out in the City of Ottawa's Official Plan. This strategy emphasizes urban intensification and increased mixed-use development centred on rapid transit as the preferred mode of travel. This means that more new residences will be built close to, or using, existing city infrastructure such as water, sewer and power lines, making growth more affordable for taxpayers. It also means that residents will increasingly be able to live, work, play and shop all within their own communities, reducing the need to get in a car and travel and instead encouraging healthier choices such as walking, cycling or use of transit to reach those destinations.

Occasional track maintenance may require the use of heavy equipment and result in temporary increases in noise. As noted in Section 5.1.2.6, these adverse effects are not anticipated to be significant.

Table 5.1.2.1-2 Recommended Mitigation Techniques to Reduce Adverse effects on Residential Communities

Phase	Potential Adverse Effects on the Community	Proposed Mitigation
Construction	• Noise • Dust • Vibration • Loss of access • Traffic	• Noise impacts will be mitigated by limiting the hours of construction to those provided within community by-laws. Within the City of Ottawa, construction within residential communities is not permitted between 2200 hours of one day and 0700 hours of the next

Table 5.1.2.1-2 Recommended Mitigation Techniques to Reduce Adverse effects on Residential Communities		
Phase	**Potential Adverse Effects on the Community**	**Proposed Mitigation**
		day (By-law 2004-253) and other measures outlined in Section 5.1.2.6 • Dust impacts shall be mitigated by ensuring that watering and/or other dust suppression techniques are used during the construction phase. Following construction, any open, unpaved areas will be seeded. • No heavy equipment will be used in close proximity to vibration-sensitive buildings. (Section 5.1.2.7) • Access to commercial buildings will be maintained through detours as required. • Access to residential properties will remain open to local traffic at all times. • A Traffic Management Plan will be developed as part of the design phase.
Operations/ Maintenance	• Security around Stations and Park and Ride lots • Aesthetics • Noise • Vibration • Safety around tracks • Unauthorized Access • Increased traffic around Park and Ride lots	• Security around Stations and Park and Ride lots will be improved through the use of lighting, surveillance cameras, accessible telephones and security patrols. • Aesthetic impacts will be mitigated through the employment of buffer zones, landscaping and regular maintenance of the facility and tracks. • As warranted, noise impacts will be mitigated through the use of sound barriers and landscaping techniques (Section 5.1.2.6) • Effects of vibration have been mitigated by running the proposed North-South LRT alignment along the former rail line and designated transportation corridors. No vibration-sensitive structures have been built adjacent to these features (Section 5.1.2.7). • Vibrational impacts (Section 5.1.2.7) will be minimized through the use of joint-free rails wherever possible. • Community safety impacts related to the electrified twin LRT tracks will be mitigated through the use of secure fencing In addition to the existing fencing along the existing rail right-of-way, new security fencing will be provided: – Alongside the LRT from Greenboro Station to Bowesville Road; – Both sides of airport link have fencing or barriers; – Adjacent the River Road Park and Ride

Table 5.1.2.1-2 Recommended Mitigation Techniques to Reduce Adverse effects on Residential Communities		
Phase	**Potential Adverse Effects on the Community**	**Proposed Mitigation**
		Lot (except at the station); – Between LRT tracks at station curbside platforms; and – Bordering the Chapman Mills East Woodlot from Cresthaven Road to Woodroffe Avenue. • Accesses will be fenced except at authorized crossings and within an urban street right of way. Unauthorized access will be controlled as part of normal traffic operation on City of Ottawa streets including any new bylaws that may be required. • Where warranted, increased traffic around Park and Ride lots will be mitigated through the use of turning lanes and traffic signals.
	• Noise during track maintenance	• Noise impacts will be mitigated by limiting the hours of track maintenance to those provided within community by-laws (Section 5.1.2.6).

Potential Effects to Commercial/Industrial Properties

As part of the EA process an inventory of existing conditions including identification of existing and proposed commercial sites was undertaken. The majority of commercial sites are found in the downtown area, with some along the existing rock cut area between Bayview and Carling, Confederation Heights, at the Greenboro, South Keys transit stations and in the developing Barrhaven Town Centre. Future commercial development is proposed in the LeBreton Flats and Riverside South plans.

Throughout the corridor the LRT is located within existing or planned right-of-way which is part of an overall development concept, thus the potential effects associated with the existing conditions are concentrated on the downtown area. Through the downtown the LRT and BRT share the existing transit lanes, potential adverse effects associated with this area include; impact on accessibility to adjacent off street parking and impact on street operations (i.e. taxi stands, parking, loading zones). Through design no business are displaced, all present building accesses are maintained and over 92% of the existing total length of parking, loading, taxi, hotel loading and drop-off areas and, existing turning movements are retained. Reduction in the bus fleet resulting from the use of the higher capacity LRT will improve transit and vehicle movements downtown.

The following outlines the proposed mitigation and commitment to future work required to mitigate potential adverse effects to commercial development downtown during and after construction of the LRT.

- Continue the dialogue with downtown stakeholders into design, through construction and into a monitoring program to resolve parking loading and operational concerns.
- Contractor to provide a documented construction staged approach for the City of Ottawa to monitor.

- Dust control plan to be established by contractor and monitored by the City of Ottawa.
- Traffic control plan to be prepared by contractor and monitored by the City of Ottawa.
- Design to consider impacts on street operations.
- Detail design to minimize reduction in current curb operations.
- Access to adjacent properties to be retained as long as possible during construction and closures to be coordinated with owners.
- Operating authority to reduce bus volumes by 30% for opening day.
- Bus rerouting plan to be developed for construction period.
- Media program to be initiated to keep public aware of road closures and project progress.
- Temporary signage to direct clients to stores and parking during interruptions.
- Streetscaping and wayfinding plan to be developed as part of the design process.

Potential Effects Land Uses and City of Ottawa's Policies

The project is anticipated to result in benefits to the land use and policy in that it helps to achieve the growth management strategy set out in the City of Ottawa's Official Plan. This strategy emphasizes urban intensification and increased mixed-use development centred on rapid transit as the preferred mode of travel. This means that more new residences will be built close to, or using, existing city infrastructure such as water, sewer and power lines, making growth more affordable for taxpayers. It also means that residents will increasingly be able to live, work, play and shop all within their own communities, reducing the need to get in a car and travel and instead encouraging healthier choices such as walking, cycling or use of transit to reach those destinations.

The Ottawa Official Plan supports compact urban development in proximity to rapid transit facilities. In the new Riverside South and Barhaven communities, residential lands (in most cases rear yard areas) directly abut the LRT right-of-way with higher densities located at planned LRT stations. In the planned "town centre" districts, the LRT corridor will have abutting motor vehicle lanes with "fronting" development on either side. This urban form of development is consistent with the policies of the Ottawa Official Plan. The assumption in the planning for land use distribution and building setbacks from the LRT right-of-way in the Riverside South CDP was that standard residential lot depths of 32 metres abutting a 30 metre wide LRT right-of-way would mitigate effects both of train noise and vibration on dwellings. Subsequent to the approval of the CDP, noise and vibration specialists on the North-South LRT EA team confirmed that 14 metres is the minimum required dwelling setback based on the now planned-for 20 metre wide LRT corridor. The resultant minimum lot depth abutting the LRT corridor is 38 metres, a lot depth which is common for residential uses abutting major transportation corridors in typical urban development scenarios. The Ottawa Official Plan requires that detailed site specific noise and vibration studies accompany all development applications in proximity to LRT facilities. Adjustments to the lot depths abutting the LRT corridor, if required, will be carried out in accordance with these detailed studies as required through the development approval process.

Proximity Issues

It is recognized that the Railway Association of Canada is developing "Proximity Guidelines" to assist in planning new rail facilities. The Project Team was made aware that an internal draft of these Guidelines was prepared in July 2005. This was well after alternatives were generated and evaluated. The July 2005 draft is not available publicly for review and is not posted on the "proximity issues" website. However a listing of proximity issues is available on the website.

<http://www.railcan.ca/> Based on a review of this list it can be confirmed that the issues listed were considered in some form during the generation and evaluation of alternatives as well as during the impact assessment/mitigation stage of the project.

Federal Property to be Newly Acquired / Leased

Property acquisition for the corridor and stations will not adversely effect the planned land use as the transit facility is part of the land development plans. Lands required for park and ride and rail facilities have an impact on the development lands but are being negotiated with the developers The following table includes descriptions of all the federal property parcels that are impacted by the proposed LRT ROW. Detailed images of these parcels are included in Appendix I. Figures 5.1.2.1-2 – 5.1.2.1-8 provide plans showing the federal property to be newly acquired or leased. Additional properties potentially required for construction staging and construction accesses are outlined in Section 5.1.2.18.

Table 5.1.2.1-3 Government Property to be Newly Acquired / Leased

#	Owner	Contact	Location	Description
1	Federal Government	Parks Canada	Rideau Canal National Historic Site of Canada (at Strandherd/Armstrong Roads)	Proposed LRT will pass over the Rideau River (Strandherd structure)
2	Federal Government	Transport Canada	Width of ROW south of Leitrim Rd.	LRT right-of way
3	Federal Government	Transport Canada	West of Bowesville Av. south of LRT	Proposed Bowesville Park & Ride
4	Federal Government	Transport Canada	East of Bowesville Av. south of LRT	Possible Bowesville maintenance Yard
5	Federal Government	Transport Canada	South of Leitrim Rd. west of LRT	Proposed Leitrim Park & Ride
6	Federal Government	Transport Canada	South of Lester Rd. west of LRT	NRC track lease
7	Federal Government	Transport Canada	North of Lester Rd. west of LRT	Possible Lester Maintenance Yard and Proposed Bus Turnaround
8	Federal Government	PWGSC	Between Junction Av. & Transitway (Sawmill Creek)	Partial Fee Simple Acquisition - possible staging/construction site
9	National Capital Commission	NCC	Colonel By Drive (tunnel runs under)	road diversion and staging/construction areas and permanent easement
10	Federal Government	Parks Canada	Bed of the Rideau Canal – Dow's Lake tunnel runs under	Twinning of Dow's Lake tunnel
11	National Capital Commission	NCC	strip border on Dow's Lake between Ag Can lands and lake - small triangular parcel just north/west of Canal - tunnel runs under	open cut and refill - temporary and permanent easements

Table 5.1.2.1-3 Government Property to be Newly Acquired / Leased				
#	Owner	Contact	Location	Description
12	National Capital Commission	NCC	south of Gladstone Avenue both sides of LRT	land required for LRT Gladstone Station -Half vacant - half parking for St. Anthony's Soccer Club
13	National Capital Commission	NCC	West side of LRT between Breezehill Av. N. and LRT ROW	possible purchase for LRT widening
14	National Capital Commission	NCC	Lebreton Flats	LRT Corridor and Bus Turn Around
15	National Capital Commission	NCC	550 Albert Street	LRT Corridor Between Empress Av. and Bronson Av.

Zoning Requirements for Park and Ride Lots

Four of the five Park and Ride lots may require rezoning of the land on which they will be constructed. The Greenboro lot is already being used for Park and Ride as it is southern terminus of the existing O-Train line. Currently, the land is zoned as provided in Table 5.1.2.1-4.

Table 5.1.2.1-4 Current Land Use / Zoning	
Park and Ride Lot Location	Current Land Use / Zoning
Woodroffe	FG – Future Growth Zone (City of Nepean Urban Area Schedule B19, By-Law 100-2000)
River Road	FG – Future Growth Zone (City of Gloucester Zoning By-Law 333of 1999, Map No. 22C)
Bowesville	FG – Future Growth Zone (City of Gloucester Zoning By-Law 333of 1999, Map No. 22D)
Leitrim	Os – Open Space (City of Gloucester Zoning By-Law 333 of 1999, Map No. 23C)
Greenboro	Currently a Park and Ride facility.

Significance

After mitigation discussed above there will be no significant adverse effects to surrounding land uses. In fact, the residual effects of this project will result in benefits to surrounding land uses as it will assist the City of Ottawa in meeting the growth objectives set out in their Official Plan.

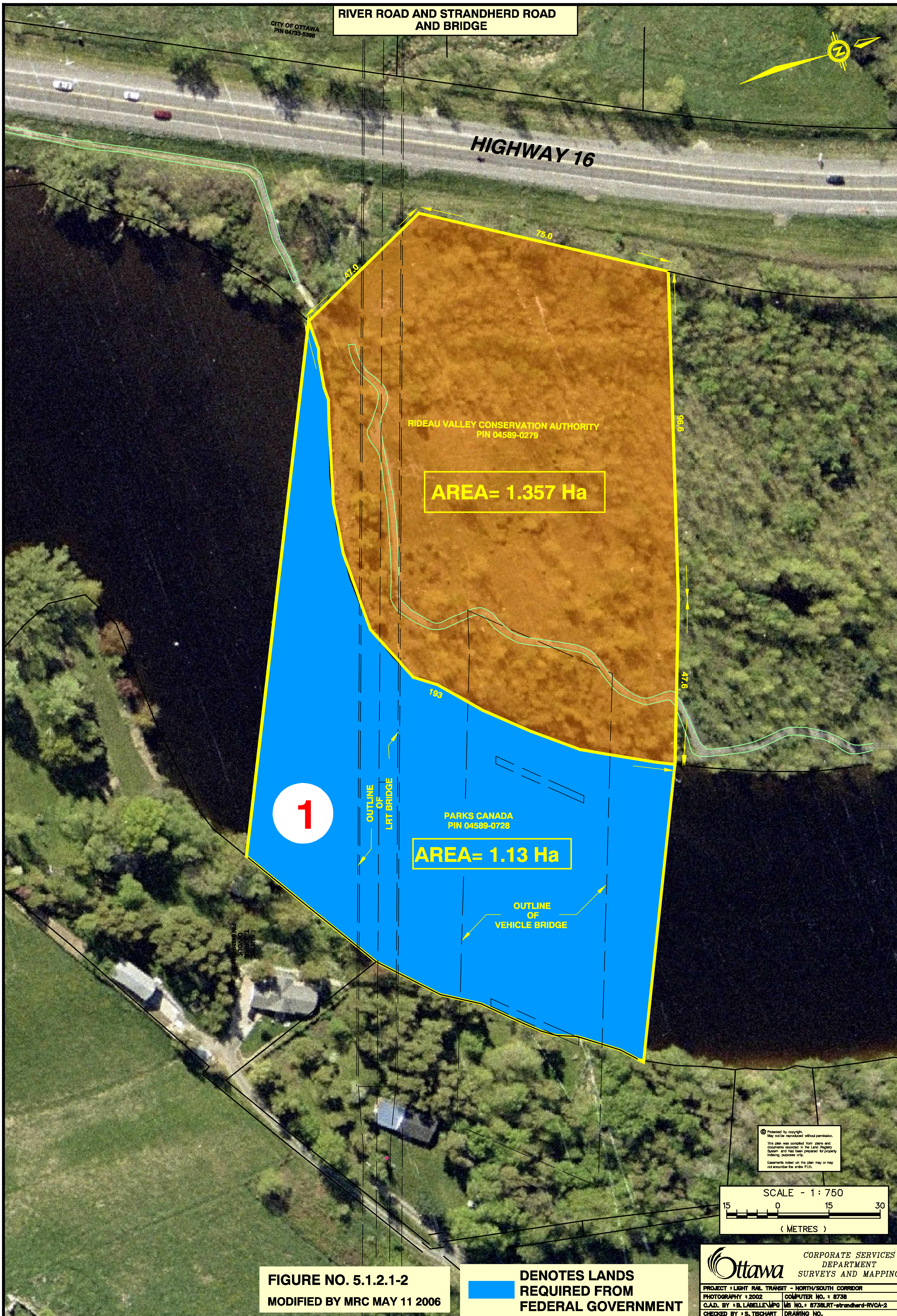


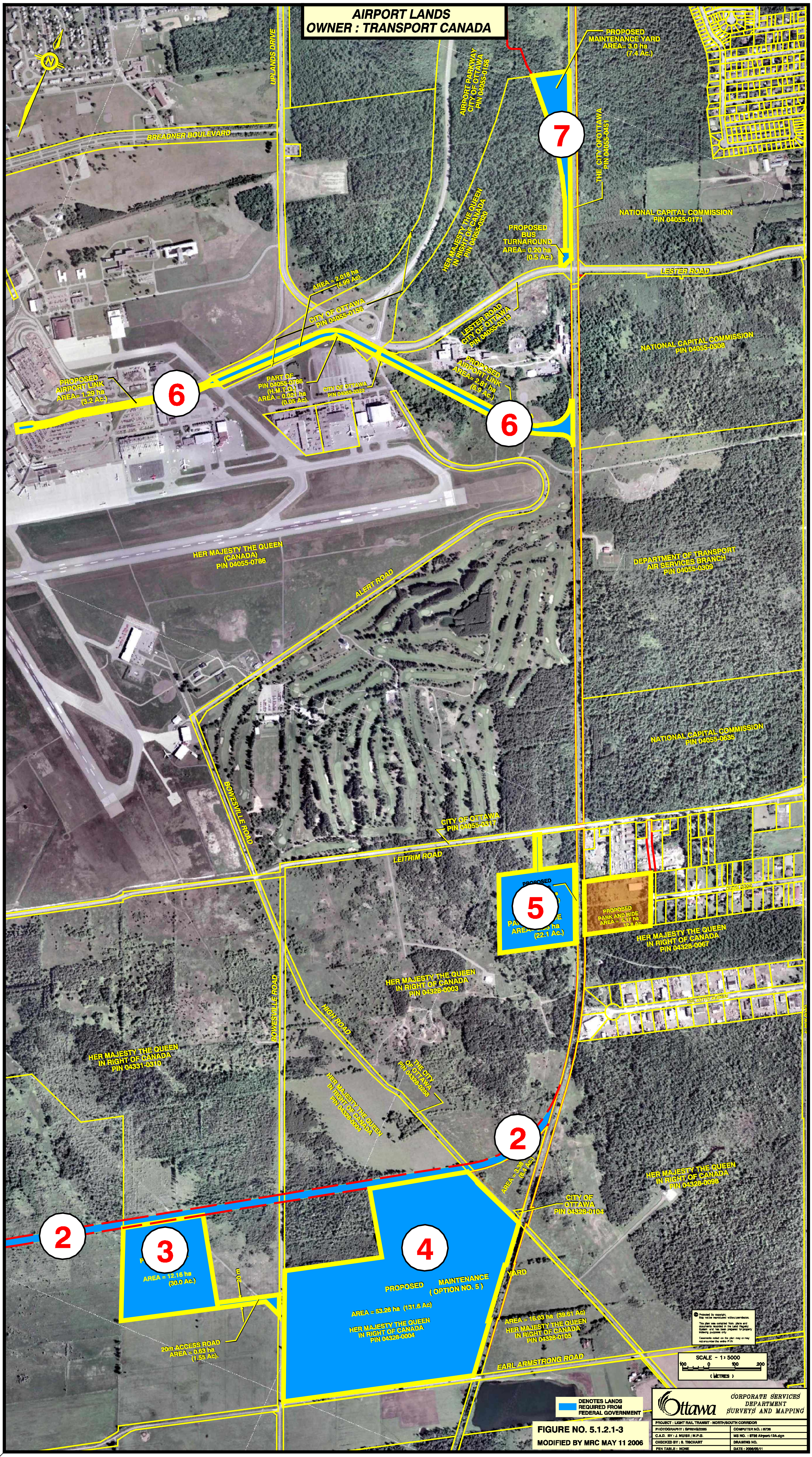
FIGURE NO. 5.1.2.1-2

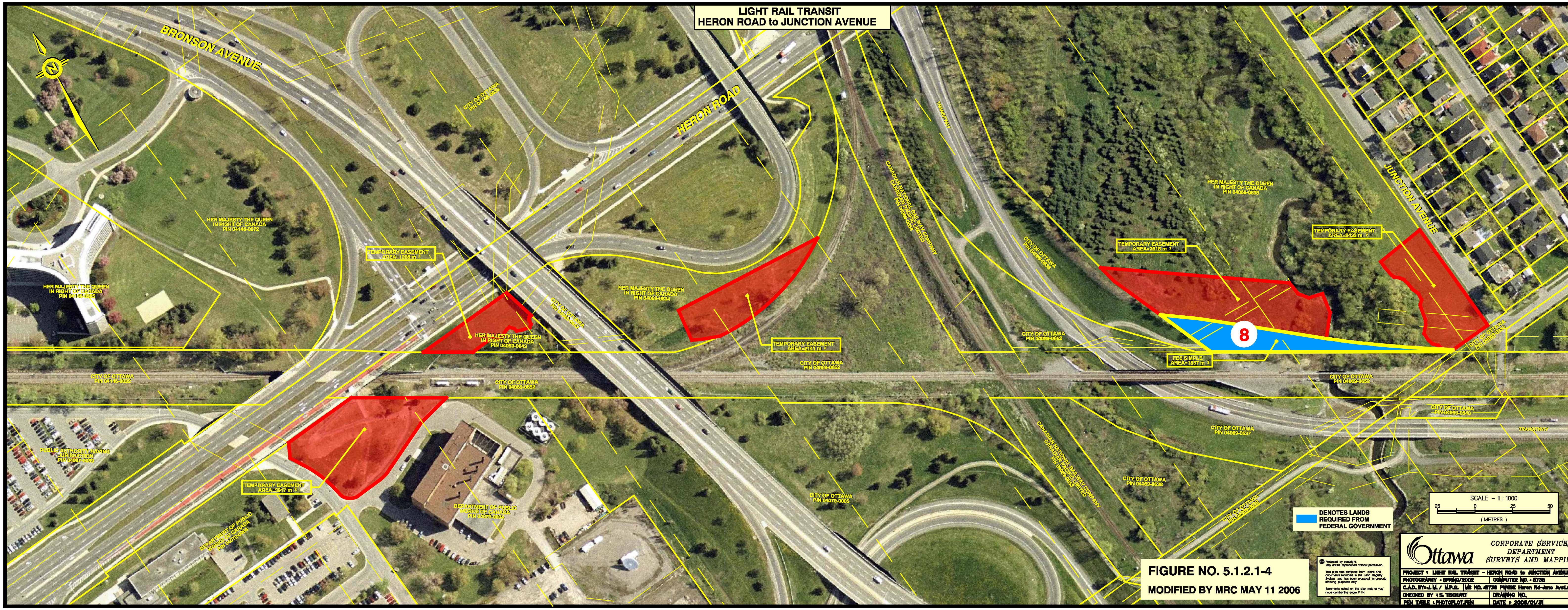
MODIFIED BY MRC MAY 11 2006

DENOTES LANDS REQUIRED FROM FEDERAL GOVERNMENT

Ottawa
CORPORATE SERVICES DEPARTMENT
SURVEYS AND MAPPING

PROJECT : LIGHT RAIL TRANSIT - NORTH/SOUTH CORRIDOR	
PHOTOGRAPHY : 2002	COMPUTER NO. : 8738
C.A.D. BY : B. LABELLE\MPG	MS NO. : 8738LRT-strandherd-RVCA-2
CHECKED BY : S. TISCHART	DRAWING NO.
PEN TABLE : NONE	DATE : 2006/03/01


AIRPORT LANDS
OWNER : TRANSPORT CANADA
PROPOSED MAINTENANCE YARD AREA = 3.0 ha (7.4 Ac.)
7
THE CITY OF OTTAWA PIN 04055-0451
NATIONAL CAPITAL COMMISSION PIN 04055-0171
PROPOSED BUS TURNAROUND AREA = 0.20 ha (0.5 Ac.)
LESTER ROAD
UPLANDS DRIVE
BREADNER BOULEVARD
AIRPORT PARKWAY CITY OF OTTAWA PIN 04055-0156
HER MAJESTY THE QUEEN IN RIGHT OF CANADA PIN 04055-0320
NATIONAL CAPITAL COMMISSION PIN 04055-0308
PROPOSED AIRPORT LINK AREA = 1.29 ha (3.2 Ac.)
6
PROPOSED AIRPORT LINK AREA = 2.8 ha (6.9 Ac.)
HER MAJESTY THE QUEEN (CANADA) PIN 04055-0786
ALERT ROAD
DEPARTMENT OF TRANSPORT AIR SERVICES BRANCH PIN 04055-0309
NATIONAL CAPITAL COMMISSION PIN 04055-0635
BOWESVILLE ROAD
LEITRIM ROAD
5
(22.1 Ac.)
PROPOSED PARK AND RIDE
HER MAJESTY THE QUEEN IN RIGHT OF CANADA PIN 04328-0067
HER MAJESTY THE QUEEN IN RIGHT OF CANADA PIN 04328-0003
HIGH ROAD
HER MAJESTY THE QUEEN IN RIGHT OF CANADA PIN 04331-0310
2
HER MAJESTY THE QUEEN IN RIGHT OF CANADA PIN 04328-0098
CITY OF OTTAWA PIN 04328-0104
3
AREA = 12.16 ha (30.0 Ac.)
4
PROPOSED MAINTENANCE (OPTION NO. 5)
AREA = 53.26 ha (131.6 Ac.)
HER MAJESTY THE QUEEN IN RIGHT OF CANADA PIN 04328-0004
AREA = 16.03 ha (39.61 Ac.)
HER MAJESTY THE QUEEN IN RIGHT OF CANADA PIN 04328-0105
20m ACCESS ROAD AREA = 0.63 ha (1.55 Ac.)
EARL ARMSTRONG ROAD
SCALE - 1 : 5000
(METRES)
DENOTES LANDS REQUIRED FROM FEDERAL GOVERNMENT
Ottawa
CORPORATE SERVICES DEPARTMENT SURVEYS AND MAPPING
FIGURE NO. 5.1.2.1-3
MODIFIED BY MRC MAY 11 2006



LIGHT RAIL TRANSIT
HERON ROAD to JUNCTION AVENUE
BRONSON AVENUE
HERON ROAD
JUNCTION AVENUE
8
CITY OF OTTAWA
PIN 04069-0637
CITY OF OTTAWA
PIN 04069-0638
TRANSITWAY
DENOTES LANDS REQUIRED FROM FEDERAL GOVERNMENT
SCALE – 1 : 1000
25 0 25 50
(METRES)
FIGURE NO. 5.1.2.1-4
MODIFIED BY MRC MAY 11 2006
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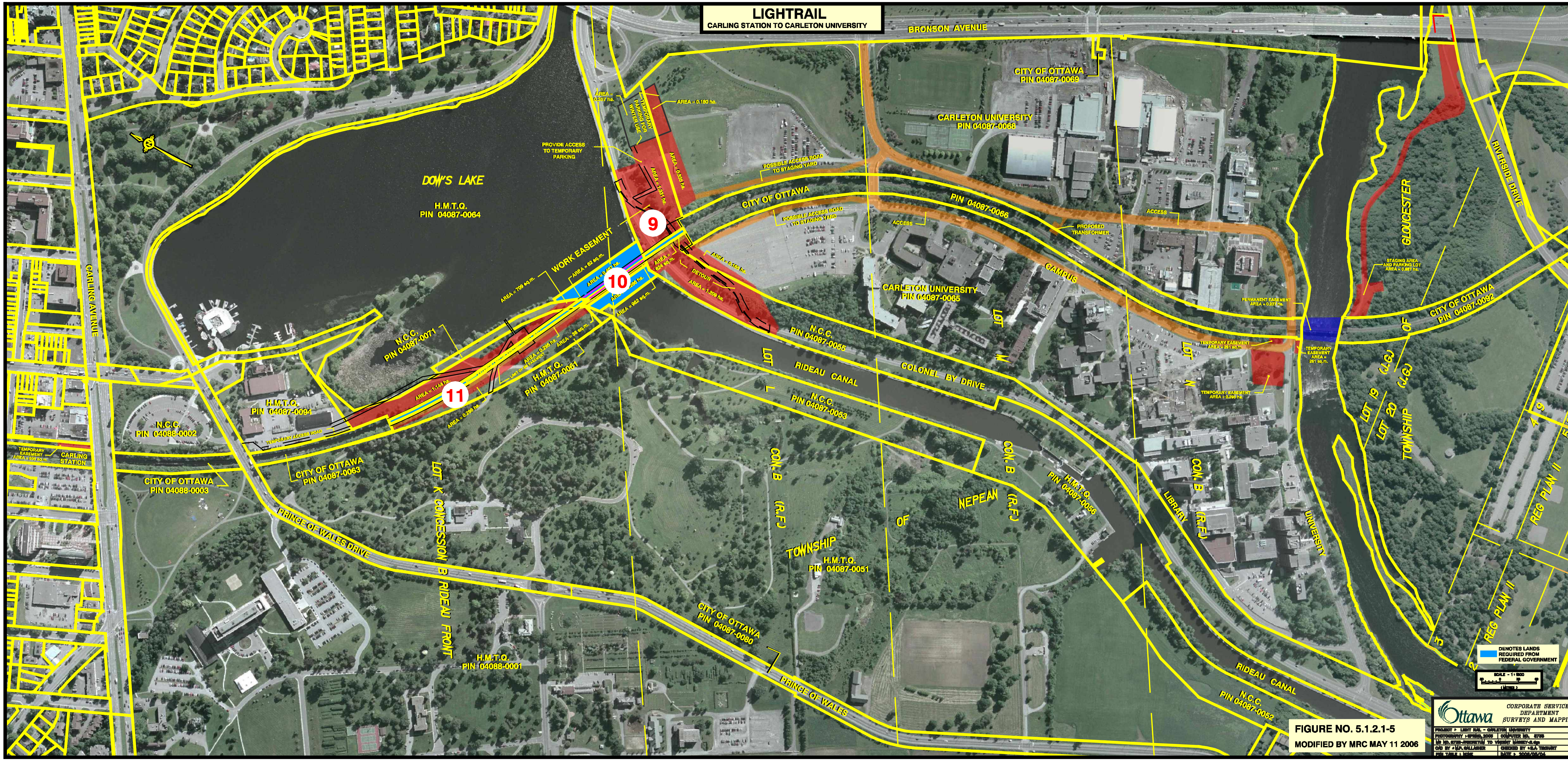
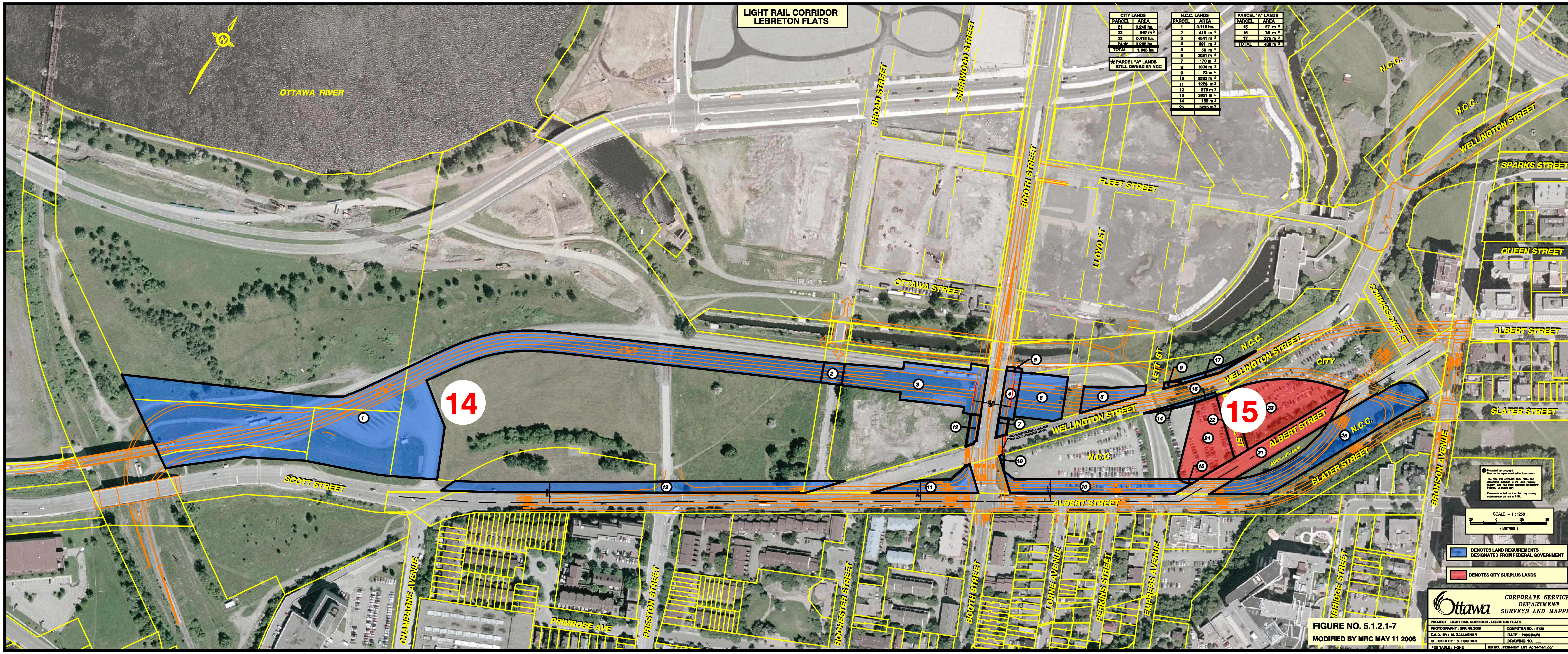
This plan was compiled from plans and documents recorded in the Land Registry System and has been prepared for property indexing purposes only.
Easements noted on the plan may or may not encumber the entire P.I.N.
Ottawa
CORPORATE SERVICES DEPARTMENT SURVEYS AND MAPPING
PROJECT : LIGHT RAIL TRANSIT – HERON ROAD to JUNCTION AVENUE
PHOTOGRAPHY : SPRING/2002
COMPUTER NO. : 8738
C.A.D. BY : J. M. / M.P.G.
MS NO. 8738 PWGSE Heron Rd-Junc Ave1.dgn
CHECKED BY : S. TISCHART
DRAWING NO.
PEN TABLE : PHOTOPLOT.PEN
DATE : 2006/01/31



LIGHTRAIL
CARLING STATION TO CARLETON UNIVERSITY
BRONSON AVENUE
CITY OF OTTAWA
PIN 04087-0069
CARLETON UNIVERSITY
PIN 04087-0068
DOW'S LAKE
H.M.T.Q.
PIN 04087-0064
PROVIDE ACCESS
TO TEMPORARY
PARKING
POSSIBLE ACCESS ROAD
TO STAGING YARD
CITY OF OTTAWA
PIN 04087-0066
ACCESS
PROPOSED
TRANSFORMER
CAMPUS
9
10
11
WORK EASEMENT
DETOUR
CARLETON UNIVERSITY
PIN 04087-0065
GLOUCESTER
RIVERSIDE DRIVE
STAGING AREA
AND PARKING LOT
CITY OF OTTAWA
PIN 04087-0092
PERMANENT EASEMENT
TEMPORARY EASEMENT
N.C.C.
PIN 04087-0071
N.C.C.
PIN 04087-0085
H.M.T.Q.
PIN 04087-0061
H.M.T.Q.
PIN 04087-0094
N.C.C.
PIN 04088-0002
TEMPORARY ACCESS ROAD
TEMPORARY
EASEMENT
CARLING
STATION
CARLING AVENUE
CITY OF OTTAWA
PIN 04088-0003
CITY OF OTTAWA
PIN 04087-0063
RIDEAU CANAL
N.C.C.
PIN 04087-0063
COLONEL BY DRIVE
LOT L
LOT M
LOT N
CON. B (R.F.)
TOWNSHIP OF NEPEAN
H.M.T.Q.
PIN 04087-0056
H.M.T.Q.
PIN 04087-0051
LIBRARY
UNIVERSITY
LOT 19 (J.G.)
LOT 20 (J.G.)
TOWNSHIP OF
REG PLAN II
PRINCE OF WALES DRIVE
LOT K CONCESSION B RIDEAU FRONT
H.M.T.Q.
PIN 04088-0001
CITY OF OTTAWA
PIN 04087-0080
PRINCE OF WALES
RIDEAU CANAL
N.C.C.
PIN 04087-0052
DENOTES LANDS
REQUIRED FROM
FEDERAL GOVERNMENT
Ottawa
CORPORATE SERVICES
DEPARTMENT
SURVEYS AND MAPPING
FIGURE NO. 5.1.2.1-5
MODIFIED BY MRC MAY 11 2006


LIGHT RAIL
N/S LINE REQUIREMENTS
PRESTON STREET
ELM STREET
SPRUCE STREET
SOMERSET STREET WEST
OAK STREET
LAUREL STREET
LARCH STREET
BALSAM STREET
GLADSTONE AVENUE
LOUISA ST
CHAMPAGNE AVENUE
OAK ST
LIGHT RAIL CORRIDOR
LORETTA AVENUE
BREEZEHILL AVENUE
BREEZEHILL AVENUE NORTH
THE QUEENSWAY
AREA = 765m²
AREA = 1183m²
AREA = 1156m²
12
13
DENOTES LANDS REQUIRED FROM FEDERAL GOVERNMENT
SCALE - 1 : 1250
(METRES)
Ottawa
CORPORATE SERVICES DEPARTMENT SURVEYS AND MAPPING
PROJECT : LIGHT RAIL N/S LINE REQUIREMENTS
PHOTO : SPRING 2002
COMPUTER NO. 8738
C.A.D. BY : A. MELBOURNE
MS NO. 8738LRT-PHOTO-2
CHECKED BY : S. TISCHART
DRAWING NO.
PEN TABLE : NONE
DATE : MAY 2005
FIGURE NO. 5.1.2.1-6
MODIFIED BY MRC MAY 11 2006



CITY LANDS	
PARCEL	AREA
21	0.248 ha.
22	957 m²
23	0.419 ha.
24 *	0.282 ha.
TOTAL	1.045 ha.

N.C.C. LANDS	
PARCEL	AREA
1	3.119 ha.
2	419 m²
3	4541 m²
4	691 m²
5	56 m²
6	2021 m²
7	170 m²
8	1004 m²
9	73 m²
10	2533 m²
11	1223 m²
12	278 m²
13	3951 m²
14	132 m²
25	5225 m²

PARCEL "A" LANDS	
PARCEL	AREA
15	57 m²
16	76 m²
17	275 m²
TOTAL	408 m²

5.1.2.2 Central Experimental Farm

Potential Construction Effects and Mitigation

The Dominion Arboretum is primarily manicured lawn with a great diversity of planted deciduous and coniferous trees and shrubs. Many of the trees were planted over 100 years ago. Twenty-eight mature planted trees along with 36 young planted trees and shrubs will be impacted by the footprint of the expanded Dow's Lake Tunnel and associated construction related activities. No adverse effects are anticipated during operation. In addition, Pedestrian movement and staff access to parts of the Dominion Arboretum may be affected during construction.

The following outlines the proposed mitigation measures and commitments to future work to mitigate effects to the Dominion Arboretum during construction:

- Continue consultation with Dominion Arboretum staff as design progresses to discuss site access, establish a program to identify and transplant and to protect or replace others, and explore other mitigation measures to minimize adverse effects during construction.
- Transplant the 36 young trees and shrubs to a temporary nursery and after construction replanted to their original locations. Additional compensation for removal of mature trees and additional mitigation measures for transplanted trees and shrubs will be negotiated through discussions with Dominion Arboretum staff.
- Employ sedimentation and erosion control measures.
- Ensure existing hydrologic regime will be maintained.
- Clearing and disposal of all construction-related debris following construction.
- Ensure an environmental inspector is on site during construction to ensure compliance with mitigation measures.
- Implement measures to protect nesting migratory birds (timing of vegetation clearing to avoid breeding period or implement nest surveys to confirm no nesting in affected areas prior to clearing – this relates to meeting requirements of the Migratory Birds Convention Act – MBCA).
- Fencing and signage will be installed during construction to ensure the safety of pedestrians during construction.

Operational and Maintenance Effects

No potential adverse environmental effects are anticipated during the operational phase. A noise impact assessment was not completed at this location given that it is not identified as a noise sensitive site based on the definition provided by Health Canada. However, by reviewing the results other sensitive sites in the area it can be determined that the operation of this project will not result in a significant increase in sound. The details of the noise assessment work are presented in Section 5.1.2.6.

Significance

The construction of the LRT system will result in construction impacts to the Dominion Arboretum. With the implementation of previously noted mitigation measures potential adverse effects to the Dominion Arboretum, including pedestrian movement and staff access, can be minimized and no significant residual adverse effects should occur.

No potential adverse environmental effects are anticipated during operations.

5.1.2.3 Rideau Canal

Potential Operational and Maintenance Effects

Potential adverse effects during operations are limited to stormwater run-off and noise issues associated with the boating community docked under the Mackenzie King Bridge.

Potential adverse effects and proposed mitigation measures for stormwater run-off has been outlined in Section 5.1.1.4. Specific mitigation measures related to stormwater run-off include the commitment to not permit any new outflows into the Canal and to design deck drainages capture systems on all new bridges over the Canal.

The potential noise impacts to boaters docked on the Rideau Canal in the vicinity of the Mackenzie King Bridge were addressed by examining impacts at Noise Receptor NR1 (the National Arts Centre), which immediately adjacent to the area in question. Modelling for noise impacts at NR1 considered the acoustically reflective surface of water The change in sound levels at NR1 due to the project will be not be significant (1 dB daytime, 0 dB night time). On a short-term Leq (30 min) basis, the maximum change will only be 3 dB, which in human terms is also not significant (considered imperceptible). It should be noted that the LRT vehicles are “streetcar” type trains operating on continuously welded rails. In terms of maximum pass-by noise levels, the LRT vehicles will be similar to heavy trucks and buses which already use the bridge. Thus, the character of the ambient noise environment will not significantly change.Additional details on noise issues are outlined in Section 5.1.2.6.

Potential Construction Effects and Mitigation

There are three crossings of the Rideau Canal associated with the project.

The first crossing in downtown will be along the existing Mackenzie King Bridge. No additional widening of this bridge is required and therefore there will be no significant effects to this feature.

The second crossing is at Dow’s Lake. This crossing will require the construction of a new tunnel adjacent to the existing tunnel under Dow’s Lake.

The third crossing is the south crossing. A new bridge will be required and will be designed in accordance with the Strandherd-Armstrong Bridge Aesthetic Guidelines (du Toit Allsopp Hillier, November 2005).

All new crossing will be designed to meet navigable requirements and will be constructed in accordance with any conditions outlined on the *Navigable Waters Protection Act* permit which will be obtained for each new structure. In addition, construction will not impede through navigation of boats along the canal at anytime.

Permits for work in/on/over/under the Rideau Canal and licences (or amendments to licences) will be required for all Parks Canada Agency crossings. Please refer to Table 5.1.1.2-1 for crossing specific requirements.

Specific potential adverse effects and proposed mitigation to fisheries, surface water, stormwater-runoff and terrestrial features have been outlined in the appropriate sections of Section 5.1.1 of this report.

The new bridges at the south Rideau River crossing will be designed in accordance with the Strandherd-Armstrong Bridge Aesthetic Guidelines (du Toit Allsopp Hillier, November 2005). Parks Canada and NCC will be consulted during the design of these bridges and all required permits and approvals will be obtained.

At the Dow's Lake crossing a Stage 2 Archaeological Assessment will be undertaken and Parks Canada will be consulted regarding potential underwater resources in the vicinity of the Dow's Lake.

Construction effects during the winter and Winterlude will be minor and of short duration. Construction will be staged to avoid adverse effects during key times (e.g. Winterlude activities). There will be no construction adverse effects in the spring or summer as construction will be timed such that through navigation will be maintained throughout the duration of the project.

Additional details of potential recreational effects and proposed mitigation are outlined and addressed in Section 5.1.2.4 (Recreation). Additional details on potential effects to environmental feature have been addressed in Section 5.1.1.

Significance

The project will result in potential adverse effects during the construction stage. With the implementation of above noted mitigation measures potential adverse effects can be minimized. Given the relatively short duration of construction no significant adverse environmental effects are anticipated when the above noted mitigation measures are implemented.

5.1.2.4 Recreation

Overview

The City of Ottawa owns and operates many recreation facilities for use by its residents. These include large multi-purpose facilities, soccer fields, ball diamonds, arenas, pools as well as other facilities not necessarily related to sports such as Seniors Centres and Community Buildings. The proposed LRT alignment being mostly in existing or dedicated right-of-way through development planning does not impact any of these facilities.

The City of Ottawa Official Plan includes promotion of non-motorized transportation to reduce pressure on the roadways, preserve the environment and improve public health. Multi-use pathways for walking, in-line skating and off road cycling are key components in achieving that goal. In that respect the City of Ottawa has established in the transportation demand management program and through land use planning a number of supportive measures that promote walking, in-line skating and recreational cycling.

Both the planned southern communities and LeBreton Flats include provisions for sidewalks and pathways within the community and to the proposed Light Rail Station areas. Existing pathways within the study area include parallel walkways within the ROW on the east side between Lester and Leitrim, a controlled at grade multi-use pathway crossing the existing O-Train track south of Sawmill Creek, grade separated pathways under the rail at Carleton University and overpasses through the (tunnel) Dominion Arboretum, Carling Avenue, Beech Street, Young Street, Gladstone Avenue, Somerset Street and Wellington Street structures. Through LeBreton Flats existing pathways cross the Transitway and proposed LRT alignment at grade at Preston, Broad and Booth Streets. Through the downtown multi-use pathways are found on Albert and Slater and extend across the Rideau Canal on Mackenzie King and Laurier Avenue Bridges. Sidewalks and commuter cycling on traffics as part of the cycling network plan are present. Intersection controls provide a safe pedestrian crossing of the streets in the downtown area.

In addition to the existing pathways the City of Ottawa is carrying out a study to investigate the potential to provide Multi-use pathways in or adjacent to rapid transit corridor, and provide walking and cycling crossings of rapid transit corridor where feasible.

Potential Construction Effects and Mitigation

The construction of the LRT system will temporary effect the operations of the multi-use pathways. The grading and excavation for the laying of track may result in diversion or closure of pathways during construction. Movement of heavy construction vehicles in the vicinity of multi-use pathways can create an unsafe environment for users of the pathway. Movement of construction vehicles across pathways can result in debris being deposited on the pathway. Dust from construction activities can make the use of adjacent pathways unpleasant and unsafe.

The Chapman Mills Conservation Area located along the western banks of the Rideau River may have some potential effects due to construction of the LRT. The Strandherd/Armstrong Bridge will cross the Rideau River and pass through the Chapman Mills Conservation Area. The recreational path will ultimately pass underneath the structure but will be rerouted during bridge construction. The ultimate plan shows a separate LRT structure that will be located south of the Strandherd/Armstrong crossing. This structure will be grade separated from both River Road and Prince of Wales Drive. This structure will pass over the conservation area but will be designed to enhance the area.

During detail design phase the City of Ottawa will assess the impacts to the recreational and cycle networks. Paths will be maintained or rerouted if required. The construction contracts will include requirements to limit adverse effects on the cycle network through fencing to restrict vehicle access and the control of excavated material

The following outlines the proposed mitigation measures and commitments to future work to mitigate potential adverse environmental effects to multi-user pathways during construction:

- Pathways will be diverted were possible around construction areas.
- Construction areas will be fenced in.
- Haul roads will be cleaned to ensure debris is not impacting on crossing pathways.
- Signage and or flagmen will be used at crossings, where applicable.
- Dust control measures will be applied to reduce dust impacts.
- City of Ottawa will monitor construction impacts and revise operations as required to address problems.

Potential Operational and Maintenance Effects and Mitigation

The operations of LRT service on this dedicated right-of-way may result in effects to the operation of the multi-use pathways. Securing the corridor will result in limited and controlled crossing of the tracks and removal of local cut through paths.

The following outlines the proposed mitigation measures and commitments to future work to mitigate adverse effects to multi-user pathways during operations:

- Station areas will provide at grade controlled pedestrian crossing.

- Existing pathways to be rerouted to controlled crossing.
- Fencing along key segments of the LRT corridor to prevent pedestrian accidents with train. Fencing will be provided:
  - Alongside the LRT from Greenboro Station to Bowesville Road;
  - Both sides of airport link have fencing or barriers;
  - Adjacent the River Road Park and Ride Lot (except at the station);
  - Between LRT tracks at station curbside platforms; and
  - Bordering the Chapman Mills East Woodlot from Cresthaven Road to Woodroffe Avenue.
- Wayfinding signage at crossings.
- Future controlled crossings to be developed in conjunction with community plans.
- Pedestrian lighting at crossings.
- Structure designs to consider the needs of future network enhancements.

Significance

The construction of the LRT system will result in adverse effects to the operations of the multi-use pathways for short periods of time. With the implementation of above noted mitigation measures potential for adverse effects to multi-use pathways can be minimized and no significant residual effects should occur.

Adverse effects during operations (i.e. potential conflicts) have been addressed through design. No significant adverse environmental effects are anticipated with the design mitigation noted above.

5.1.2.5 Health and Wellbeing

As noted in Section 5.1.1.7 and Section 5.1.2.6, this project will not result in significant adverse effects to air quality or noise. Location mapping for modelled noise sensitive receptors can be reviewed in Appendix D (Noise Report Figures 2a-p).

This project will likely result in benefits to air quality and assist the City of Ottawa in meeting the growth objectives set out in their Official Plan.

The Official Plan sets out a growth management strategy emphasizing urban intensification and increased mixed-use development centred on rapid transit as the preferred mode of travel. This means that more new residences will be built close to, or using, existing city infrastructure such as water, sewer and power lines, making growth more affordable for taxpayers. It also means that residents will increasingly be able to live, work, play and shop all within their own communities, reducing the need to get in a car and travel and instead encouraging healthier choices such as walking, cycling or use of transit to reach those destinations.

Given that this project will assist the City of Ottawa in meeting these growth objectives and will not result in noise or air quality impacts, it can be concluded that this project will not result in adverse effects to human health and will likely result in some benefits.

Pedestrian crossing of the tracks will be provided at signal controlled crossings and intersections. Pedestrian walkways along the roadway will be provided to connect LRT stops with the crossing locations in the downtown. Traffic signals and turning lanes are provided to ensure turning vehicles can manoeuvre through the intersection safely. Signage along the LRT lane will be installed to ensure traffic and pedestrians recognize that the lane is a designated transit lane.

Diamond Lane markings, with which the public is familiar, will be used to define the transit lane through downtown.

Access controls include pavement texture used on the transit lane to define it from the other lanes along with signage to identify the transit lane.

In addition to the existing fencing along the existing rail right-of-way, new security fencing will be provided:
- Alongside the LRT from Greenboro Station to Bowesville Road;
- Both sides of airport link have fencing or barriers;
- Adjacent the River Road Park and Ride Lot (except at the station);
- Between LRT tracks at station curbside platforms; and
- Bordering the Chapman Mills East Woodlot from Cresthaven Road to Woodroffe Avenue.

All applicable safety legislation will be followed during all phases of the project.

In advance of opening the LRT lanes a public awareness campaign as part of the over all project communications plan will be activated, to inform the public of the changes and procedures. In addition an enforcement blitz will be initiated as part of the communications effort. The City of Ottawa will monitor traffic and parking activities to identify any conflicts with the transit operations, parking restrictions and turning lane lengths will be adjusted to minimize interruption to transit movement, and ensure the safety of the public.

Significance

This project will not result in significant adverse environmental effects to human health and will likely result in some benefits in that it will assist in achieving the vision identified in the City's Official Plan and encourage residents to live, work, play and shop all within their own communities, reducing the need to get in a car and travel and instead encouraging healthier choices such as walking, cycling or use of transit to reach those destinations. The greatest potential effect is pedestrian and traveller safety. With the implementation of mitigation measures noted above potential for adverse safety effects can be minimized.

5.1.2.6 Noise

A detailed noise assessment was undertaken as part of this study. The noise assessment examined operational noise issues and construction noise issues. The following outlines the results of this assessment. The full report is included in Appendix D.

5.1.2.6.1 Operational Noise

Identification of Receivers

Noise sensitive receptors of concern within the study area are located adjacent to (within 75 m) the proposed and existing LRT line and in close proximity to (within 400 m) the alternative Maintenance Facility Sites. Residences have different setback distances and various degrees of visual screening from the LRT system. In keeping with Ministry of the Environment (MOE) and Health Canada (HC) practices, noise sensitive receptors include the following existing and zoned for future use land uses:

- Permanent and seasonal residences;
- Hotels, motels and campgrounds;
- Churches and places of worship;
- Hospitals and senior's residences;
- Universities, schools, and daycare centres; and
- Sites within the study area where socially significant First Nations cultural or religious ceremonies may take place.

It should be noted that industrial and commercial land uses are not considered noise sensitive land uses, and have not been included in the assessment (other than hotels, schools, and the National Arts Centre). The noise sensitive land uses included in the assessment are consistent with Ontario Provincial practices and the definitions used in Health Canada's draft "Fact Sheet for Noise (2005)".

A total of 20 noise sensitive receptors (NRs), typically residences, were selected as representative of locations where worst-case noise effects were expected to occur. Impacts to any other NRs in the study area would be less than at these receptors. The selected receptors include residential areas, downtown hotels, Carleton University, and the National Arts Centre. The NRs included in the noise assessment are illustrated in Figures 2a-p of Appendix D and outlined in Table 5.1.2.6.1-1. The approximate setbacks shown are for the ultimate track locations.

Table 5.1.2.6.1-1: Location and Descriptions of Noise Receptors

Modelled Receptor	Approximate Setback Distance to LRT Line (m)	Description
NR1 [M, W]	26	National Arts Centre and Rideau Canal docks
NR2	7	Arc De Hotel
NR3	7	Albert at Bay Suites
NR4	12	470 Albert Residences
NR5 [M]	15	481 Slater Residences
NR6	29	Bayview Residences
NR7	71	Breezehill Residences
NR8	26	Champagne Residences
NR9	27	Norman Residences
NR10	59	Carling Residences
NR11	64	Carleton University Residences
NR12 [M]	31	Brookfield Residences (Junction/Sawmill)
NR13	26	Traverse Drive Residences
NR14	40	Carleton University Engineering
NR15	59	School
NR16 [M, Y]	382	Haxby Residences
NR17 [Y]	342	Viking Residences
NR18	32	Leitrim Residence
NR19	27	Cresthaven Residences
NR20 [M]	47	Timberline Residences
NR21 [P]	n/a	Sandstone Court Residences
NR22 [P]	n/a	Wildshore Residences
NR23 [P]	n/a	Planned Residences (zoned for future use)
NR24 [P]	n/a	East Leitrim Residences

Notes: (M) denotes an ambient measurement location

(W) denotes receptor near the outlet of the Rideau Canal at the Mackenzie King Bridge. During summer months boats may dock near this location. This receptor is representative of noise impacts on these temporary boating receptors

(Y) denotes locations adjacent to maintenance and storage facility

(P) denotes locations adjacent to station parking lots

n/a Not applicable. These receptors are near Station parking lots or the rail facility, but are at significant distances to the main LRT line. These receptors are used to estimate noise from these "stationary" noise sources.

Receivers 19-24 are located in the areas of Riverside South and Barrhaven that are planned to be redeveloped to mix-use communities in the future. The LRT system is a key piece of infrastructure required to support these developments. The noise assessment addresses impacts on existing receptors and on future receptors that are currently under construction. These receivers were chosen to demonstrate the potential impact the project would have on noise levels in these areas.

It should be noted that the developers planning communities along this corridor (and not currently under construction) will have to undertake additional noise assessment studies under the land use planning process, to ensure that their developments meet the City of Ottawa's Noise Guidelines. These noise assessments will include the LRT System as existing infrastructure. If required, noise mitigation measures for the future developments, in the form of noise barriers, mandatory air conditioning, or wall and window upgrades, would be installed by the developer. This is the standard practice for land use development within Ontario, which places the responsibility on developers for installing mitigation along existing or planned approved transportation infrastructure.

There are existing noise barriers in the area of Traverse Drive, installed as pat of the original O-Train pilot project. These noise barriers will remain. See Figure A1 of Appendix D. The acoustical effects of these barriers have been considered in this analysis.

At the time of the noise assessment, the preferred Maintenance Facility had not been identified. Therefore the assessment was undertaken at the Maintenance Facility Alternative that had residences in closest proximity (the Walkley Facility Site). Noise decays with distance, and therefore, if noise guidelines are met for this alternative, they will be met for all other facility design alternatives. Noise will be one of several criteria uses to select the final maintenance facility site, including construction costs, land ownership, and other environmental effects.

Noise Sources

Proposed LRT Vehicle Noise

The LRT vehicle manufacturer has not yet been selected. The proposed vehicles will be comprised of a single light rail passenger car, which is electrically powered for on board power and drive power. The vehicle will be rated for a maximum speed of 85 km/h; however, the maximum average operational speed proposed is 68 km/h. The maximum allowable noise level specified for the proposed train is an Lmax sound level of 78 dBA at a distance of 15 m from the track centre line with a vehicle speed of 85 km/h.

LRT Traffic Data

The ultimate (Year 2021) LRT traffic will be approximately 216 LRT total movements per day. It is anticipated that the frequency of LRT movements will depend on the time of day they occur. During regular operations post expansion, only LRT traffic will be permitted to use the tracks. In year 2021, it is anticipated that all LRT vehicles will consist of a single electrically powered car to transport passengers. In the year 2021, it is estimated that there will be a total of 204 LRT movements during the daytime period and 12 during the nighttime period. Average LRT operational speeds used as inputs for the assessment and can be found in Appendix D. Train traffic data for the proposed LRT line is summarized in Table 5.1.2.6-2.

Table 5.1.2.6.1-2: Year 2021 LRT Traffic Information

Direction	Daytime[1] Year 2021	Night-time[1] Year 2021	30-minute peak[2] Year 2021
Northbound	102	6	10
Southbound	102	6	10
Totals	204	12	20

Notes: (1) Daytime period is 0700-2200h, Night-time period is 2200-0700h
(2) 30-minute peak is based on projected 3-minute headways of LRT movements.

Engine Bells and Whistles

The LRT vehicles will be equipped with engine warning bells as a safety device. The engine warning bells will only be used in case of emergency. In addition to the warning bells, it is planned that chimes will be used for short periods only when the LRT vehicle is entering or leaving a station in the downtown area. The purpose is to provide warnings that the doors of the LRT will be closing and it will be crossing through the intersection shortly. Noise levels from the chimes will be loud enough to notify passengers on the platform and train, and would be expected to have similar sound levels as those used on Toronto Transit Commission subways, or Calgary ‘C-Train’ LRTs. It is not anticipated that the sound levels associated with the chimes will be high enough to impact noise sensitive receptors.

Warning bells and whistles will be tested in the morning prior to the LRT trains leaving the Maintenance Facility. Warning bells will be tested indoors within the Maintenance Building / Storage Barn, and therefore off-site noise impacts from bell and whistle testing are not anticipated.
As a result, engine warning bells and station chimes have not been considered further in this analysis.

Station Parking Lot Noise

At several of the planned LRT stations along the south portions of the proposed expansion, there are large Passenger Pick-Up and Drop Off areas, which will include parking lots where commuters will park prior to boarding the LRT. These planned parking lots are adjacent to existing or planned residential subdivisions. Residences in close proximity will be impacted by noise from road traffic in the parking lots caused by automobiles. These parking lots are essentially stationary sources of noise and are evaluated as such at the receptors of concern.

Pedestrian Crossing Warning Bells

The existing "O-Train" system incorporates a level pedestrian crossing near Brookfield Drive and Traverse Drive. Under current operations, engine warning whistles are sounded on approach to the crossing, and pedestrian crossing warning bells are also sounded at the crossing. This crossing will be replaced by an elevated pedestrian overpass, and the use of engine warning whistles and pedestrian crossing warning bells will be discontinued at this location. This is a positive change resulting from the proposed project, as it will eliminate existing engine whistle noise and crossing bell noise near these residences. There will be no other at-grade pedestrian crossings for this project. As a result, pedestrian crossing bells have been excluded from additional analysis.

Freight Trains

This project will result in the elimination of freight rail traffic on the existing corridor. There will be no more regularly scheduled freight traffic along the portion of the track from Walkley Drive north. This is a positive impact, as it will result in the elimination of current night-time freight train traffic through the study area. A freight traffic spur line is proposed in the corridor to run adjacent to the LRT lines from the CN Walkley crossing south to the Canadian National Research Council Centre for Surface Transportation Technology (NRC-CSTT). Freight traffic along this spur would consist of short 1 locomotive "switcher" trains with few cars. Freight traffic would be limited to 1 to 2 trains per month, and would likely occur during daytime hours. Freight traffic noise impacts will therefore be less than existing conditions, and have not been considered further in this study.

Rail Facility Activities

At the time of the noise assessment, the preferred maintenance facility location had not been identified. Therefore the assessment was undertaken at the maintenance facility alternative that had residences in closest proximity (the Alternative 1 Walkley facility site). Noise decays with distance, and therefore, if noise guidelines are met for this alternative, they will be met for all other facility design alternatives (which are farther away from sensitive receptors). The distances between the proposed rail facilities and the closest existing or planned noise sensitive land uses are: Walkley Facility, 150 m; Bowesville Facility, 400 m; and the Lester Facility, 400 m.

The maintenance facilities would include a large Maintenance Building and combined Train Storage Barn. All maintenance activities, including testing of engine bells and whistles, and coupling and uncoupling of trains, would take place indoors within these structures. As a result, there are no impulsive noise impacts predicted for maintenance facility activities.

Noise sources within the storage facilities would include switching and marshalling train movements and noise from maintenance activities and PA system. As all maintenance will occur within enclosed buildings, in evaluating potential noise impacts, only switching and marshalling facility activities have been considered.

Rail Maintenance (Rail Grinding)

As part of rail maintenance, the top surface of the rail will be ground from time to time to flatten the surface and remove surface wear and corrugation resulting from the wheel/rail interactions. The exact frequency of rail grinding cannot be predicted at this time. However, based on MRC's and RWDI's experiences with other transit systems, rail grinding would be expected to occur on an annual basis, and no more frequently than a semi-annual (every 6 month) basis.

Noise from rail grinding may be audible and louder than existing conditions. Rail grinding will use industry standard methods and technologies, and all rail grinding will be conducted in accordance with the restrictions outlined in the City of Ottawa Noise Control By-law.

Rail Wheel Squeal

As railway cars travel around curved track sections, "wheel squeal" noise may be created, as the wheels laterally slip across and along the rail track as the train makes the turn. The proposed LRT track incorporates two main design features to control wheel squeal noise:

a) The proposed railway design avoids tight turning radii. A review of the drawings indicates the tightest turning radius on the main line will be 55 m. Wheel squeal is generally most pronounced for turning radii less than 27 m (90 ft) [1].
b) Also, as part of the specification, the proposed train design incorporates resilient "bochum" type wheels, with rubber block isolation of the wheel rim. These types of wheels reduce wheel squeal by 10 to 20 dBA over normal rail wheels [1,2].

With the inclusion of these design features, significant wheel squeal is not anticipated. However, during initial operation of the LRT line, if wheel squeal issues still arise, additional treatment measures will be employed, including but not limited to rail inlays, petroleum lubrication or water spray lubrication, or the addition of on-board friction modifier/lubrication systems. The use of rail squeal mitigation will be based on complaints and observations of operations, and will be examined as part of the Project Environmental Management Program (PEMP).

Since wheel squeal is unlikely with the incorporation of these mitigation measures, it has not been considered further in this analysis.

Applicable Guidelines

The following guidelines were used to assess noise impacts. It should be noted that there are inconsistencies in approach between guidelines, in terms of approach, metrics, thresholds for considering the technical and economic feasibility of mitigation, etc. Impacts and the requirements for mitigation have been assessed against all of the guidelines listed herein.

Provincial Policy on Highway Noise

The Ministry of Transportation / Ministry of the Environment "Protocol for Dealing with Noise Concerns during the Preparation, Review and Evaluation of Provincial Highway's Environmental Assessments" (the Joint Protocol) is referenced in the Terms of Reference for the project, and while not directly applicable to LRT projects, does serve to indicate what is acceptable for Provincial transportation-related EAs.

The Joint Protocol establishes that all impact assessment should be based on conditions 10 years after completion of the project. The impact assessment is restricted to outdoor living areas.

The objective for outdoor sound levels is L_{eq} (16 h) of 55 dBA or the existing ambient. The significance of noise impacts are quantified using this objective as well as changes from existing conditions. Mitigation is to be investigated if the change in sound level above the ambient resulting from the project is greater than 5 dB. Mitigation is warranted only where it can be applied within the project right-of-way, where project cost is not significantly affected, and where noise control will result in a minimum of 5 dB of attenuation (i.e., if the mitigation is technically, administratively, and economically feasible).

Guidelines for New Residential Development

Absolute assessment criteria have been used to assess compatibility of planned or proposed residential or noise sensitive developments adjacent to rail corridors. Criteria for Canadian Mortgage and Housing Commission (CMHC), Ontario Ministry of the Environment (MOE), Canadian National Railways (CNR) and Canadian Pacific Railways (CPR) are reviewed herein.

The CMHC, MOE, CNR and CPR have generally consistent guidelines for outdoor living areas; with CMHC guidelines based on a 24-hour day rather than a 16-hour day. MOE, CNR, and CPR guidelines for night-time sound exposure levels in the plane of a bedroom window are also consistent. These guidelines are summarized in Table 5.1.2.6.1-3 below. The daytime limit is consistent with the Joint Protocol. These limits have been used in this report to assess long-term sound exposures from LRT traffic.

Table 5.1.2.6.1-3: Applicable Outdoor Noise Guidelines

Noise Descriptor	Point of Reception	Limit (dBA)
L_{eq} (16 h)	Outdoor Living Area	55
L_{eq} (8 h)	Plane of Bedroom Window	50

Notes: L_{eq} (Day) = L_{eq} (16), from 0700-2300h and L_{eq} (Night) = L_{eq} (8), from 2300-0700h.

– An outdoor living area receptor is the closest location on the assessed property, at a 1.5 m receptor height. The plane of bedroom window assumes a 4.5 m receptor height (second storey window).

– Rail warning device noises (whistles and bells) is not included in the above guidelines.

City of Ottawa Official Plan Criteria

The City of Ottawa has adopted its own noise criteria in terms of a peak L_{eq} (30 minute) sound level. In Section 4.8.8 of the City of Ottawa's Official Plan, a L_{eq} (30 minute) limit of 58 dBA applies to the noise assessment for vehicular traffic along new construction, reconstruction and widening of regional roads and transitways.
Draft revisions to the policy, portions indicate that the policy applies to outdoor living areas only (indoor noise levels for future developments would be addressed through the land use planning process). The objective levels are:

- An overall daytime L_{eq} (16 h) of 55 dBA and
- a maximum L_{eq} (30 min) of 58 dBA,
- or the existing ambient, whichever is higher.

Mitigation is to be investigated when future sound levels exceed the objective levels, and when the change from existing ambient conditions exceeds 5 dB. Mitigation will be installed within the right-of-way, when it can achieve a more than 6 dB reduction, and where it is technically, administratively, and economically feasible.

Health Canada Criteria

Health Canada (HC) has indicated that for their review under CEAA provisions, information must also be provided in the form of 15-hour daytime and 9-hour night-time sound exposures (L_{eq} (15 h), from 0700 to 2200 h and L_{eq} (9 h) values, from 2200 to 0700h, in dBA).

In addition, HC has asked that a maximum daytime criterion of L_{eq} Day of 75 dBA, and a maximum night-time criterion of L_{eq} Night of 65 dBA be considered in the assessment.

Change Assessment Criteria

In cases where sound levels increase, there is no specific guidance provided for mitigation of rail traffic noise. As noted in the Joint Protocol, mitigation would only be warranted if the increase in sound level was greater than 5 dB (marginal impact) and if the effective mitigation would be technically and economically feasible.

As outlined in the Ontario EA Terms of Reference, based on general practice for sound with similar characteristics (i.e., tone, frequency of occurrence, etc.), increases (or decreases) in sound exposure can be ranked as follows:

Table 5.1.2.6.1-4: Impact Of Changes In Noise Level

Change in Sound Level (dB)	Impact	Reasoning
< 3	Not Significant	Generally imperceptible
3 to < 5	Low	Just-noticeable change
5 to 10	Medium	Increasingly identifiable change
> 10	High	Perceived as a doubling (halving) in sound level

Stationary Sources Criteria

The noise sensitive receptors (NR21- NR24) in close proximity to planned station parking lots may be impacted by road traffic noise from automobiles in the parking lot. As the parking lots act as a stationary source of noise, they are evaluated under criteria for stationary sources set forth by the MOE. Similarly, activities within rail facilities may be considered as stationary sources of sound.

The applicable noise guideline limits are the MOE "Stationary Source" guidelines for Class 1 areas, which are set out in Publication NPC 205 [8]. NPC-205 guidelines assess the noise from the facility alone against the guideline limit, rather than examining changes in total noise levels (facility plus ambient). These guidelines state that one hour sound exposures (L_{eq} (l hour) dBA values) from stationary noise sources in Class 1 (urban) areas shall not exceed that of the background (typically caused by road traffic), where the background is considered to be:

- The higher of 50 dBA, or background noise, during the daytime (0700-1900h);
- The higher of 47 dBA, or background noise, during the early evening (1900-2300h); and
- The higher of 45 dBA, or background noise, during the night-time (2300-0700h).

Existing Ambient Sound Levels

In order to quantify current ambient sound levels at the receptors, on site measurements were conducted. In June 2005, long-term sound monitors were installed at receptors NR1, NR5, NR12, NR16 and NR20. The locations were chosen on the basis of their orientation, track exposure, setback distance and existing ambient sound environment, and are representative of existing ambient noise conditions at all receptors. Measurements were conducted for a minimum 48-hour basis.

Measured ambient sound levels include contributions from rail noise, road noise, industrial noise and sounds of nature. It was not considered necessary to measure noise at each receiver given the urban nature of the area. The chosen receiver locations measured, provided a range of urban ambient sound environments. For receptor locations where no monitoring occurred, ambient sound levels from the closest measurement location or areas with a similar ambient sound environment were applied. Results from the measurements, in addition to applicable modelled receptors are presented below in Table 5.1.2.6.1-5.

Measurement results are shown graphically in Appendix D for each of the five measurement locations, along with the raw measurement data. Generally, these measured sound exposures are consistent with typical urban environments in proximity to transportation corridors.

Table 5.1.2.6.1-5: Measured Ambient Sound Levels

Measured Receptor	Other Receptors Where Same Levels Apply	Daytime Sound Levels		Night-time Sound Levels		L_{eq}(30 min) Levels [1]	
		L_{eq} (16 h)	L_{eq} (15 h)	L_{eq} (8 h)	L_{eq} (9 h)	Minimum	Peak
NR1/ Rideau Canal	NR2	68	69	62	62	65	71
NR5	NR3, NR4	71	71	64	64	66	75
NR12	NR6-NR11, NR13-NR15	59	59	53	53	54	66
NR16	NR17	53	53	48	49	51	56
NR20	NR18, NR19, NR21-NR24	50	50	44	45	46	54

Notes: (1) Minimum L_{eq} (30 min) is the minimum measured 30 minute L_{eq} to occur through the entire daytime period (0700 to 2300h). Peak L_{eq} (30 min) is the highest measured 30-minute L_{eq} to occur through the entire day.

– All sound levels are presented as energy equivalent sound levels (L_{eq}), in dBA.

The sound environment at the site directly backing onto the existing O-Train line (NR12) was dominated by rail traffic noise and in the absence of rail noise, by sounds of road traffic from Airport Parkway. The sound environment of receptors in the downtown area, at close setbacks to the proposed LRT line (NR1, NR5), was dominated by the sounds of local road traffic with city buses as the most significant source. The sound environment of the receptor in close proximity to the Ottawa Central Railway facility (NR16) and Barrhaven Town Centre (NR20) was dominated by local road traffic noise and in the absence of road traffic noise by sounds of nature (birds, rustling leaves, etc.).

Noise Model Used for LRT Traffic

The noise impacts associated with the proposed LRT line were assessed using a computerized prediction model for LRT rail traffic noise, which is equivalent to the U.S. Federal Transportation Authority (FTA) algorithms. This model incorporates LRT rail line noise prediction algorithms. The following factors were taken into account in the analysis:

- Horizontal and vertical rail line-receiver geometry;
- Ground absorption;
- Rail traffic volume;
- Vehicle type;
- Number of locomotives and cars;
- Speed; and,
- Screening provided by houses and existing sound barriers.

For the purposes of this assessment, the ground topography was modelled as flat between the LRT line and modelled receptors. Modelling the ground as flat negates any screening that would occur with an elevation change and is a conservative approach. Distances required as inputs to the model were obtained from the aerial photos.

As part of the construction for existing O-Train Pilot Project, a 4.0 m high noise barrier was installed near Traverse Drive (NR13) section of the track. The location of the noise barrier is shown in Appendix D. The noise barrier will remain as part of this project, and its acoustical effects have been included in the noise modelling. The LRT lines will run through a significant 10 to 14 m deep in-cut from Dows Lake through to Somerset Drive in the north. This acts as a significant noise barrier for residences along Breezehill (NR7), and for residences backing the LRT line along Champagne (NR8), and siding on to the rail line east of Preston Street along George, Aberdeen, Beech, Pamilla, Adeline and Norman (NR9). The barrier effects of a 10 m deep in-cut have been included in the noise modelling for these receptors.

The accuracy of the FTA noise model is expected to be $\pm$1.5 dB over the distances in question, similar to other noise models.

Noise Model Used for Parking Lot Traffic

As a conservative assumption, peak volumes of automobile traffic in each parking lot were assumed to occur during a worst-case hour. During this time period, it was conservatively assumed that half the volume of the parking lot would either fill or empty, equivalent to 200 vehicles entering or leaving each of the parking lots. Automobiles were assumed to follow a 20 km/h speed limit while in the station parking lot.

Off-site sound exposures due to parking lot operations were modelled using a computerized spreadsheet version of the international standard ISO 9613 environmental noise propagation algorithms. The modelling took into account the following factors:

- Source sound power level and directivity;
- Distance attenuation;
- Source-receptor geometry;
- Ground and air (atmospheric) attenuation; and
- Meteorological effects on noise propagation.

The accuracy of the ISO 9613 noise model is expected to be ±1.5 dB over the distances in question, similar to other noise models.

The noise impacts of slamming automobile doors was not considered. While noise from door slams may be relatively loud, they are very short term events, and thus, even with penalties applied, overall L_{eq} noise levels would only be minorly affected by their inclusion. Similarly, noise from early morning snow removal has not been considered. Snow removal will done by one or two vehicles (as opposed to the 200 cars during worst-case normal operations), and thus will be much less than the worst-case hour operations examined in this assessment.

Noise Assessment Results

Future "no-build" (Year 2021) sound exposures were based on the measured existing sound levels of the selected noise sensitive receptors (i.e., the future no-build scenario is assumed to the same as existing conditions). The measured existing levels were not increased to account for typical natural growth in traffic levels in order to represent a worst-case scenario.

Noise levels from LRT train operations were predicted using noise modelling. Sound exposures were generally modelled at receptor heights of 1.5 m and 4.5 m, corresponding to Outdoor Living Areas (OLAs) and bedroom window receptors, respectively. To account for a multilevel building, in some cases receptor heights differed from those mentioned. Sample noise model output files for future conditions can be found in Appendix D.

Future "build" sound levels at the selected noise sensitive receptors were conservatively estimated by adding the future no-build levels plus the additional contribution from future LRT trains, and therefore do not account for any decreases in traffic levels or changes in traffic patterns that may result from LRT operations.

Modelled future year 2021 noise levels resulting from the proposed LRT line traffic alone are presented in Table 5.1.2.6.1-6.

Table 5.1.2.6.1-6: Predicted LRT Train Related Sound Levels (Year 2021)

Modelled Receptor	Train Only Sound Levels Year 2021				
	Daytime L_{eq} (15 h)[1]	Night-time L_{eq} (9 h)[1]	Daytime L_{eq} (16 h)[2]	Night-time L_{eq} (8 h)[2]	Peak L_{eq} (30 min)[3]
NR1/Rideau Canal	60	50	**60**	49	**65**
NR2	63	53	**63**	52	**68**
NR3	61	51	**61**	50	**66**
NR4	60	50	**60**	49	**65**
NR5	60	50	**60**	49	**65**
NR6	39	29	39	28	44
NR7	38	28	38	27	43
NR8	40	30	40	29	45
NR9	37	27	37	26	42
NR10	30	20	30	19	35
NR11	49	39	49	38	54

Table 5.1.2.6.1-6: Predicted LRT Train Related Sound Levels (Year 2021)					
Modelled Receptor	Train Only Sound Levels Year 2021				
	Daytime L_{eq} (15 h)[1]	Night-time L_{eq} (9 h)[1]	Daytime L_{eq} (16 h)[2]	Night-time L_{eq} (8 h)[2]	Peak L_{eq} (30 min)[3]
NR12	53	43	53	42	58
NR13	46	36	46	35	51
NR14	49	39	49	38	54
NR15	49	39	49	38	54
NR18	50	40	50	39	55
NR19	52	42	52	41	57
NR20	51	42	51	41	56

Notes:
(1) Day is from 0700h to 2200h, Night is from 2200h to 0700h.
(2) Day is from 0700h to 2300h, Night is from 2300h to 0700h.
(3) L_{eq} (30 min) is the peak 30 minute L_{eq} to occur through the entire day (i.e., maximum train activities).
All sound levels are presented as energy equivalent sound levels (L_{eq}), in dBA.
Results have been rounded to the nearest whole number.
Values in Bold indicate values are greater than the 55 dBA daytime, 58 dBA half-hour City of Ottawa objectives.

The items in **Bold** in Table 5.1.2.6-6 indicate sound levels that are in excess of the City of Ottawa objectives of L_{eq} (16 h) of 55 dBA and L_{eq} (30 min) of 58 dBA. These receptors are concentrated in the downtown core where already high ambient sound exposure levels exist. As a result, under City of Ottawa policies, the guideline limits in these areas become the existing ambient, and change from existing conditions should be minimized. Similarly, under the MTO/MOE Joint Protocol, change from existing conditions should be evaluated.

Table 5.1.2.6.1-7 presents the predicted Future No-Build and Future Build sound exposures for the project. Daytime L_{eq} (15 h), night-time L_{eq} (9 h) and peak L_{eq} (30 min) values are presented.

Table 5.1.2.6.1-7: Future No-Build and Future Build Sound Levels						
Modelled Receptor	Future No-Build[1]			Future Build[2]		
	L_{eq} (15 h)	L_{eq} (9 h)	Minimum L_{eq} (30 min)	L_{eq} (15 h)	L_{eq} (9 h)	Peak L_{eq} (30 min)
NR1/Rideau Canal	69	62	65	70	62	68
NR2	69	62	65	70	63	70
NR3	71	64	66	71	64	69
NR4	71	64	66	71	64	69
NR5	71	64	66	71	64	69
NR6	59	53	54	59	53	54
NR7	59	53	54	59	53	54
NR8	59	53	54	59	53	55
NR9	59	53	54	59	53	54
NR10	59	53	54	59	53	54

Table 5.1.2.6.1-7: Future No-Build and Future Build Sound Levels						
Modelled Receptor	Future No-Build [1]			Future Build [2]		
	L_{eq} (15 h)	L_{eq} (9 h)	Minimum L_{eq} (30 min)	L_{eq} (15 h)	L_{eq} (9 h)	Peak L_{eq} (30 min)
NR11	59	53	54	59	53	57
NR12	59	53	54	60	53	59
NR13	59	53	54	59	53	56
NR14	59	53	54	59	53	57
NR15	59	53	54	59	53	57
NR18	50	45	46	53	46	56
NR19	50	45	46	54	47	57
NR20	50	45	46	54	47	56

Notes: (1) Future No-build levels are the existing ambient sound exposures. The L_{eq} (30 min) values chosen is the minimum value during the daytime period. Peak 30 min LRT noise levels would occur during the daytime, and therefore using this value in subsequent change assessments is conservative

(2) Future Build levels are the Future No-build levels + the contribution from LRT trains

All sound levels are presented as energy equivalent sound levels (L_{eq}), in dBA.

Results have been rounded to the nearest whole number

Under existing conditions, the daytime Provincial and City objective sound levels of a L_{eq} (16 h) of 55 dBA are exceeded for most receptors, with the exception of receptors to the far south in areas of future residential development. Similarly, existing conditions exceed the recommended night-time levels of 50 dBA under residential land-use planning guidelines. However, in general, the addition of LRT related noise would not significantly increase existing sound levels. The impacts of change from existing conditions are presented in Table 5.1.2.6.1-8.

Table 5.1.2.6.1-8: Predicted Sound Level Increases Due to Project						
Noise Receptor	Noise Descriptor					
	Daytime L_{eq} (15 h)		Night-time L_{eq} (9 h)		L_{eq} (30 min)	
	Change[1]	Impact[2]	Change	Impact	Change	Impact
NR1/Rideau Canal	1	Not Significant	0	Not Significant	3	Low
NR2	1	Not Significant	1	Not Significant	**5**	Medium
NR3	0	Not Significant	0	Not Significant	3	Low
NR4	0	Not Significant	0	Not Significant	3	Low
NR5	0	Not Significant	0	Not Significant	3	Low
NR6	0	Not Significant	0	Not Significant	0	Not Significant
NR7	0	Not Significant	0	Not Significant	0	Not Significant
NR8	0	Not Significant	0	Not Significant	1	Not Significant

Table 5.1.2.6.1-8: Predicted Sound Level Increases Due to Project						
Noise Receptor	Noise Descriptor					
	Daytime L_{eq} (15 h)		Night-time L_{eq} (9 h)		L_{eq} (30 min)	
	Change[1]	Impact[2]	Change	Impact	Change	Impact
NR9	0	Not Significant	0	Not Significant	0	Not Significant
NR10	0	Not Significant	0	Not Significant	0	Not Significant
NR11	0	Not Significant	0	Not Significant	3	Low
NR12	1	Not Significant	0	Not Significant	**5**	Medium
NR13	0	Not Significant	0	Not Significant	2	Not Significant
NR14	0	Not Significant	0	Not Significant	3	Low
NR15	0	Not Significant	0	Not Significant	3	Low
NR18	3	Low	1	Not Significant	**10**	High
NR19	4	Low	2	Not Significant	**11**	High
NR20	4	Low	2	Not Significant	**10**	High

Notes: (1) Change is Future Build minus Future No-build, rounded to nearest decibel.
(2) Impact of changes is based on ranking scheme outlined in Table 5.1.2.6.1-4.
- All sound levels are presented as energy equivalent sound levels (L_{eq}), in dBA.
- Values in Bold indicate changes greater than 5 dB.

As indicated in Table 5.1.2.6.1-9, changes in long-term daytime and night-time L_{eq} values are not significant for the majority of the study area. However, a few receptors located near the south end of the LRT line, are predicted to have a low (less than 5 dB) increase due to low ambient sound levels in the area. Currently, the area surrounding the south end of the LRT line is under development for future residential and commercial uses (i.e., the area is zoned for these future uses), and has a quiet existing ambient sound environment. Using the existing ambient sound level as a proxy for future “no-build” conditions is very conservative in this case, as it is expected that actual background ambient sound levels will increase by 2021 due to eventual increased local road traffic.

For short term peak sound levels, receptors in the south end show high changes from existing conditions, with increases of ~10 dB. However, total L_{eq} (30 min) noise levels are still below the City of Ottawa’s 58 dBA criteria. Therefore, no mitigation is required.

Receptors near NR12 (Brookfield Residences) show increases of 5 dB over ambient, based on conservative modelling. However, total sound levels are only 59 dBA, which is 1 dB over the City’s 58 dBA criterion. These minor excesses translate into an imperceptible increase over the limit. The modelling is conservative, and therefore mitigation is not warranted.

At NR2 the increase in short-term L_{eq} (30 min) sound levels is 5 dB. The maximum short-term sound level is 70 dBA at this receptor. However, the predicted 5 dB change is based on a comparison of the minimum daytime L_{eq} (30 min) value with the maximum peak value due to LRT traffic. For much of the time, the change would be less than 5 dB. In addition, NR2 represents a hotel with its surrounding areas comprised of commercial and government office buildings. It is a reasonable assumption that NR2 as well as the surrounding buildings incorporate central air conditioning, which would allow the building windows (if operable) to be kept closed for noise control (consistent with Provincial land use planning policies). This increase would occur during daytime hours, and therefore would not affect hotel clientele at this receptor. The maximum change in long-term L_{eq} (15 h) sound levels is less than 5 dB. Therefore, considering the above, mitigation may not be warranted for this receptor.

Future L_{eq} (15 h) and L_{eq} (9 h) sound levels will be below the 75 dBA / 65 dBA maximum criteria proposed by Health Canada.

Predicted Year 2021 Receptor Sound Levels Due to Stations and Rail Facilities (Stationary Noise Sources)

Receptors NR16 and NR17 are located in close proximity to the worst case LRT maintenance facility alternative (Alternative 1, Walkley Facility) and away from the LRT main line. Maintenance and Storage facility switching and marshalling activity would be the dominant source of noise for these receptors. The rail facility would be considered to be a "stationary source" (incorporating the noise of moving vehicles and trains within the facility) under Provincial and City guidelines. Predicted sound levels from rail facility activities have been evaluated against MOE NPC-205 guidelines for stationary sources at these receptors. As Alternative 1 has the closest setback distances to noise sensitive receptors, if NPC-205 noise guidelines are met for this alternative, they will be met for all alternatives.

Similarly, for stations with parking lots, noise from vehicles moving within the parking lots would constitute a "stationary source", and needs to be evaluated against NPC-205 guidelines. A worst-case scenario would consist of a high influx or efflux of automobiles within the parking lots. Half the parking lot volume moving in one hour (approximately 200 vehicles) was considered worst case, as indicated by MCRC personnel. This would translate into a quarter of the parking lot volume in 30 minutes and would provide similar sound levels.

Table 5.1.2.6.1-9: Predicted Stationary Source Sound Levels (Year 2021)

Modelled Receptor	Stationary Source Only Sound Levels Year 2021		
	Daytime L_{eq} (15 h)[1]	Night-time L_{eq} (9 h)[2]	Peak L_{eq} (30 min) / Peak L_{eq} (1 hr)[3]
NR16	31	23	40
NR17	37	29	46
NR21	38	32	38
NR22	38	32	38
NR23	36	30	36
NR24	34	28	34

Notes: – All sound levels are presented in dBA.
(1) As a conservatism, sound levels were taken to be equivalent to the Peak L_{eq} assuming consistent traffic volumes throughout the day.
(2) Night-time sound levels account for the time period (0000h to 0630h) when the LRT does not operate and no vehicle movements take place.
(3) Peak L_{eq} (30 min) and Peak L_{eq} (1 hr) sound levels are equivalent since both incorporate equal volume / unit time rates.

It is expected that peak maintenance facility activities and peak LRT rider volumes will occur during daytime hours, coinciding with "rush hour" commuter times. Therefore, from a stationary noise source perspective, MOE NPC-205 daytime guideline limits are applicable. Table 5.1.2.6.1-10 provides a comparison of predicted L_{eq} (1hr) sound levels against the applicable NPC-205 daytime limits. Note that NPC-205 guidelines assess the noise from the facility alone against the guideline limit, rather than total noise (facility plus ambient). This is what is shown in Table 5.1.2.6.1-10.

Table 5.1.2.6.1-10: Predicted Peak L_{eq} (1 hr) Sound Levels and NPC-205 Limits

Modelled Receptor	NPC-205 Daytime Minima	Peak L_{eq} (1 hr) Sound Level	Meets Guideline?
NR16	50	40	Yes
NR17	50	46	Yes
NR21	50	38	Yes
NR22	50	38	Yes
NR23	50	36	Yes
NR24	50	34	Yes

Notes: – All sound levels are presented in dBA

Predicted peak L_{eq} (1 hr) sound levels are within guideline limits at the receptors. It is expected that maintenance facilities and LRT stations including the parking lots will be in compliance with MOE NPC-205 stationary source guidelines for all periods of the day.

Table 5.1.2.6.1-11 presents the predicted long-term Future No-Build and Future Build sound exposures for the project for stationary sources. Daytime L_{eq} (15 h), night-time L_{eq} (9 h) and peak L_{eq} (30 min) values are presented. These values are used for assessing impacts in terms of changes in total noise levels, rather than compliance with NPC-205.

Table 5.1.2.6.1-11: Predicted Long Term Sound Exposures from Station and Rail Facilities

Modelled Receptor	Future No-Build [1]			Future Build [2]		
	L_{eq} (15 h)	L_{eq} (9 h)	Minimum L_{eq} (30 min) / L_{eq} (1 hr)	L_{eq} (15 h)	L_{eq} (9 h)	Peak L_{eq} (30 min) / L_{eq} (1 hr)
NR16	53	49	51	53	49	51
NR17	53	49	51	53	49	52
NR21	50	45	46	50	45	47
NR22	50	45	46	50	45	47
NR23	50	45	46	50	45	46
NR24	50	45	46	50	45	46

Notes: (1) Future No-build levels are existing ambient sound exposures. The L_{eq} (30 min) values chosen is the minimum value due to road traffic during the daytime period, and is equivalent to an L_{eq} (1 hr) level, in accordance with NPC-103 guidelines.

(2) Future Build levels are the Future No-build levels + the contribution from station parking lots and LRT rail facility activities.

– All sound levels are presented as energy equivalent sound levels (L_{eq}), in dBA.

– Results have been rounded to the nearest whole number

The impacts of change from existing conditions are evaluated in Table 5.1.2.6.1-12. For longer-term L_{eq} (15h) and L_{eq} (9 hr) sound levels, there were no significant changes predicted. For short-term L_{eq} (30 min) sound levels, there were 1 dB increases at a few receptors, but these are also considered not to be significant changes. In conclusion, maintenance and storage facility activities and vehicular noise from proposed parking lots will not significantly increase existing ambient sound levels. Therefore, no mitigation is required at maintenance facilities or at proposed LRT Parking Lots.

Table 5.1.2.6.1-12: Change From Existing Conditions – Station Parking Lots and Rail Facilities

Noise Receptor	Noise Descriptor					
	Daytime L_{eq} (15 h)		Night-time L_{eq} (9 h)		L_{eq} (30 min)	
	Change[1]	Significance[2]	Change	Significance	Change	Significance
NR16	0	Not Significant	0	Not Significant	0	Not Significant
NR17	0	Not Significant	0	Not Significant	1	Not Significant
NR21	0	Not Significant	0	Not Significant	1	Not Significant
NR22	0	Not Significant	0	Not Significant	1	Not Significant
NR23	0	Not Significant	0	Not Significant	0	Not Significant
NR24	0	Not Significant	0	Not Significant	0	Not Significant

Notes: (1) Change is Future Build minus Future No-build, rounded to nearest decibel.
(2) Significance of changes is based on ranking scheme outlined in Table 5.1.6.2.1-4.
– All sound levels are presented as energy equivalent sound levels (L_{eq}), in dBA.

5.1.2.6.2 Construction Noise

The exact nature of construction activities cannot be specified in detail at this time. The construction staging, equipment, and schedule are to be determined by the successful consultant for the design-build contract for the initial phase of this project. However, given the nature of the work, some assumptions about the types of equipment that will be used and nature of the work can be made. The construction data that is provided below is the best data available at this time.

Worst-case predictions of maximum 1-hour noise levels (L_{eq} (1-hr) values) from various types of construction activities are provided. As sufficiently advanced construction plans are not available at this time, L_{dn} sound levels (including adjustments for frequency, duration, tonality and impulsive noise) have not been provided and cannot be calculated. The noise modelling results provided are expected to have an accuracy of $\pm$ 1.5 dB over the distances in question, similar to other noise modelling methods.

Construction Activities

Construction will take place over a three-year period. Through the downtown area on the Mackenzie King bridge and Albert and Slater Streets embedded continuously welded rail (CWR) will be constructed that will accommodate bus and other traffic and snow removal. In addition the reconstruction of Albert and Slater Streets including utility relocations, grading, and surface work will be carried out. On the existing Mackenzie King structures the rail will be attached to the deck with vibration dampening and embedded in a paved surface to produce a smooth running surface.. Rail will be embedded in the relocated Transitway through the LeBreton Flats to Bayview Station in order to accommodate both rail and bus transit in the same corridor. Construction through LeBreton Flats area includes the Transitway and Booth Street road construction and the Booth Street Bridge over the Transitway and LRT. South of Bayview Station along the existing O-Train corridor to the Greenboro Station two CWR tracks, ballast and ties will be placed to provide the double track required for the LRT service. This segment includes rock widening between Dow's Lake and Somerset Street, tunnel construction through the Dominion Arboretum and Dow's Lake, the construction of a railway bridge over the Rideau River at Carleton University, an underpass of Heron Road, an overpass of the VIA line, Transitway and Sawmill Creek, an underpass of Walkley Road, and an overpass of the Walkley Subdivision and South East Transitway. On new structures, the CWR track, ties and ballast will be placed on the concrete deck Between Greenboro Station and Leitrim Road the existing track will be replaced with twin CWR track, ties and ballast. Rail access from the Walkley Subdivision to the National Research Centre for Surface Transportation Technology (NRC) south of Lester will be maintained. An overpass of Hunt Club Road is included in the segment to accommodate the LRT track. Extending south of the NRC. twin CWR tracks, ballast and ties continue through Riverside South Community to Barrhaven Town Centre. Structures over Mosquito Creek and over the Rideau River are included in this section of the corridor. Road crossings will accommodate traffic crossing through infilling between the tracks. The rail link to Macdonald-Cartier International Airport includes twin CWR tracks and ballast and an underpass at Alert Road and the Delta Taxiway. Rock drilling and blasting of the bedrock may be used for bridge foundations to twin the existing Dow's Lake rail tunnel and widen the existing rock cut section from Carling Station to beyond Gladstone Station. It is anticipated that rock drilling operations will be short term in nature at specific locations. Every effort will be made to limit rock drilling and blasting at a given site adjacent to sensitive receptors. Rock drilling and blasting in the winter period is preferred.

Construction schedules will consider timing constraints to minimize impacts on surrounding land uses, noise sensitive receptors, and the environment. Impacts on the operation of the Rideau River and Canal will be considered to accommodate navigation along the waterway. Blasting at Dow's Lake will be staged to avoid impacts on the waterway during the navigation season, and to avoid potential vibration impacts on fish spawning activities.

The following summarize anticipated construction activities in the various sections.

Barrhaven Station to Strandherd/Armstrong Bridge

Construction activities required for this section are site excavation and grading, drainage, electric installation, track laying, platforms and shelters installation. Associated equipment that could generate noise is bulldozers, excavators, tree excavators, compactors, rollers, ditchers, loaders, dump trucks, transport trucks, cranes, concrete pumps, and pneumatic or hydraulic tools.

Strandherd/Armstrong Bridge to Leitrim Station

General construction operations along this portion of the track will include site excavation and grading, drainage, street building, bridgework, electric installation, platforms and shelters installation, building erection, and track laying. Along the track there will be construction of two bridges that required conventional construction activities like excavation, foundation, application of concrete as well as pile drilling. Activities will require the use of bulldozers, excavators, tree excavators, compactors, rollers, ditchers, graders, pavers, loaders, dump trucks, transport trucks, cranes, pneumatic or hydraulic tools, compressors, drilling rigs, and water pumps.

Maintenance Facility Construction

Activities required for the facility construction are grading, drainage, electric installation, track construction, roadwork, as well as maintenance facilities construction. All of these activities will require the use of bulldozers, excavators, tree excavators, compactors, rollers, ditchers, graders, pavers, loaders, dump trucks, transport trucks, cranes, pneumatic or hydraulic tools, and compressors.

Leitrim Station to Rideau River

General construction operations in this section will include excavation, grading, drainage, street building, bridgework, retaining walls construction, track laying, electric installation, stations construction and building erection. Along the track there will be construction of eight bridges that will require typical construction activities like excavation, foundation construction, and application of concrete. Construction of two of the bridges will require pile drilling. All activities will require the use of bulldozers, excavators, compactors, ditchers, graders, pavers, loaders, dump trucks, transport trucks, cranes, pneumatic or hydraulic tools, compressors, drilling rigs, and water pumps.

A proposed staging area is located near Junction Avenue in this section. The need for wooden hoardings to protect nearby residents from noise due to construction and staging activities in this area will be determined during the implementation phase as part of the PEMP.

Rideau River Crossing

Construction of the bridge over the river will require excavation, foundation, construction of structures, application of concrete, retaining wall, track laying. Equipment associated with the activities that can cause the noise is excavators, loaders, dump trucks, transport trucks, cranes, pneumatic or hydraulic tool, compressors, concrete pumps, and water pumps.

Carleton University

Construction activity at Carleton will include general site excavation, drainage, street building, construction of two pedestrian tunnels, track laying, electric installation, station construction, building erection, utilities relocation, and retaining wall construction. All the activities will require the use of bulldozers, excavators, compactors, graders, pavers, loaders, bobcats, dump trucks, transport trucks, cranes, pneumatic or hydraulic tools, compressors, drilling rigs, and generators.

Dow’s Lake Tunnel

The Dow’s Lake Tunnel will be widened or twinned to provide for two tracks. Activities causing noise for the Dow’s Lake Tunnel construction will be site excavation and grading, blasting, rock drilling, framework and retaining wall construction, concrete application, and track laying. Equipment required for the construction of the tunnel are excavators, tree excavators, loaders, large drill rigs, hydraulic impact hammers, compactors, bulldozers, dump trucks, water pumps, generators, cranes, transport trucks, concrete redi-mix trucks, concrete pumps and compressors.

Dow’s Lake Tunnel to Gladstone (Rock Cut)

The existing in-cut section running from the end of Dows' Lake Tunnel (near Carling Station) to beyond Gladstone Station will be widened. The construction activities required for this section are rock drilling, blasting, site excavation and grading, drainage, electric installation, track laying and station construction. Associated equipment that could generate noise are rock drilling rigs, bulldozers, excavators, compactors, rollers, loaders, dump trucks, transport trucks, cranes, concrete pumps, pneumatic or hydraulic tools. Alternatives to blasting along this section may exist, and if so, would be preferred. These alternatives will be investigated as design progresses and will be used where feasible. It is anticipated that rock drilling operations will be short term in nature at specific locations. Every effort will be made to limit rock drilling and blasting at a given site adjacent to sensitive receptors. Rock drilling and blasting in the winter period is preferred.

Gladstone Station to Bayview Station

General construction operations will include excavation, grading, drainage, street building, bridgework, track laying, electric installation, platforms and shelters installation, and building erection. Along the track there will be construction of two bridges that required typical construction activities like excavation, foundation, application of concrete as well as pile drilling. All activities will require the use of bulldozers, excavators, tree excavators, compactors, rollers, ditchers, graders, pavers, loaders, bobcats, dump trucks, transport trucks, cranes, pneumatic or hydraulic tool, compressors, drilling rigs, generators and water pumps.

LeBreton Flats

General construction operations will be site excavation and grading, drainage, street building, bridgework, electric installation, stations construction, building erection, track laying. Along the track there will be construction of three bridges that required conventional construction activities like excavation, foundation, application of concrete as well as pile drilling. All the activities will require the use of bulldozers, excavators, compactors, rollers, ditchers, graders, pavers, loaders, bobcats, dump trucks, transport trucks, cranes, pneumatic or hydraulic tool, compressors, drilling rigs and concrete pumps.

Downtown Albert/Slater

Construction activities within the downtown area are street building, utility relocations, electric installation, track laying and station construction. All the activities will require the use of bulldozers, compactors, pavers, loaders, bobcats, dump trucks, transport trucks, cranes, pneumatic or hydraulic tool, compressors, and concrete pumps.

Mackenzie King Bridge

Construction activities along the bridge are structure improvement, street building, utilities relocation, electric installation, track laying and stations construction. All the activities will require the use of bulldozers, pavers, loaders, bobcats, dump trucks, transport trucks, cranes, pneumatic or hydraulic tool, compressors and concrete pumps.

Airport Connection

General construction operations will be site excavation and grading, drainage, street building, bridgework, electric installation, platforms and shelters installation, building erection and track laying. Along the track there will be construction of two bridges that require conventional construction activities like excavation, foundation, application of concrete as well as pile drilling. All the activities will require the use of bulldozers, excavators, tree excavators, compactors, rollers, ditchers, graders, bobcats, pavers, loaders, dump trucks, transport trucks, cranes, pneumatic or hydraulic tool, compressors, and drilling rigs.

Noise From Track Construction

The following types of significant noise-generating equipment in Table 5.1.2.6.2-1 are expected for general track construction.

Table 5.1.2.6.2-1 Types of Construction Equipment for Track Construction (in dBA)

Task	Equipment Type	PWL	SPL at 15 m
North-South Section of Track (Barrhaven to Bayview)			
Removal of Existing Track	Wheeled loader	102	70
	Trucks	105	73
	Boom (Hoist) truck	105	73
	Generator	107	75
	Dozer	115	83
	Grader	112	80
Construction of New Track	Wheeled loader	102	70
	Tracked excavator	113	81
	Trucks	105	73
	Compactor-rammer	108	76
	Generator	107	75
	Compressor	112	80
	Pneumatic hammer	114	82
East-West Section of Track (Bayview to Mackenzie King)			
Removal of Pavement	Groove cutter	115	83
	Pneumatic pavement breaker	120	88
	Wheeled loader	102	70
	Tracked excavator	113	81
	Trucks	105	73
	Generator	107	75
	Compressor	112	80
Pouring Ties, Installing Track	Trucks	105	73
	Truck mixers	116	84
	Boom (Hoist) truck	105	73
	Compressor	112	80
	Generator	107	75
	Concrete pumps	118	86
	Poker vibrators	100	68
Backfilling	Trucks	105	73
	Wheeled loader	102	70
	Compactor-rammer	108	76
	Generator	107	75
Repaving	Asphalt melter	103	71
	Asphalt spreader	110	78
	Road roller	104	72

Table 5.1.2.6.2-1 Types of Construction Equipment for Track Construction (in dBA)			
Task	**Equipment Type**	**PWL**	**SPL at 15 m**
	Trucks	105	73

Notes: PWL - Sound Power Level of the equipment in continuous typical operation, from British Standard BS 5228.
SPL - Equivalent continuous Sound Pressure Level at a 15 m distance.

The worst-case 1-hour construction scenarios have been predicted, based on the typical construction equipment outlined above, assuming that one item of each type of equipment is operating continuously during the hour. Predicted worst-case construction noise levels for track construction are shown in Table 5.1.2.6.2-2.

Table 5.1.2.6.2-2 Predicted Worst-Case Construction Sound Levels – Track Construction			
Item	**Total Sound Power Level (dBA)**	**Distance to Closest Receptor (m)**	**Resulting Sound Level [1] (dBA)**
North-South Section of Track (Barrhaven to Bayview)			
Removal of existing track	118	25	82
Construction of New Track	119		83
East-West Section of Track (Bayview to Mackenzie King)			
Removal of Pavement	122	10	94
Pouring Ties, Installing Track	121		93
Backfilling	112		84
Repaving	112		84

Notes: (1) Sound levels are worst-case L_{eq} (1 h) values, in dBA, except for pile driving, which are L_{max} values

Noise From Station Construction

Construction activities will also occur for station construction (including parking lot construction. Construction activities for the stations on green field sites would include site preparation and levelling, paving, concrete pouring for the station foundation, and construction of any station shelters. Station construction in the downtown east-west corridor would include removal of the existing pavement, construction of the station foundation, construction of any station shelters, and repaving of disturbed sections.

Table 5.1.2.6.2-3: Typical Construction Equipment for Station Construction (in dBA)			
Task	**Equipment Type**	**PWL**	**SPL at 15 m**
Site Preparation	Wheeled loader	102	70
	Tracked excavator	113	81
	Trucks	105	73
	Generator	107	75
	Dozer	115	83
	Grader	112	80
Removal of Pavement	Groove cutter	115	83
	Pneumatic pavement breaker	120	88

Table 5.1.2.6.2-3: Typical Construction Equipment for Station Construction (in dBA)			
Task	**Equipment Type**	**PWL**	**SPL at 15 m**
(if required)	Wheeled loader	102	70
	Tracked excavator	113	81
	Trucks	105	73
	Generator	107	75
	Compressor	112	80
Pouring foundation, Installing shelters	Trucks	105	73
	Truck mixers	116	84
	Compressor	112	80
	Generator	107	75
	Concrete pumps	118	86
	Poker vibrators	100	68
	Boom (Hoist) truck	105	73
Backfilling	Trucks	105	73
	Wheeled loader	102	70
	Compactor-rammer	108	76
	Generator	107	75
Paving	Asphalt melter	103	71
	Asphalt spreader	110	78
	Road roller	104	72
	Trucks	105	73

Notes: PWL - Sound Power Level of the equipment in continuous typical operation, from British Standard BS 5228.
SPL - Equivalent continuous Sound Pressure Level at a 15 m distance.

Predicted worst-case construction noise levels for station construction are shown in Table 5.1.2.6.2-4.

Table 5.1.2.6.2-4 Predicted Worst-Case Construction Sound Levels – Station Construction			
Item	**Total Sound Power Level (dBA)**	**Distance to Closest Receptor (m)**	**Resulting Sound Level [1] (dBA)**
Site Prep	119	10	91
Pavement Removal	122		94
Foundations	121		93
Backfilling	112		84
Paving	112		84

Notes: (1) Sound levels are worst-case L_{eq} (1 h) values, in dBA, except for pile driving, which are L_{max} values

Noise From Bridge Construction

Bridges will have to be constructed at various locations to facilitate water crossings and grade separations. The potential locations of bridges are shown in Appendix D. It is possible that pile driving will be required for the bridge bases. Noise from pile driving will depend on the method used: drop hammer, diesel or air hammer, vibratory, or bored/cast in place. Worst-case drop hammer or diesel hammer noise levels have been used in this assessment. Construction equipment is likely to include the following equipment:

Table 5.1.2.6.2-5 Typical Construction Equipment for Bridge Construction (in dBA)

Task	Equipment Type	PWL	SPL at 15 m
Site Preparation	Wheeled loader	102	70
	Tracked excavator	113	81
	Trucks	105	73
	Generator	107	75
	Dozer	115	83
	Grader	112	80
Pile Driving (if required)*	Pile Driving	125	93
Installing foundations, Installing bridge	Trucks	105	73
	Truck mixers	116	84
	Compressor	112	80
	Generator	107	75
	Concrete pumps	118	86
	Poker vibrators	100	68
	Boom (Hoist) truck	105	73
	Heavy Crane	109	77
Backfilling	Trucks	105	73
	Wheeled loader	102	70
	Compactor-rammer	108	76
	Generator	107	75
Paving (if required)	Asphalt melter	103	71
	Asphalt spreader	110	78
	Road roller	104	72
	Trucks	105	73

Notes: PWL Sound Power Level of the equipment in continuous typical operation, from British Standard BS 5228.
SPL Equivalent continuous Sound Pressure Level at a 15 m distance.
*Represents worst-case maximum sound level (L_{max}) from drop hammer or diesel hammer with tubular steel or H shaped piles.

Predicted worst-case construction noise levels for station construction are shown in Table 5.1.2.6.2-6.

Table 5.1.2.6.2-6 Predicted Worst-Case Construction Sound Levels – Bridge Construction

Item	Total Sound Power	Distance to Closest	Resulting Sound

	Level (dBA)	Receptor (m)	Level [1] (dBA)
Site Prep	119	130	69
Pile Driving	125		75
Foundations	121		71
Backfilling	112		62
Paving	112		62

Notes: (1) Sound levels are worst-case L_{eq} (1 h) values, in dBA, except for pile driving, which are L_{max} values

Noise From Blasting

Blasting is proposed to widen the existing Dow's Lake Tunnel and the in-cut section of the track from Dow's Lake to beyond Gladstone Station. The section of the proposed route where blasting is proposed is indicated in Appendix D. Blasting will involve rock drilling using portable diamond drills to create a series of holes, which will then be filled with high explosive and detonated, according to a specific blast design.

Detailed information on the duration and frequency of blasting and rock drilling activities are not available and cannot be provided at this time. It is anticipated that rock drilling operations will be short term in nature at specific locations. Every effort will be made to limit rock drilling and blasting at a given site adjacent to sensitive receptors. Rock drilling and blasting in the winter period is preferred. Drilling and blasting plans will be developed by the selected Contractor based on their geotechnical review. Noise mitigation of rock drilling and blasting will be employed wherever feasible.

Along the in-cut section from Dow's Lake to Somerset Station, the rock drill will likely be placed above grade at the same elevation as the houses (along the existing walking paths). Rock drilling and blasting in this area will be in close proximity to residences, and noise and vibration impacts within this area must be carefully considered. Alternatives to blasting along this section may exist, and if so, would be preferred. These alternatives will be investigated as design progresses and will be used where feasible.

Table 5.1.2.6.2-7 presents the range of noise from typical sound power levels for rock drilling equipment, and Table 5.1.2.6.2-8 shows the predicted worst-case construction noise levels for rock drilling.

Table 5.1.2.6.2-7 Typical Construction Equipment for Blasting (in dBA)

Task	Equipment Type	PWL	SPL at 15 m
Rock Drilling	Rock Drill	118 to 130	86 to 98

Notes: PWL Sound Power Level of the equipment in continuous typical operation, from RWDI measurements
SPL Equivalent continuous Sound Pressure Level at a 15 m distance.

Table 5.1.2.6.2-8 Predicted Worst-Case Construction Sound Levels – Rock Drilling

Item	Total Sound Power Level (dBA)	Distance to Closest Receptor (m)	Resulting Sound Level [1] (dBA)

Rock Drilling In-cut Area	118 to 130	25	80 to 93
Rock Drilling Carleton University Residences		280	61 to 73

Notes: (1) Sound levels are worst-case L_{eq} (1 h) values, in dBA, except for pile driving, which are L_{max} values

Blasting noise and vibration have specific limits specified by the MOE, outlined in Publication NPC-119, to protect structures from concussion and ground-borne vibration. The cautionary limit applies for unmonitored blasts. Blasts should be designed to meet the limit. The peak limit may be used where routine monitoring of blasts are conducted.

Table 5.1.2.6.2-9 MOE NPC-119 Vibration Limits for Blasting

Vibration Source	Cautionary [1]	Peak [2]
Concussion (air overpressure)	120 dB	128 dB
Ground-borne Vibration	1.0 cm/s (0.40 in/s)	1.25 cm/s (0.5 in/s)

Notes: [1] The cautionary limit applies for unmonitored blasts.
[2] The peak limit may be used where routine monitoring of blasts are conducted.

Blasting within the Dow's Lake Tunnel will take 1 to 2 months to complete. Noise from rock drilling will range from 61 to 73 dBA at the closest residence (Carleton University student residences). Rock drilling and blasting along the in-cut section will produce sound levels ranging from 80 to 93 dBA at the nearest residences. Activities may take place at multiple locations. It is anticipated that rock drilling operations will be short term in nature at specific locations. Every effort will be made to limit rock drilling and blasting at a given site adjacent to sensitive receptors. Rock drilling and blasting in the winter period is preferred.

The City is committed to ensuring that noise impacts associated with these activities are minimized to the extent possible. The City has committed attempting to achieve a construction noise sound exposure of 75 to 80 dBA (12-hr Leq) at noise sensitive receptors (e.g., schools, hospitals, residences). However, short-term exceptions may be required. To achieve this, the following mitigation measures will be employed:

- The contractor will be encouraged to use rock drills producing noise on the "quiet" range of the spectrum to reduce noise levels as much as possible.
- Where feasible, portable noise barriers to reduce noise impacts from rock drilling. These may consist of transport trailers, stack hay bales, or other methods, provided that the line-of-site between the source and receiver is broken, and all gaps and cracks are minimized. Barriers could reduce rock drilling noise by 5 to 10 dB.
- Blasting and rock drilling will be restricted to weekdays during daytime hours, from 0700h to 1900h (7 am to 7 pm). In the presence of persistent complaints, the City may implement additional restrictions or time controls.
- Where possible, blasting will be scheduled for roughly the same time each day, and local residents will be made aware of the time of blasting.
- Residents in the area of blasting and rock drilling will be consulted well in advance to inform of them of the nature of the drilling and blasting, the expected noise levels and the schedule of operations (i.e., what week or weeks they may expect rock drilling and blasting to take place near their residence).

- Blasting vibration levels meeting NPC-119 guidelines are not expected to cause structural damage but will be noticeable indoors. By scheduling blasts at the same time of day, residents can adjust their activities accordingly.
- All blasts will be designed to meet the overpressure and vibration limits outlined in Table 5.1.2.6.2-9. Monitoring will be undertaken to ensure that the limits are met.
- In the presence of persistent complaints, where rock drilling may occur for extended periods of time (greater than 2 weeks), and where additional noise mitigation measures such as noise barriers are not feasible, issues will be dealt with on a case-by-case basis.

Local Noise Control By-Laws

The study area is located in the City of Ottawa, Ontario. A copy of the Noise By-Law (By-Law 2004-253) enacted by the Council of the City of Ottawa can be found in Appendix D. In general, construction noise is not permissible between the hours of 2200h to 0700h Monday through Saturday and between the hours of 2200h to 0900h on Sundays. If overnight work is anticipated, an exemption will be required from the City.

MOE Model Municipal Noise Control By-Law

Construction noise impacts are temporary in nature, and largely unavoidable. It is for this reason that applicable MOE guidelines stipulate limits on individual pieces of equipment as opposed to a site-specific or receptor-based limit. With adequate controls, impacts can be minimized. However, for some periods of time and types of work, construction noise will be noticeable, and impacts will be significant. In the presence of persistent noise complaints, the equipment used should meet the construction equipment noise emission standards specified in MOE Publication NPC-115 – “Construction Equipment”. The applicable portions are shown in Table 5.1.2.6.2-10.

Table 5.1.2.6.2-10 NPC-115 Maximum Noise Emission Levels for Typical Construction Equipment

Type of Unit	Maximum Sound Level[1] (dBA)	Distance (m)	Power Rating (kW)
Excavation Equipment[2]	83	15	Less than 75 kW
	85	15	75 kW or Greater
Pneumatic Equipment[3]	85	7	-
Portable Compressors	76	7	-

Notes: [1] Maximum permissible sound levels presented here are for equipment manufactured after Jan. 1, 1981.
[2] Excavation equipment includes bulldozers, backhoes, frontend loaders, graders, excavators, steamrollers and other equipment capable of being used for similar applications.
[3] Pneumatic equipment includes pavement breakers.

Contract Documentation and Construction Code of Practice (Proposed Mitigation)

To minimize the potential for construction noise impacts, it is recommended that provisions be written into the contract documentation for the contractor. These measures will also be outlined within the Project Environmental Management Plan (PEMP). The PEMP will outline responsibilities for ensuring that noise mitigation measures are implemented and that noise complaints are dealt with.

- General construction will be limited to the time periods 0700h to 2200h (7 am to 10 pm) Monday through Saturday and 0900h to 2200h on Sundays, as allowed by the local City of Ottawa by-laws. If construction activities are required outside of these hours, exemptions will be sought in advance by the contractor, directly from the City.

- There will be explicit indication that contractors are expected to comply with all applicable requirements of the contract and local noise by-laws. Enforcement of noise control by-laws will be the responsibility of the Municipality for all work done by contractors.

- All equipment will be properly maintained to limit noise emissions comply with (MOE NPC-115 guidelines). As such, all construction equipment will be operated with effective muffling devices that are in good working order.

- The contract documents will contain a provision that any initial noise complaint will trigger verification that the general noise control measures agreed to are in effect.

- In the presence of persistent noise complaints, all construction equipment will be verified to comply with MOE NPC-115 guidelines.

- In the presence of persistent complaints and subject to the results of a field investigation, alternative noise control measured may be required, where reasonably available. In selecting appropriate noise control and mitigation measures, consideration will be given to the technical, administrative and economic feasibility of the various alternatives.

- Construction mitigation alternatives include but are not limited to:
  - Re-scheduling of noisy operations to daytime hours, where possible;
  - Use of alternate, quieter equipment or methods, where available; and
  - The use of portable, localized noise barriers for critical areas.

The following outline the specific mitigation measures for rock drilling and blasting:

- The contractor will be encouraged to use rock drills producing noise on the “quiet” range of the spectrum to reduce noise levels as much as possible.

- Where feasible, portable noise barriers to reduce noise impacts from rock drilling. These may consist of transport trailers, stack hay bales, or other methods, provided that the line-of-site between the source and receiver is broken, and all gaps and cracks are minimized. Barriers could reduce rock drilling noise by 5 to 10 dB.

- Blasting and rock drilling will be restricted to weekdays during daytime hours, from 0700h to 1900h (7 am to 7 pm). In the presence of persistent complaints, the City may implement additional restrictions or time controls.

- Where possible, blasting will be scheduled for roughly the same time each day, and local residents will be made aware of the time of blasting.

- Residents in the area of blasting and rock drilling will be consulted well in advance to inform of them of the nature of the drilling and blasting, the expected noise levels and the schedule of operations (i.e., what week or weeks they may expect rock drilling and blasting to take place near their residence).

- Blasting vibration levels meeting NPC-119 guidelines are not expected to ?? cause structural damage but will be noticeable indoors. By scheduling blasts at the same time of day, residents can adjust their activities accordingly.

- All blasts will be designed to meet the overpressure and vibration limits outlined in Table 5.1.2.6.2-9. Monitoring will be undertaken to ensure that the limits are met.

- In the presence of persistent complaints, where rock drilling may occur for extended periods of time (greater than 2 weeks), and where additional noise mitigation measures such as noise barriers are not feasible, issues will be dealt with on a case-by-case basis.

5.1.2.6.3 Summary of Potential Adverse Effects, Mitigation Measures and Significance

Operational Noise

As a result of the assessment noise impacts resulting from the operation of the proposed LRT system are not significant for the majority of the study area and, as previously discussed mitigation is not warranted. The following summary the key finding of potential operational noise impacts:

- For long-term daytime L_{eq} (15 h) and night-time L_{eq} (9 h) sound exposures, changes of less than 5 dB are expected at receptors along the project length. These are main thresholds for investigating mitigation requirements under the MTO/MOE Joint Protocol and City of Ottawa guidelines. As the changes in sound exposures are less than 5 dB, mitigation measures are not warranted.

- For the City of Ottawa's short-term L_{eq} (30 min) criterion:

  - Changes greater than 5 dB are anticipated for receptors at the south end of the project (NR18, NR19 and NR20). This is due to the low existing ambient in the area. The total predicted L_{eq} (30 min) sound levels are at or below 58 dBA for these receptors. Therefore, mitigation is not warranted at these locations under the City's guidelines.

  - Receptors near NR12 (Brookfield Residences) show increases of 5 dB over ambient, based on conservative modelling. However, total sound levels are only 59 dBA, which is only 1 dB over the City's 58 dBA criterion. In terms of human perception, a 1 dB increase in sound level is imperceptible, and would not be measurable. The modelling used is very conservative in nature, and the 5 dB excess would not likely be seen. Therefore, considering the above, mitigation is not be warranted at this receptor. Instead, in the presence of persistent complaints, post-construction monitoring of operational noise could be used to ensure that the City's guidelines are met. If required, noise mitigation, in the form of a short right-of-way noise barrier high enough to break the line of sight between the receptors and the LRT wheels, could be used.

– At NR2 the increase in short-term L_{eq} (30 min) sound levels is 5 dB. The maximum short-term sound level is 70 dBA at this receptor. However, the predicted 5 dB change is based on a comparison of the minimum daytime L_{eq} (30 min) value with the maximum peak value due to LRT traffic. For much of the time, the change would be less than 5 dB (i.e., during the main part of the day when background traffic levels are heavier, and the resulting short-term ambient is higher). Again, the predicted change is based on very conservative noise modelling, which is likely overestimating potential noise impacts.

  NR2 represents a hotel with its surrounding areas comprised of commercial and government office buildings. It is a reasonable assumption that NR2 as well as the surrounding buildings incorporate central air conditioning, which would allow the building windows (if operable) to be kept closed for noise control (consistent with Provincial land use planning policies).

  Additional mitigation measures in this area are not technically feasible. This receptor is in the downtown core, and noise barriers cannot be constructed, as the track runs along an operating roadway, and the proposed LRT system already incorporates noise-controlling features, such as "bochum" type resilient wheels.

Therefore, considering the above, and considering that the change in long-term sound levels is less than 5 dB, mitigation is not warranted at this receptor.

Construction Noise

Worst-case construction noise levels have the potential to be very loud during some short periods of time. However, impacts from construction are relatively short compared to operational noise impacts, and therefore, they are usually better tolerated by the community at large. Of special concern are rock drilling and blasting noise from Dow's Lake Tunnel to Somerset Station.

With the application of the below noted noise mitigation, it is not anticipated that there will be significant potential noise impacts during construction:

- Restricting noisy activities to daytime hours where possible;
- Adhering to the City's Noise Control bylaws; and
- Implementing the noise control procedures outlined in the Construction Code of Practice outlined in this document.

Significance

Noise impacts resulting from the operation of the proposed LRT system are not significant for the majority of the study area and, as previously discussed mitigation is not warranted. Noise impacts resulting from construction are relatively short term in duration and, with the implementation of mitigation measures (i.e. construction code of practice), disturbances can be minimized.No significant adverse environmental effects are anticipated during construction or operation.

5.1.2.7 Vibration

The objective of this assessment was to predict and assess rail vibration impacts at vibration sensitive receptors due to this proposed expansion. A screening level approach has been undertaken for the main line of the proposed system, and the results of that assessment are discussed below. A separate, detailed vibration impact assessment has been conducted for the National Arts Centre. The results and recommendations of that assessment are provided later in this section. The full reports are included in Appendix E.

5.1.2.7.1 Operational Vibration

Sources And Receptors

Proposed LRT Vehicle Noise

The vehicles are currently being designed and as yet no operational unit exists. They will be comprised of a single light rail passenger car, which is electrically powered for on board power and drive power. The vehicle will be rated for a maximum speed of 85 km/h; however, the maximum average operational speed proposed is 68 km/h. The maximum allowable noise level specified for the proposed train is an Lmax sound level of 78 dBA at a distance of 15 m from the track centre line with a vehicle speed of 85 km/h.

LRT Traffic Data

The same information outlined in the noise section was used for the vibration assessment.

LRT Traffic Speeds

The same information outlined in the noise section was used for the vibration assessment.

Freight Trains

As discussed previously, once the expansion of the LRT line is completed, regular freight train traffic will cease. At most, one freight train per month will use an adjacent spur line, running from Walkley Road south. Vibration impacts from freight activity will be equal to or less than existing conditions, and have not been considered further in this assessment.

Rail Facility Activities

At the time of the noise assessment, the preferred Maintenance Facility had not been identified. Therefore the assessment was undertaken at the Maintenance Facility Alternative that had residences in closest proximity (the Walkley Facility Site). It was determined that if noise guidelines are met for this alternative, they will be met for all other facility design alternatives.

Noise sources within the storage facilities would include switching and marshalling train movements and noise from maintenance activities. As all maintenance will occur within enclosed buildings, in evaluating potential noise impacts, only switching and marshalling facility activities have been considered.

Locations of Vibration Sensitive Receptors

Existing and future land uses along the LRT corridor will have various levels of vibration sensitivity. In general, vibration sensitivity can be ranked as follows, in keeping with criteria outlined in international standard ISO 2631-2:

Critical spaces:	Includes hospital operating theatres and precision labs (with high performance optical microscopes, electron microscopes, magnetic resonance imaging, photolithography machines, etc.
Residential spaces:	Includes permanent and seasonal residences, hotels, motels, hospitals, nursing homes, and student residences.
Commercial/Office:	Includes commercial offices, warehouses, and school lecture halls.
Industrial/Workshop:	General industrial land uses.

There are varying land uses along the proposed LRT route, as outlined in Table 5.1.2.7.1-1.

Table 5.1.2.7.1-1 Land Uses Along the Proposed LRT Route

Areas	Land Uses in the Area
Downtown (Mackenzie King to Bayview)	Downtown core areas. Land uses include office space, hotels, residential, the Rideau Canal (e.g. mooring) and performing arts (National Arts Centre). No critical spaces (hospitals, laboratory or high-technology manufacturing) or industrial areas identified.
Bayview to Carleton	Various residential and commercial uses. No critical spaces (hospitals, laboratory or high-technology manufacturing) or industrial spaces identified.
Carleton University	Student residences are located near the proposed route. In addition, Engineering Department buildings have the potential to have critical uses.
Confederation Heights	Various government offices including Communications Security Establishment (CSE) headquarters, Public Works Canada, Canada Post, and others. CSE headquarters have the potential to have critical space uses.
Confederation Heights to Walkley Road	Parkway along west edge. Gabrielle-Roy and Lamoureux Public Schools, residential land uses and parkland east of LRT.
Walkley Road to South Keys	Various commercial and residential land uses. No critical spaces identified.
South Keys to Barrhaven Town Centre	Mainly proposed future residential development. Some scattered existing residential and commercial land uses. No critical spaces (existing or proposed) identified.

Applicable Guidelines

There are no universally accepted guidelines available in Ontario that address potential vibration impacts from light rail systems. Rather, several guidelines exist which may serve to indicate what would generally be acceptable, including international standards such as ISO 2631-2, and the railway standards used by Canadian National Railways (CNR), GO Transit, and Canadian Pacific Railways (CPR) in evaluating vibration impacts for new residential development located adjacent to existing railway corridors. The U.S. Federal Transportation Authority (FTA) has also published guideline limits for rail transit projects. Appendix D provides a discussion and comparison of the guideline limits.

The guidelines used in the assessment are shown in Table 5.1.2.7.1-2, and are based on the comparisons outlined in Appendix D. In general, the guideline limits are consistent with ISO

2631-2 limits for whole body vibration. A stricter limit for critical spaces, consistent with FTA guidelines, has been selected. The residential limit is consistent with ISO 2631 and with levels used in other rail transit projects (GO Transit and Toronto Transit Commission (TTC) projects). The guideline limits are shown graphically in Figure 5.1.2.7.1-1. This approach is generally consistent with the methodology used in the original "O-Train" pilot project Environmental Assessment.

Table 5.1.2.7.1-2 Applied Vibration Criteria

Land Use	Applied Limit (VdB re: 1 μ in/s)	Rationale
Critical Spaces	65	From FTA. To address impacts on particularly sensitive lab equipment (such as magnetic resonance imaging, electron microscopes, etc.)
Residential Spaces	75	From ISO 2631-2. Consistent with limits used for GO Transit and TTC transit projects
Commercial / Office Spaces	84	From ISO 2631-2
Industrial Spaces	90	From ISO 2631-2

Existing Vibration Levels

In order to quantify current levels along the project route, vibration measurements were conducted. In June 2005, RWDI personnel deployed monitors near Slater Street and Bronson Avenue, within the downtown core, to measure typical vibration levels from downtown traffic pass-bys. Monitoring was also conducted in close proximity to Junction Avenue and Brookfield Road, to measure vibration levels of existing "O-Train" pass-bys. Vibration monitoring locations and information on the monitoring equipment used are included in Appendix E.

Measurement results of vertical z-axis vibration levels are shown in Table 5.1.2.7.1-3. Additional information is provided in Appendix E. The measured existing vibration levels meet the "Residential Spaces" and "Critical Spaces" limits.

Table 5.1.2.7.1-3 Measured Existing Vibration Levels (Z-axis)

Measurement Location	Measuring	Measured Vibration Levels (VdB re: 1 μ·in/s)			Setback (m)
		Minimum	Maximum	Average	
VM1	Heavy Truck and Bus Pass-bys	58.6	59.8	59.2	7
		32.2	59.4	48.4	9
		46.7	62.9	57.9	10
		23.7	55.7	37.2	13
VM2	Existing O-Train Pass-by	38.1	64.1	51.1	17
		58.5	59.9	59.3	33

Vibration Model Used for LRT Train Pass-bys

The vibration impacts associated with the proposed track addition and extensions were assessed using a computerized prediction model for LRT vibration, which is equivalent to the U.S. Federal Transportation Authority (FTA) algorithms. The following factors were taken into account in the analysis:

- Horizontal and vertical rail line-receiver geometry (including distances from the track, and in-cuts (portions of the track laid at the bottom of an in-cut trench));
- Train type and speed;
- Wheel and suspension types;
- Track types;
- Transit structures; and
- Geological conditions that affect coupling.

As discussed previously, measurements of pass-by vibration levels due to the existing O-Train system were conducted, at various setback distances. These measurements were compared against predictions made using the FTA vibration prediction algorithms, and were in very good agreement. This validates the use of the model for this assessment. Additional information on the comparison can be found in Appendix E. Impacts from the proposed LRT vehicles will likely be less than those for the existing O-Train, since the train units will be lighter (vibration levels from trains generally increase with vehicle weight). Therefore, predictions using the FTA model will generally be conservative.

A review of the current plan shows that no cross-overs or other special track work features, which tend to increase vibration levels, will be placed in proximity to residences or other critical receptors. Therefore, the potential effect of these features is not relevant to this assessment.

Vibration Assessment Results

Vibration contours, showing the locations where the “Critical Spaces” and “Residential Spaces” guidelines are met, based on average train speed through the sections between stations, have been developed, and are presented in Appendix E. The “Commercial/Office Spaces” and “Industrial Spaces” limits will be met at all distances greater than 3 m from the centreline of the track. Sample calculations are provided in Appendix E.

Figures 5.1.2.7.1-1 and 5.1.2.7.1-2 present generalized curves showing predicted vibration levels versus distance for the proposed LRT vehicle. Figure 5.1.2.7.1-1 presents the results based on average track speeds along each section of the track. Figure 5.1.2.7.1-2 presents the results based on the maximum allowable track speeds of 50 km/h downtown, and 84 km/h for the rest of the mainline. Maximum speeds will rarely be reached downtown.

In general, in the downtown core area, the distances required to meet the criteria at maximum and average train speeds are:

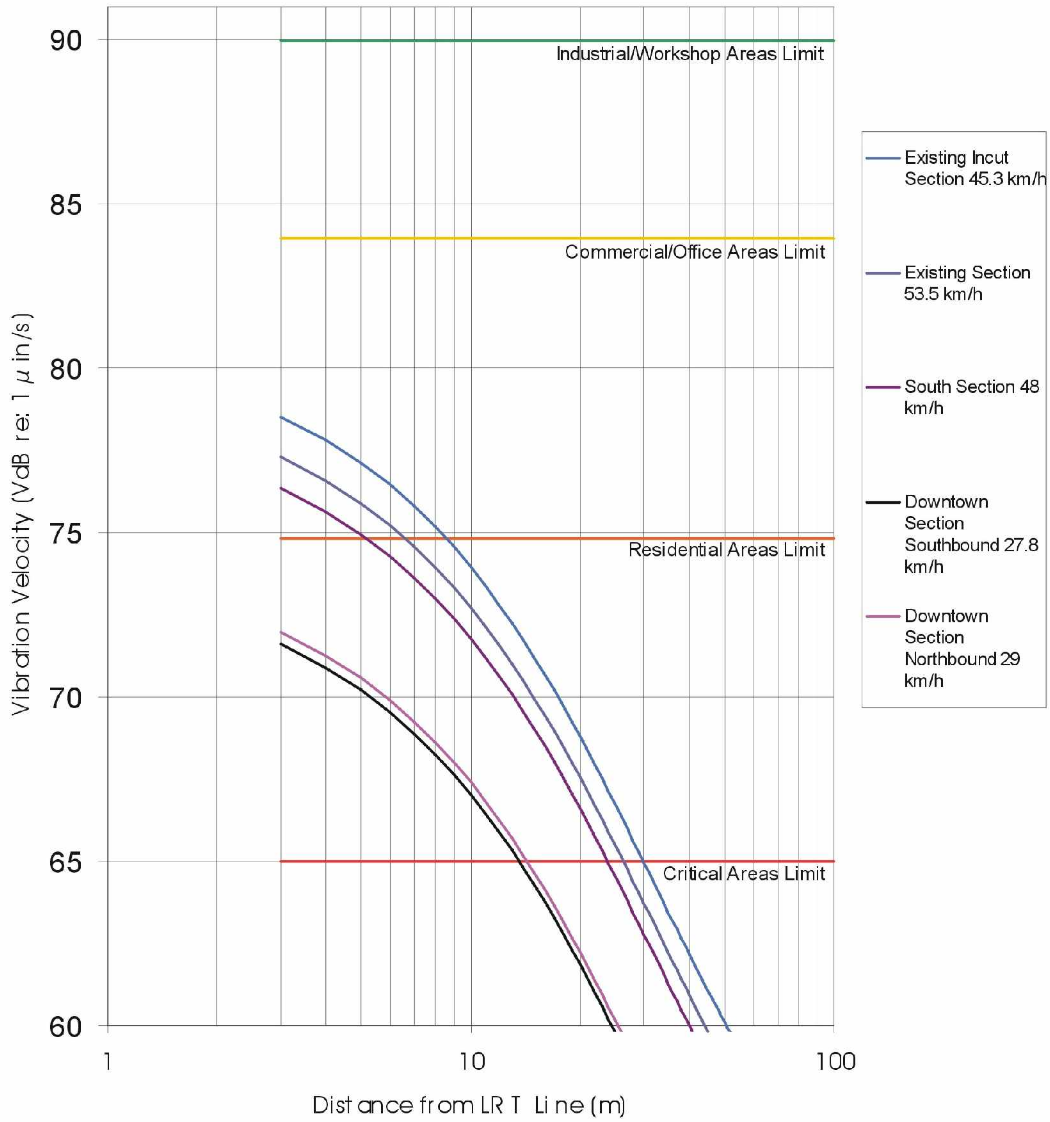
- Maximum train speeds
  - Residential areas: 6 m
  - Critical areas: 25 m
- Average train speeds
  - Residential areas: All distances
  - Critical areas: 15 m

And for the main line of the track, the distances required to meet the criteria at maximum and average train speeds are:

- Maximum train speeds
  - Residential areas: 19 m
  - Critical areas: 53 m
- Average train speeds
  - Residential areas: 6 to 10 m
  - Critical areas: 24 to 33 m

A review of the proposed track layout shows that all residential land uses will be located outside of these setback distances.

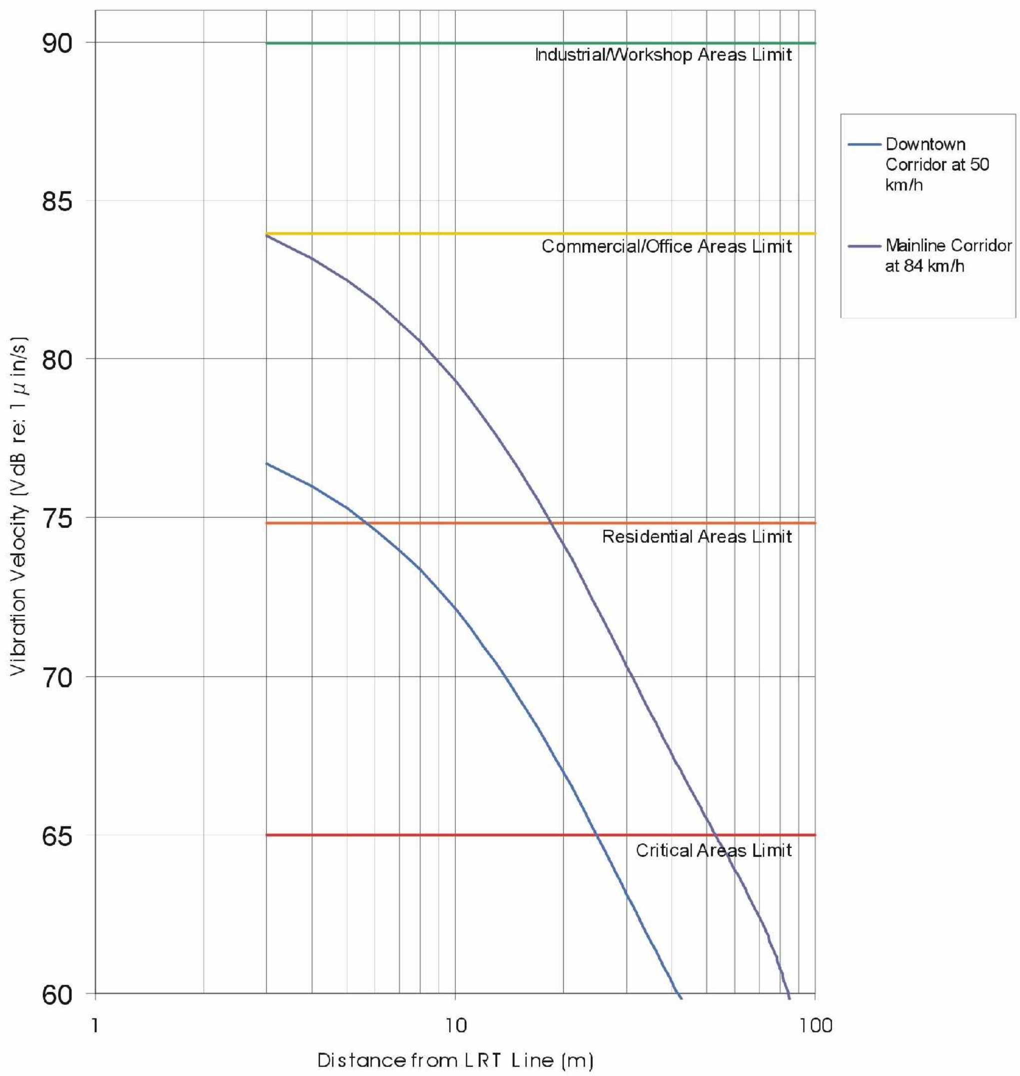
Figure 5.1.2.7.1-1 Vibration Levels Versus Distance – Average LRT Speed



Vibration Levels Versus Distance – Average LRT Speeds	Drawn by: CJP	Figure: 4
	Approx. Scale:	N/A
Ottawa N/S Corridor LRT Priority Project - Ottawa, Ontario Project #W05-5007A	Date Revised:	Aug. 16, 2005

RWDI

Figure 5.1.2.7.1-2 Vibration Levels Versus Distance – Max LRT Speed



Vibration Levels Versus Distance– Maximum LRT Speeds		Drawn by: CJP	Figure: 5
		Approx. Scale: N/A	
Ottawa N/S Corridor LRT Priority Project- Ottawa, Ontario	Project #W05-5007A	Date Revised: Aug. 17, 2005	

Table 5.1.2.7.1-4 presents a summary of the required setback distances to meet the guideline limits used in this assessment. The potential vibration impacts within each LRT section are discussed in detail.

Table 5.1.2.7.1-4 Minimum Distance From Track Required to Meet Guideline Limit

Areas	Distance From Track to Reach Guideline Limit (m)				Shown on Figure No.
	Critical	Residential	Commercial / Office	Industrial	
Downtown (Mackenzie King to Bayview)	15	All	All	All	3a to 3c
Bayview to Carleton	33	10	All	All	3d to 3 e
Carleton University	27	7	All	All	3f
Confederation Heights	27	7	All	All	3g to 3h
Confederation Heights to Walkley Road	27	7	All	All	3h
Walkley Road to South Keys	27	7	All	All	3i to 3j
South Keys to Barrhaven Town Centre	24	6	All	All	3k to 3y

Notes: [1] Based on average train speeds through the area.
All The guideline limit is met for all distances greater than 3 m from the track

Downtown (Mackenzie King to Bayview)

Receptors within the downtown core include residential uses (homes, hotels), institutional uses (a high school) and commercial / office uses (government and other office towers), and the National Arts Centre (NAC). The NAC has specific issues due to existing structural tie-ins to the Mackenzie King Bridge. Vibration impacts (and the resulting structure borne noise impacts) on the NAC are addressed later in this section

Along the proposed LRT route, no critical land uses, such as hospitals, laboratory or high-technology manufacturing have been identified. The “Residential Spaces” limit is met for all distances greater than 3 m from the track, and will therefore be met at all residential and institutional receptors within the downtown core. The lower vibration levels in this area are due to the lower LRT speeds.

It is anticipated that a track crossover will be constructed at the Mackenzie King Station to accommodate a change in direction of travel for the LRT vehicles. However, due to the relatively slow speeds of an LRT vehicle as it accelerates to leave the station, additional vibration impacts due to the cross over are not anticipated. Considering the above, vibration impacts within the downtown core will therefore be negligible.

Vibration from LRT operations will not be transmitted into the water, and therefore will not affect the boating public using the Rideau Canal in this area.

Bayview to Carleton University

The LRT track along this portion of the route is located at the bottom of a 10 to 14 m deep in cut, with the receptors located along the top portion of the cut. Due to the geology of the area, increased vibration levels are anticipated due to the vibrations traveling through the rock directly, rather than through the soil. As well, speeds are increased along this portion compared to downtown.

The “Residential” limit will be met at all distances greater than 10 m from the track. This limit will therefore be met at all residences along this portion of the route. The Critical Spaces limit may be exceeded at some commercial/industrial uses along the route. However, to the best of our knowledge, these receptors do not contain critical vibration uses.

It should be noted that the existing O-Train and freight train traffic operates through this section, and vibration impacts from the proposed LRT line will be less. Considering the above, vibration impacts within this section are predicted to be negligible.

Carleton University

The proposed LRT route passes though the Carleton University campus (following the same route as the existing O-Train line). There are student residences, lecture halls and lab spaces near the proposed route. The residential limit will be met at a 7 m setback from the tracks, and the critical spaces limit will be met at a 27 m setback from the track. All Carleton buildings lie outside of the critical spaces contour line, with the exception of a non-sensitive parking garage structure. Considering the above, vibration impacts within this section are predicted to be negligible.

Confederation Heights

The Confederation Heights area near the proposed LRT route contains a number of government offices and buildings, including the Sir Leonard Tilley building, Public Works Canada buildings, the Drake Building (former CBC building), and Canada Post offices. Again, the existing O-Train and existing freight train traffic pass near this area. The “critical spaces” contour, at a distance of 27 m from the track, touches the foundation of some buildings. It should be noted that these sites are in close proximity to the Confederation LRT station and LRT vehicles are expected to travel at speeds less than average as they approach and depart the station. Considering the slower LRT speeds expected in this area, vibration impacts within this section are expected to be negligible.

It is recognized that separate temporary buildings are being constructed attached to the Sir Leonard Tilley Building and the Drake Building. It has been assumed that the plans for these extensions considered potential vibration impacts from the existing O-Train service during planning to avoid placement of “critical” vibration sensitive equipment any closer to the LRT line than it is today. Vibration impacts from the proposed LRT service will be less than those for the existing O-Train service, and therefore the proposed LRT system extension will not adversely affect these temporary buildings.

Confederation Heights to Walkley Road

There are two schools (Gabrielle-Roy and Lamoureux Public Schools) as well as some residential land uses along this portion of the LRT route. The residential limit will be met for distances greater than 7 m from the track, and the critical spaces limit will be met for locations greater than 27 m away. The residential limit will be met at all homes and all schools in this section. No critical land uses wire identified along this portion of the route. Considering the above, vibration impacts within this section are predicted to be negligible.

Walkley Road to South Keys

This portion of the route abuts onto existing residential and commercial land uses. The residential limit will be met for distances greater than 7 m from the track, and the critical spaces limit will be met for locations greater than 27 m away. The residential limit will be met at all homes in this section. No critical land uses wire identified along this portion of the route. Considering the above, vibration impacts within this section are predicted to be negligible.

South Keys to Barrhaven Town Centre

The majority of receptors along this portion of the route are proposed future residential developments. Some residential uses currently exist in the area. No critical vibration sensitive land uses have been identified. The residential vibration limit will be met at a distance of 6 m from the track, and the critical limit will be met at 24 m from the track. There are no existing or proposed residences within the residential limit contour. Considering the above, vibration impacts within this section are predicted to be negligible.

5.1.2.7.2 Construction Vibration

Construction Activities

The same construction activities information outlined in the noise section was used for the vibration assessment.

Acceptable Limits for Construction Vibration

Construction vibration is usually assessed in terms of peak particle velocity (PPV), measured in mm/s or in/s. The PPV level is simply the maximum peak level of vibration occurring at any instant of time, and correlates better to building damage potential than root-mean-square values usually used in assessing human vibration impacts. Table 5.1.2.7.2-1 outlines limits for building damage, in the form of PPV values.

Table 5.1.2.7.2-1 Vibration Levels to Avoid Damage in Buildings (Adopted from Swiss Association for Standardization)

Building Class	PPV (in/s)	
	Steady State	Transient
I – Buildings in steel or reinforced concrete, like factories, retaining walls, bridges, steel towers, open channels; underground chambers, and tunnels, with or without concrete alignment	0.5	1.2
II – Buildings with foundation walls and floors in concrete, walls in concrete or masonry; stone retaining walls; underground chambers and tunnels with masonry alignments, conduits in loose material (e.g., multi-storey office towers)	0.3	0.7
III – Buildings as previous but with wood walls (e.g., single family residences)	0.2	0.5
IV – Construction very sensitive to vibration; objects of historic interest (e.g., heritage buildings, archaeological sites)	0.12	0.3

In general, Class III limits should be maintained near residential areas (Bayview Station south to Barrhaven Town Centre). Class II limits should be maintained in the downtown core. A survey of surrounding buildings may indicate more sensitive structures that require more stringent limits. Water, sewer and underground cables should be considered.

Table 5.1.2.7.2-2 provides vibration limits for human perceptibility. As human perception of construction vibration increases, so does the possibility of complaints, even though damage thresholds may not be exceeded.

Table 5.1.2.7.2-2 Human Perception of Vibration

Human Perception of Vibration	PPV (in/s)	
	Steady State	Transient
Imperceptible	<0.01	<0.03
Slightly Perceptible	0.01 to 0.03	0.03 to 0.2
Distinctly Perceptible	0.03 to 0.1	0.02 to 0.9
Strongly Perceptible	Above 0.1	Above 0.9

Comparing the above two table shows that even for vibration meeting stringent Class III limits, vibration levels will still be strongly perceptible.

Blasting noise and vibration have specific limits specified by the MOE, outlined in Publication NPC-119, to protect structures from concussion and ground-borne vibration. The cautionary limit applies for unmonitored blasts. Blasts should be designed to meet the limit. The peak limit may be used where routine monitoring of blasts are conducted.

Table 5.1.2.7.2-3 MOE NPC-119 Vibration Limits for Blasting

Vibration Source	Cautionary [1]	Peak [2]
Concussion (air overpressure)	120 dB	128 dB
Ground-borne Vibration	1.0 cm/s (0.40 in/s)	1.25 cm/s (0.5 in/s)

Notes: [1] The cautionary limit applies for unmonitored blasts.
[2] The peak limit may be used where routine monitoring of blasts are conducted.

Blasting is a transient vibration source, and therefore, MOE NPC-119 guidelines are equivalent to Class III limits discussed in Table 5.1.2.7.2-4.

Predicted Worst-Case Construction Vibration Impacts

Table 5.1.2.7.2-4 shows the predicted distance required to meet vibration guidelines for various types of construction equipment/activities. Where possible, equipment should be located at distances where human perception of the vibrations is limited to “distinctly perceptible”. Otherwise, vibration should be limited to the applicable limits based on building class. If excesses of the vibration levels are anticipated, alternate means of construction, or monitoring of vibration levels, should be considered.

Vibration impacts from pile driving are not anticipated, as the closest residence to pile driving activities (for bridge construction near Bayview Station) is 130m away. Blasting vibration near residences along the in-cut section from Carling to Somerset is of concern. Care must be taken to design blasts so that NPC-119 limits are met.

Table 5.1.2.7.2-4 Minimum Distances Required to Meet Construction Vibration Limits						
Item	Distance to Meet Guidelines Limit (m)					
	Distinctly Perceptible		Class II(Multi-Sensory Towers)		Class III (Wood Frame)	
	Steady State (<0.03 in/s)	Transient (<0.2 in/s)	Steady State (<0.03 in/s)	Transient (<0.2 in/s)	Steady State (<0.03 in/s)	Transient (<0.2 in/s)
Small Dozer	1.7	0.5	0.4	0.2	0.5	0.3
Idling Crane	3.2	0.9	0.7	0.4	0.9	0.5
Jake Hammer	8.0	2.2	1.7	1.0	2.2	1.2
Bulldozer, Trucks	14	4.0	3.0	2.0	4.0	2.0
Pavement Breaker	43	12	9.0	5.0	12	7.0
Vibratory Pile Driver	63	18	14	8.0	18	10
Diesel Pile Driver	108	30	23	13	30	17
0.5 kg High Explosive	250	70	55	30	70	40

Notes: Class II represents multi-storey buildings, such as hotels, office towers, etc.
Class III represents wood-framed buildings such as single-family residences, townhouses, etc.

Local Noise Control By-laws

The study area is located in the City of Ottawa, Ontario. The City of Ottawa Noise By-Law 2004-253, enacted by the Council, controls construction activities. In general, construction noise is not permissible between the hours of 2200h to 0700h Monday through Saturday and between the hours of 2200h to 0900h on Sundays. If overnight work is anticipated, consideration should be given to seeking exemptions from the City of Ottawa through the Commissioner.

Contract Documentation and Construction Code of Practice

To minimize the potential for construction noise impacts, it is recommended that provisions be written into the contract documentation for the contractor, as outlined below:

- Construction will be limited to the time periods 0700h to 2200h Monday through Saturday and 0900h to 2200h on Sundays, as allowed by the local City of Ottawa by-laws. If construction activities are required outside of these hours, exemptions should be sought in advance by the contractor, directly from the City of Ottawa.

- The contract documents will contain a provision that any initial vibration complaint will trigger verification that the general control measures agreed to are in effect.

- In the presence of persistent vibration complaints, measurements of vibration levels will be conducted to ensure that applicable limits are met.

- Where possible, equipment should be located farther than the "distinctly perceptible" distances outlined in Table 5.1.2.7.2-4. Otherwise setback distances meeting the applicable building Class II and Class III limits should be maintained. Where activities must take place within these setbacks, consideration for alternative equipment/methods and/or vibration monitoring will be given.

- Blasting should be designed to meet the performance limits outlined in NPC-119. The cautionary limits should be maintained unless monitoring of each blast is undertaken. In the presence of persistent complaints, monitoring of blasting noise and vibration for each blast should be considered.

- Given the close setback distances for residences along the in-cut section from Carling to Somerset, monitoring all blasts in this area will be undertaken if warranted.

- Residences in the area of blasting and rock drilling will be conulted well in advance to inform of them of the schedule of operations (i.e., what week or weeks they may expect rock drilling and blasting to take place near their residence).

- Where possible, blasting should be scheduled for roughly the same time each day, and local residences should be made aware of the time of blasting.

- Prior to the start of blasting, a visual "walk-around" inspection of buildings in the area will be undertaken, to establish their condition prior to the work being conducted. Wherever possible, photographs of any existing foundations cracks or structural problems will be taken.

- In the presence of persistent complaints and subject to the results of a field investigation, alternative vibration control measures may be required, where reasonably available. In selecting mitigation measures, consideration should be given to the technical, administrative and economic feasibility of the various alternatives. Alternatives could include but are not limited to:
  - Restricting vibration-causing activities to daytime hours only;
  - The use of alternative methods or equipment (for example, the use of a vibratory pile driver rather than a drop hammer or diesel system); and
  - Using smaller charge sizes for blasts.

5.1.2.7.3 Summary of Potential Effects, Mitigation Measures and Significance

Operational Vibration

The vibration guidelines are predicted to be met at all receptors (with the exception of the NAC as outlined later in this section). No vibration mitigation measures are required. No significant adverse environmental effects are anticipated during operation.

Construction Vibration

Construction vibration may at times be noticeable. A Code of Practice has been outlined to minimize the potential for construction vibration impacts. No significant adverse environmental effects are anticipated during construction.

5.1.2.7.4 Vibration Assessment of the National Arts Centre (NAC)

The NAC is located on 53 Elgin Street in downtown Ottawa, next to Confederation Square and Parliament Hill. The NAC is among the largest performing arts centres in Canada housing four different performance spaces. Low ambient noise and vibration is essential for the operations of the building, and therefore the NAC is considered to be a sensitive facility. Currently, buses using the Mackenzie King Bridge generate sufficient vibration from expansion joint and catch basin inlets impacts to create audible noise within the NAC, which can be intrusive to some occupants. The NAC has expressed concerns about the impact the proposed service could have on the existing sound environment inside the various performance spaces.

The existing NAC structure is coupled to the Mackenzie King Bridge, which from a noise and vibration perspective is a poor design considering the acoustical sensitivity of the facility. The unfavourable design of the NAC is inherently the cause of the existing noise problem from the buses and will ultimately drive the mitigation requirements for the proposed LRT.

As part of the assessment, vibration measurements were performed at several locations inside and outside of the NAC. Vibrations were measured for ambient - no buses and ambient - multiple bus passages. A copy of the NAC Vibrations Assessment Report is provided in Appendix F. Vibration effects were assessed in accordance with the methods of the United States Department of Transportation – Federal Transit Administration (FTA). The FTA model predicts vibration impacts for rail vehicles using adjustments to generalized base curves of vibration level versus distance.

The assessment concluded that the projected sound and vibration levels for the future LRT (no mitigation) is estimated to be marginally higher in magnitude compared to the ambient - multiple bus passages.

It is possible to reduce the level to below the existing ambient - multiple bus passages. There are various commercial track treatments available on the market, ranging in complexity from resilient tie fasteners to spring supported floating slabs. Floating slab systems can be very effective at controlling low frequency ground-borne vibration. A floating slab system, which can provide 10 to 15 dB of reduction at the low frequencies of interest, is therefore recommended.

Incorporating a floating slab system is anticipated to reduce the LRT impact below the existing ambient - multiple bus passages levels. Given the ability of humans to detect even slight differences in sound levels at discrete frequencies, the levels generated from the mitigated LRT will still likely be perceptible inside the NAC but would not be as noticeable as the bus traffic. It should be noted that mitigating the LRT with a floating slab would not address the current bus noise.

Once the train selection has been finalized, a detailed assessment will be undertaken to provide more specific recommendations accounting for specific frequency characteristics of the proposed LRT.

With the implementation of the additional mitigation measures noted on the following page, no significant adverse environmental effects are anticipated during construction or operation.

Summary of Mitigation

- Incorporate a floating slab system or other similar design which achieves a similar reduction in vibration in the track design on the structure in the vicinity of the NAC.
- Undertake a detailed assessment once the train selection has been finalized to provide more specific recommendations accounting for specific frequency characteristics of the proposed LRT. The City of Ottawa will consult with the NAC to select an appropriate consultant to undertake that review.
- Although the existing bus vibration is not caused or made worse by this project, efforts will be made during the design the design process to improve the existing situation if feasible.
- The City of Ottawa will consult with the NAC to develop an appropriate construction schedule to minimize impacts to NAC operations.
- Establish dialogue with NAC during design and into construction to coordinate construction efforts and minimize impacts.

5.1.2.8 Archaeology and History

Potential Construction Effects and Mitigation

A Stage 1 Archaeological Assessment of the corridor was undertaken by Heritage Quest Inc. The purpose of this investigation was to identify areas of archaeological concern and identify any additional archaeological assessments that will be required prior to construction.

The majority of the preferred alignment in the downtown and along an existing rail right-of-way has been previously disturbed and thus it is anticipated that most archaeological resources have been removed. Within this section of the corridor, however, there are several locations where construction may extend into areas that retain archaeological potential. These include LeBreton Flats, the area between the LeBreton Station and Bronson Avenue, Dow's Lake, new maintenance and station facilities, and any expansion beyond the existing rail bed south of Hunt Club Road. The Riverside South and Barrhaven areas are agricultural lands that have not been previously disturbed and have areas of archaeological potential based on the City of Ottawa's Archaeological Master Plan. A number of known archaeological sites have been identified within the study limits. Most of these will be avoided by the LRT system; however, there are a number of sites in the vicinity of LeBreton Flats, and a site close to Dows Lake that could potentially be affected.

The following outlines the proposed mitigation and commitments to future work required to mitigate adverse environmental effects to archaeological sites:

- Undertake a Stage 2 Archaeological Assessment for works in the undisturbed area comprising Riverside South and Barrhaven and the link to the Airport. During this assessment, Parks Canada should be consulted regarding potential underwater resources in the vicinity of the new Rideau River crossing. If archaeological finds are discovered, Stage 3-4 mitigation will be undertaken as required in accordance with the guidelines and policies of the Ministry of Culture. Consultation will occur with the Ontario Ministry of Culture and relevant First Nations to discussion mitigation strategies if sites are found as part of the Stage 2 Assessments. Copies of the Archaeological Assessments will be provided to the RAs.Given that much of the alignment on the existing rail right-of-way and in the downtown has been previously disturbed, limited additional archaeological investigations are required. In areas where construction will occur outside the existing transit corridor or rail bed, including LeBreton Flats, the area between the LeBreton Station and Bronson Avenue, Dow's Lake, new maintenance facility or station facilities, or other construction adjacent to the rail bed, a Stage 2 Archaeological Assessment will be undertaken. Parks Canada will be consulted regarding potential underwater resources in the vicinity of the Dow's Lake. If archaeological finds are discovered, Stage 3-4 mitigation will be undertaken as required in accordance with the guidelines and policies of the Ministry of Culture.

- Undertake Stage 3-4 Archaeological Assessments if warranted by finding of Stage 2 Archaeological Assessment. Consultation will occur with the Ontario Ministry of Culture and relevant First Nations to discussion mitigation strategies as part of this work.
- Submit additional Archaeological Assessments (i.e. Stage 2, Stage 3 and, Stage 4 Reports for the areas noted above) a minimum of 90 days prior to construction to the Ministry of Culture.
- Should buried archaeological deposits be found along any section of the corridor during construction activities, the Ministry of Culture (416 314-7148) and relevant First Nations will be notified immediately. No further disturbance of the deposits will occur until a licensed archaeologist has been consulted.
- In the event that human remains are encountered during construction activities, both the Ministry of Culture (416 314-7148), the Registrar or Deputy Registrar of the Cemeteries Regulation Unit of the Ministry of Consumer and Commercial Relations, (416 326-8392) and relevant First Nations will be notified immediately.

Potential Operational and Maintenance Effects

No adverse environmental effects to archaeological or historical features are anticipated during this phase of the project as no additional land will be impacted.

Significance

The potential for archaeological finds in areas of construction exists at some relatively undisturbed sites. With the implementation of the above noted mitigation measures potential for adverse effects can be minimized and no significant residual effects should occur.

5.1.2.9 Heritage

Potential Construction, Operational and Maintenance Effects and Mitigation

The City of Ottawa has a rich history. Numerous heritage buildings and heritage conservation districts are located in the downtown area. Through the generation and evaluation of alternatives, adverse effects to heritage features in the downtown have been avoided and no designated built heritage features will be displaced. Significant urban design work has been undertaken in the downtown area to integrate the LRT system with the streetscapes of Albert and Slater Streets and therefore no adverse effects to built heritage features or cultural landscapes are anticipated in the downtown area.

An inventory of built heritage features was developed as part of this study. No adverse effects to designated or listed properties are anticipated.

The NCC has identified a number of potential cultural landscapes in the area. These potential cultural landscapes are defined by the NCC as "…geographical terrains which exhibit characteristics or which represent the values of a society as a result of human interaction with the environment." (NCC and Parks Canada, Workshop, 1993). The identified potential cultural landscapes within the study area include the crossing of the Rideau Canal in the downtown, the Dow's Lake/Rideau Canal crossing, the Central Experimental Farm west of Dow's Lake and the north Rideau River crossing. In addition, the south Rideau River crossing (Strandherd) is identified as a potential cultural landscape.

The crossing of the Rideau Canal in downtown will be on the existing Mackenzie King Bridge. No additional widening of this bridge is required and therefore there will be no adverse effects in this feature. Temporary adverse effects are anticipated at the Dow's Lake/Rideau Canal crossing and in the vicinity of the Central Experimental Farm. However, no long term effects are anticipated as the crossing will be in a tunnel. A twin bridge will be required at the north Rideau River Crossing. This bridge will be designed sympathetic to the existing structure to mitigate heritage adverse effects. A new bridge will be required at the south Rideau River crossing. It will be designed in accordance with the Strandherd-Armstrong Bridge Aesthetic Guidelines (du Toit Allsopp Hillier, November 2005 [Copy provided in Appendix K]). Parks Canada and NCC will be consulted through the design process and all required permits and approvals will be obtained.

The Rideau Canal is a National Historic Site, designated a Canadian Heritage River by Parks Canada and is a candidate site for World Heritage status. No long term effects are anticipated to these features with the application of the mitigation measures discussed in the above paragraph. However, Parks Canada and the NCC will be consulted during the design of the Strandherd/Armstrong crossing. Parks Canada will also be consulted regarding heritage mitigation for the Dows Lake tunnel and the Rideau Canal downtown.

A number of cultural landscape features are located in the Riverside South area. No significant adverse effects are anticipated to these features, as they will be redeveloped as part of the planned growth in this area. There are two areas with high clusters of cultural landscape features in this area. These include the area in the vicinity of High Road and the former CPR crossing and Limebank Road, Armstrong Road and Mosquito Creek. These areas have been avoided during route generation and will not be adversely effected.

The existing rail corridor is part of the Bytown and Prescott Railway. This was the first railway into Ottawa and began service in 1854. Given that the corridor will continue to be used for rail purposes no adverse effects are anticipated. Given the rich rail history of the corridor, it is recommended that the former CPR corridor should be recognized through interpretive panels in at least one of the proposed stations. The specific location of this will be determined during detail design in consultation with the City of Ottawa Heritage Department.

The following outlines the proposed mitigation and commitments to future work required to mitigate potential adverse heritage effects:

- Implement urban design recommendations to integrate the LRT system with the streetscapes of Albert and Slater Streets.
- Avoid/mitigate adverse effects to the Rideau Canal in the downtown, the Dow's Lake/Rideau Canal crossing, and the Central Experimental Farm west of Dow's Lake by using the existing Mackenzie King Bridge and new tunnel at the Dow's Lake/Rideau Canal crossing.
- Design the twin bridge at the north Rideau River crossing sympathetic to the existing structure to mitigate heritage impacts.

- Design the new bridge at the south Rideau River crossing in accordance with the Strandherd-Armstrong Bridge Aesthetic Guidelines (du Toit Allsopp Hillier, November 2005).
- Develop interpretive panels in consultation with the City of Ottawa Heritage Department to recognize the rich rail history of the former CPR corridor.
- Consult with Parks Canada and NCC as appropriate during the design of the crossings of the Rideau Canal/River and obtain necessary permits during detail design.

Significance

With the application of the above noted mitigation measures no significant adverse environmental effects to designate or listed heritage properties and cultural landscape features are anticipated.

5.1.2.10 Contaminated Sites and Waste Management

Overview

An initial assessment of the corridor was conducted in order to identify properties/areas with actual or potential site contamination. A visual inspection of the preferred alternative was completed, as was a review of secondary source information including: a review of the registered waste generator data set and waste disposal site inventory; the federal contaminated sites database; and historical insurance plans. Based on a review of all the information collected, two properties/areas exhibiting actual contamination will be impacted by LRT construction activities. No potentially contaminated sites associated with registered waste generators or federal contaminated properties will be impacted.

The former Gloucester Landfill located on the southwest side of Leitrim Road and the former CPR tracks has historically been used as a municipal waste disposal facility. From 1960 to approximately 1980 various federal departments used a special waste compound (SWC) at the landfill to dispose of hazardous wastes (i.e. oils and cleaning solvents). The storage area for federal contaminated wastes was located near the centre of the landfill site, and was remediated in the 1990's, though the potential exists that the soil and groundwater at the former SWC is still environmentally impacted. There is a groundwater treatment facility on the property as part of on-going remedial efforts, which began operating in 1992. The recommended plan for the LRT corridor will affect the north portion of the property, as the second phase of the Leitrim Park and Ride Lot is located on the north side of the former landfill.

The area of LeBreton Flats has historically been used for wide variety of activities and operations, ranging from industrial land use to waste disposal. Various consultants' reports prepared for Lebreton Flats describe the type of site contamination present based on historical land use, as well as potential remedial options. Figures 4.2.7-2, 4.2.7-3 and 4.2.7-4 outline the latest plume mapping of heavy metal, PAH and TPH in this area. It is anticipated that the LRT corridor may impact the south portion of Lebreton Flats, and as such, a Phase I ESA will be completed for the south portion north of Scott Street. Should the potential for site contamination be identified, any supplemental environmental investigations (i.e. Phase II ESA) will be conducted in accordance with the guidelines outlined in the Waste Management and Mitigation section.

In addition, a former fuel service station located north of the Queensway on the west side of the existing railway tracks (near Gladstone Ave) was identified as a point source for contamination observed to be migrating within the right-of-way of the existing O-Train corridor. No secondary source information regarding the completion of a human health or ecological risk assessment was identified for this former fuel service station. However, typical contaminants of concern related to fuel stations include: total petroleum hydrocarbons, gas/diesel and heavy oils (referred to as TPH g/d and TPH ho); heavy metals; polycyclic aromatic hydrocarbons (PAH); and BTEX compounds (benzene, toluene, ethylbenzene, xylenes) are likely present.

A fuel service station located at Earl Armstrong Road and River Road, and another at Strandherd Road and Woodroffe Avenue were identified as having the potential to result in site contamination. Both fuel service stations will not be directly impacted by the preferred alternative.

Potential Site Contamination Effects and Mitigation During Construction

The potential exists that contaminated soil and/or groundwater may be encountered in the vicinity of the former Gloucester Landfill and LeBreton Flats. The types of contaminants that may be encountered include: petroleum hydrocarbons, semi-volatile and volatile organic compounds (SVOCs and VOCs), polynuclear aromatic hydrocarbons (PAHs), pentachlorophenols (PCP), heavy metals, sodium and chloride (salt impacts), spent acids and caustics, domestic waste, and herbicides/pesticides.

In addition, contaminated material will be encountered within the existing rail right-of-way. This material is primarily associated with the removal of existing railway track ballast and fill material, and rail ties. Contaminants commonly found during railway track removal include: PAHs (creosote tar), oils and lubricants, petroleum hydrocarbons, and heavy metals.

The following outlines the proposed mitigation and commitments to future work required to mitigate site contamination effects during construction:

- A Phase II Environmental Site Assessment (ESA) will be completed on the north portion of the former Gloucester Landfill that will be required for a commuter parking lot. The Phase II ESA will include intrusive environmental sampling for soil and groundwater quality. Representative soil and groundwater samples will be submitted for laboratory analysis by a Canadian Association for Environmental Analytical Laboratories (CAEAL) approved laboratory. The results of the analyses will be compared against applicable MOE Standards and Canadian Council of Ministers of the Environment (CCME) Guidelines, as stipulated in the CCME Contaminated Sites Policy. All sampling will be completed by a Qualified Person under CCME Guidelines. If remediation of this property is required, the appropriate remedial option will be selected on the basis of the extent of contamination, type of contamination, and the cost to remediate; in accordance with CCME Guidelines and O. Reg 347. The selection of the proper method for remediation and/or disposal will be performed by a Qualified Person under O.Reg. 153/04 of the OEPA, and in accordance with O.Reg. 153/04. CEPA (Part 5, Part7, Part 9, Schedule 5, and Schedule 6) will be followed in conjunction with OEPA statutes and regulations. CCME publications regarding contaminated sites will be used for guidance during the selection of proper methods for remediation and/or disposal. In addition, the investigation will determine any potential impacts on the federal groundwater treatment plan and develop measures to mitigate potential impacts. Procedures for the disposal of any material generated are outlined in the following section. Transport Canada will be consulted prior to the commencement of any Phase II ESA work at the former Gloucester Landfill, in order to ensure that any Phase II ESA work considers existing background data. Phase II ESA requirements will be determined by a Qualified Person, and in accordance with O.Reg. 153/04 under the OEPA. CEPA (Part 5, Part7, Part 9, Schedule 5, and Schedule 6) will be followed in conjunction with OEPA statutes and regulations. In addition, CCME contaminated sites publications and the Canadian Standards Association (CSA) Standard Z769-00 will be used for guidance during the selection and evaluation of Phase II ESA requirements.

- A Phase I ESA will be completed for the south portion of LeBreton Flats, north of Wellington Street. The Phase I ESA will include a review of all historical background information for the site, including: historical insurance plans, MOE inventories, maps and plans, and aerial photographs. The Phase I ESA will be completed in accordance with the Contaminated Sites Policy under the CCME Guidelines. The Phase I ESA will make recommendations for further environmental investigation, at the discretion of the Qualified Person. If cleanup is required, procedures for the disposal of any material generated are outlined in the following section.

- A Phase I ESA will be completed for any property, or portion of a property, to be acquired or leased by the City of Ottawa for the purposes of accommodating the North-South corridor LRT. Where a property has been recommended for further environmental investigation, as per the Phase I ESA completed by AMEC Earth and Environmental for the CPR Ellwood/Prescott Subdivision lands (O-Train Corridor) (see Appendix G [Appendix B of the Site Contamination Study Report]), the City of Ottawa will complete a Phase II ESA on a site-by-site basis.

- The City of Ottawa is currently negotiating with the property owner of the former fuel service station located on the north side of the Queensway near Gladstone Ave. (west side of the existing right-of-way), with regard to the presence of contamination observed to be migrating within the existing O-Train Corridor. Any contaminated material that is encountered during construction will be managed and disposed of in accordance with the mitigation measures outlined in the following subsection. Additional measures will be taken to prevent the further spreading of contamination within the LRT corridor.

- During construction, contaminated fill and ballast material from the railway right-of-way (ROW) may be encountered. The environmental quality of the material will be assessed by a Qualified Person under O.Reg. 153/04, or applicable CCME Guidelines (i.e. contaminated sites policy), and the need for further environmental investigation will be determined, as needed.

Potential Waste Management Effects and Mitigation During Construction

During construction, materials will be generated that will need to be managed and stored on and off-site. Materials may include excess soils, excess water (i.e. dewatering), and railway debris such as fill and ballast material and old rail ties.

Based on the recommended plan for the LRT corridor, areas of significant cut into the existing ground surface have been identified, which could result in the generation of excess soil. Areas requiring significant cuts (i.e. greater than 4.0 metres) into the existing ground surface include: Barrhaven Town Centre station; Cresthaven Road; River Road; High Road; Bayview Area Station (Wellington Street); and a section of the airport LRT line.

In addition, fuels and chemical substances may be required on-site which will need to be managed and stored appropriately (i.e. OPSS 180, Ontario Occupational Health and Safety Act, Canadian Occupational Health and Safety Regulations).

Tracking of dirt and mud off-site during construction will be minimized with the use of gravel tracking pads.

All clean-up work and disposal will be completed in accordance with applicable MOE Standards, OEPA regulations and CCME Guideline requirements. The following outlines the proposed mitigation and commitments to future work required to mitigate construction waste impacts:

- All excess material generated during construction activities will be properly managed in accordance with O.Reg. 347 (General Waste Management), as amended to O.Reg. 558 of the Ontario Environmental Protection Act (Ontario EPA).
- Excess material generated during construction activities which exhibits visual or olfactory evidence of contamination will be characterized by a Qualified Person to determine if it is hazardous or non-hazardous, in accordance with O.Reg. 347 (amended to O.Reg. 558) of the Ontario EPA, as well as Ministry of the Environment (MOE) Guidelines, if applicable, and CCME Guidelines.
- The appropriate Provincial (i.e. MOE) authority will be kept informed of any excess material generated that is designated as hazardous waste as per O.Reg. 347 (amended to O.Reg. 558), or is suspected of being hazardous, and will be consulted regarding containment and/or disposal measures.
- The volume of excess material generated will be recorded in a daily log and/or note book. If disposal of excess material is required (i.e. hazardous waste), the volume of clean fill needed will be determined based on the amount of material removed.
- Excess material (hazardous or non-hazardous) will be transported off-site (as required) by a licensed hauler/transport subcontractor using pre-determined haul routes, to be finalized prior to construction activities.
- If wastes (hazardous) are to be transported across provincial boundaries, this will be done in accordance with Canadian Environmental Protection Act (CEPA) Regulation SOR/2002-301 (Interprovincial Movement of Hazardous Wastes).
- All wastes transported from the construction site, or stored on the construction site, will be done so in accordance with O.Reg. 347 (amended to O.Reg. 558).
- identify waste management procedures for storage, transporting, handling and disposal of water materials; compare requirements of the Ontario Water Resources Act (OWRA).

The following outlines the proposed mitigation and commitments to future work required to mitigate effects related to earthwork activities:

- Excess soil will be characterized as hazardous or non-hazardous if visual or olfactory evidence of contamination is observed by a Qualified Person under O.Reg. 153/04 or CCME Guidelines, during the course construction. Non-hazardous soil will be managed on-site and either disposed of at a licensed landfill, reincorporated into construction activities (i.e. infilling or grading), or sold as clean fill material. Soil classified as hazardous will be handled according to the procedures outlined in the section above.

The following outlines the proposed mitigation and commitments to future work required to mitigate impacts related to the storage of fuels, chemicals, and other products brought to the construction site:

- All construction supplies such as fuels, oils and lubricants, and other chemical compounds will be stored in an exclusion zone away from construction activities so as to avoid site contamination via mishandling and improper storage.
- A Spill Prevention, Control and Countermeasures (SPCC) Plan will be prepared for all construction activities within the boundaries of the LRT corridor, by the Contractor. The Contractor will develop, implement, and maintain the SPCC Plan to ensure that construction activities do not increase the risk of a release of fuel, oils, or other hazardous materials and chemicals to the environment. The SPCC Plan will describe the procedures and equipment in-place to minimize spills, leaks, or releases of hazardous materials. In addition, the plan will address the reporting and response procedures in the event of an incident. The plan should incorporate the following: an inventory of all on-site hazardous chemicals; clearly identified hazardous materials storage areas with secondary containment features; install and maintain spill kits in areas that are readily accessible to workers. The kits should contain absorbent pads, booms, drain covers, etc.; and all wastes generated as a result of spill clean-up will be managed according to O.Reg. 347 (amended to O.Reg. 558).
- Fuels and other toxic chemical substances brought to the construction site will be stored in appropriately sealed containers in accordance with O.Reg. 347 and the Technical Standards and Safety Authority (TSSA) Act.
- The MOE Spills Action Centre (SAC) and Federal Spills Response Centre (if the incident is on or adjacent to federal property) will be notified in the event of a spill that impacts, or has the potential to impact, human health or the environment.

Potential Operation and Maintenance Effects and Mitigation

Upon completion of the LRT project it is anticipated that periodic inspections and maintenance will be required for the railway tracks and adjacent right-of-way. Equipment, chemicals, and other materials may need to be used to facilitate inspection and maintenance activities. It is expected that the City of Ottawa (or its agent) will assume all maintenance and inspection activities associated with the operation of the LRT corridor, including the replacement of rail ties when required. Railway ties are not permitted to be disposed of at a landfill, and cannot be burned or incinerated due to the use of creosote preservative which can be harmful to humans and the environment.

The following outlines the proposed mitigation and commitments to future work required to mitigate effects related to operation and maintenance of the LRT corridor:

- Any chemicals or potentially harmful products used within the LRT corridor for maintenance purposes will be stored and handled in accordance with the measures outlined in the previous section. Operation and maintenance activities will be performed in accordance with OHSA guidelines, as well as the City of Ottawa's internal health and safety protocol. All general refuse (i.e. bottles, plastics) will be disposed of at a licensed landfill. Old railway ties will be collected, stored, and handled in accordance with the Environmental Canada document, entitled "Industrial Treated Wood Users Guidance Document".
- All chemicals and railway debris (i.e. railway ties, equipment etc.) will be stored at a maintenance facility.
- Refer to the waste management section above for procedures dealing with operation and maintenance generated wastes (i.e. containment and handling); SPCC Plan; and substances storage and handling (i.e. OHSA).

Significance

As discussed above, there is potential for impacts to contaminated sites during construction and potential for waste impacts to land during construction. With the implementation of the above noted mitigation measures potential for adverse effects can be minimized and no significant residual effects should occur.

5.1.2.11 Navigation

Construction Effects and Mitigation

The project crosses the following navigable waterways:

- Rideau Canal at the Mackenzie King Bridge:
- Rideau Canal (Dow's Lake);
- Rideau River north crossing; and
- Rideau River south crossing (Strandherd).

All structures have been designed to maintain the required navigable clearance. All bridge structures will be constructed of concrete and will not allow debris to fall, thereby preventing a potential health and safety hazard for boaters. The tunnel under the Rideau Canal (Dow's Lake) will be constructed in the winter as a cut and cover and reinstated to the existing subsurface conditions. Thus adverse effects during and after construction are considered to be mitigated. Other structures over the Rideau River will require the following mitigation and commitment to future work:

- Apply to Transport Canada for approval under the Navigable Waters Protection Act
- Apply for approval as a Lawful Works
- Contact Transport Canada and Parks Canada to establish the clearance envelope and operating constraints
- Contact Parks Canada, RVCA, DFO, and Transport Canada to finalize design, methodology and timing.
- Obtain Permits from Parks Canada for all crossing of the Rideau Canal/River
- During construction delineate the channel through the work area.
- Ensure debris does not fall into the water during construction.
- Contractor to provide plans of how he will retain the channel during construction.
- City of Ottawa to monitor the work

Operation and Maintenance Effects

No adverse effects are anticipated as the crossing will be designed to meet navigation requirements identified by Transport Canada.

Significance

As discussed above, all applicable structures have been designed to maintain the required navigable clearance. With application of the appropriate approval process and the implementation of appropriate mitigation measures potential adverse effects to navigation can be minimized and/or avoided during construction and operations.

5.1.2.12 Utilities

Construction Effects and Proposed Mitigation

There are a number of existing underground and overhead utilities within the recommended LRT corridor that are impacted by the project. These were identified and assessed based on reviews of available utility base mapping and as-built information provided by the City of Ottawa, as well as follow-up meetings with the utility companies affected. All known utility features have been compiled onto a composite utility base plan that was used during the Study.

In addition, the EA study team has made three separate presentations to the Ottawa Utility Coordinating Committee (UCC) to provide updated information on the progress of the study and proposed alignment information.

The following utilities have been contacted over the course of the study and have confirmed the location of existing plant, identified potential conflicts and provided preliminary relocation cost estimates (where applicable):

- Hydro Ottawa
- Hydro One
- Bell Canada
- Enbridge Gas
- Rogers
- Allstream
- Sprint (Call-Net)
- Level 3 Communications
- 360º Networks (Group Telecom/Bell)
- PWGSC (Steam Plant)
- Trans-Northern Pipelines Inc.

There has also been on-going co-ordination with City of Ottawa utilities (sewer, water, street lighting and traffic signals), including the proposed high and low-pressure water main (Lines ‘A’, ‘B’ and ‘C’) replacement projects. The City of Ottawa has carried out closed-circuit television (CCTV) inspection of all existing sewers along Albert and Slater Streets (including cross-streets) to assess the need to rehabilitate or reconstruct any existing storm, sanitary or combined sewers.

The majority of notable utility conflicts occur in the downtown Corridor (Bronson to Elgin) with some relocation work required along the existing O-Train corridor. There are only minor conflicts along the Corridor south of Leitrim through the proposed Riverside South Community and into South Nepean related to existing storm and sanitary sewer and watermain crossings.

A brief description of the major utility conflicts identified to date follows:

Downtown Corridor (Bronson to Elgin)

Hydro Ottawa – there are existing hydro duct banks running the full length of Albert and Slater Streets as well as an overhead line on Albert Street between Bronson and Lyon. Hydro has identified that relocation work including maintenance hole rebuilds and duct bank relocation on Slater Street between Metcalfe and Elgin and Albert Street between Bank and Elgin is required.

Hydro One – three existing direct buried conduits (depth of 6-7 feet) are located under the proposed LRT on Slater between Metcalfe and Elgin. The potential impact of the LRT on the conduits is to be confirmed.

Bell Canada – has an extensive network of existing underground utility duct banks running under both Albert and Slater Streets. This network is fed from a major central switching facility located on the south side of Albert St. between Bank and O’Connor, and under CRTC regulations contains telecommunications plant from all major carrier corporations. There are minor impacts to Bell plant along Albert Street between O’Connor and Elgin Streets. The existing underground plant along the full length of Slater Street is in direct conflict with the proposed LRT line and must be relocated, including new feeds to all buildings. A large co-ordination effort will be required to construct a new duct bank, maintain the existing service and re-feed all of the buildings. A $30M preliminary estimate for relocations in these areas has been provided by Bell (subject to completion of a design feasibility study to be completed by end of 2005). As well, extreme caution is to be taken during all construction activities (i.e. excavations) near the switching building.

Enbridge Gas – existing gas mains are present all along Albert and Slater Streets and several cross streets. Enbridge has provided an estimate to relocate the gas mains and crossings that are in conflict with the proposed LRT line.

Rogers – a preliminary estimate has been provided to relocate maintenance holes and lower duct crossings under platforms and tracks and reconfigure aerial plant west of Bronson Avenue. This estimate does not include the cost of relocating Rogers' cables either in Bell duct banks or on Hydro poles that are being relocated.

Combined sewers – 140m of existing combined sewers on Albert Street and 125m of combined sewers on Slater Street (both near Bronson Avenue) require separation due to MOE regulations. Two new sewers (sanitary and storm) will replace the existing combined sewer. A new storm outlet must be located to the west of Bronson Avenue during detailed design.

Storm sewers – Approximately 3.7km of existing storm sewer is present within the LRT Corridor downtown. The results of the City of Ottawa CCTV inspection indicate that most of the sewers show moderate structural deficiencies and would be candidates for rehabilitation beginning in about 5 years. A section of storm sewer on Slater west of Elgin is hydraulically deficient and should be upgraded.

Sanitary sewers – There are no hydraulic constraints in the sanitary system with the LRT Corridor downtown. It has been proposed to proactively replace all service laterals to each building.

Approximately 53 storm and sanitary structures (maintenance holes and chambers) are directly impacted by the LRT route through the downtown Corridor. Access structures will have to be re-built to provide access to the sewer network for future maintenance and rehabilitation requirements. The City of Ottawa has also proposed to proactively rehabilitate those sewers that have the shortest remaining life cycle and have the highest potential to impact LRT service. A preliminary estimate has been provided to cover all of the related sewer works described above.

Water – the existing water mains running under Albert and Slater Streets date from the late 1890s. The City of Ottawa's Water Services Branch has indicated that these mains would not survive major construction works, and that the LRT project would provide them the opportunity to replace the existing water mains in conjunction with the reconstruction of the roadways. Two existing water mains on Slater Street would be consolidated and replaced by a single new water main, while the existing water main on Albert Street will be replaced with a new water main in the same location.

Traffic signals – all downtown intersections along Albert and Slater Streets are to be re-built and a new communication duct bank (interconnect) is required along Albert Street to be located under sidewalk or shared within street lighting or the telecommunications duct.

Street lighting – all existing street lighting along Albert and Slater Streets will be replaced. It is proposed to install new street lighting on the new traffic signal poles and catenary poles for the overhead power supply for the LRT. The location of any streetlighting poles will be difficult to place due to location of loading bays, other buried utilities in the sidewalk and the proximity to the building foundations.

Existing O-Train Corridor (Bayview to Leitrim)

Enbridge Gas – an existing gas main on the Airport link near Thad Johnston and Alert roads will require relocation.

Telecommunications – Sprint, Level 3 Communications and 360º Networks all have fibre-optic cables (long distance carriers) running along the existing O-Train Corridor between Bayview and Leitrim. Most of the cable is buried with some rigid duct banks running above ground at a number of structures. Level 3 Communications is located south of Walkley only and 360º Networks is located north of Walkley only. All three utilities have determined that their plant is in conflict with the proposed LRT and will require relocation to some degree. A “joint build” duct bank has been proposed to reduce the relocation costs and will be examined further by the utilities involved.

Water – an existing large diameter feedermain runs along the existing Corridor from south of Hunt Club Road to north of Leitrim Road. Its exact location needs to be field verified in order to determine the extent of the impacts from the proposed works.

In order to help with the dissemination of information and the development of the required utility relocation plans, a Utility Coordination meeting group was organized with representation from all of the impacted utilities and City of Ottawa departments. A series of meetings were held from March through August 2005 in order to present the proposed LRT alignment, update the composite utility mapping, determine the utility impacts along the corridor, select preliminary relocation corridors in the downtown Corridor and develop relocation plans and strategies to a functional design level.

Separate meetings focused on operating issues that each of the utility companies have for their specific needs and corridors. Preliminary discussion on separation requirements, access to chambers, frequency of maintenance issues and other related issues also took place. All of the work begun during the EA process has continued through the RFP process. The Utility Coordination group will continue to meet as the LRT project enters the detail design phase in order to ensue that all utility impacts have been mitigated.

An existing Trans Northern Pipelines natural gas pipeline was identified as crossing the LRT corridor at approximately sta. 18+770 between the proposed Earl Armstrong and East Spratt LRT stations. There is no impact to the pipeline due to construction of the LRT, however Trans Northern Pipelines has an established set of construction procedures for all construction activities near gas pipelines. These procedures shall be followed during the detail design phase and will be included in the contract documents during construction.

Operational and Maintenance Effects

Impacts during operations (i.e. potential conflicts) have been addressed through design. No significant adverse environmental effects are anticipated with the design mitigation noted above

Significance

All potential utility impacts are continuing to be addressed and future meetings with each utility company and the Utility Coordination Group will provide for planning and mitigation measures during the construction, operation and maintenance of the proposed LRT system.

5.1.2.13 Traffic Operations

Traffic

A traffic simulation model (Vissim) of Ottawa's downtown core was developed to evaluate the impact of introducing LRT operations on Albert and Slater Streets. The traffic analysis considered the cumulative impacts of pedestrians, all cross-street impacts, turning movements, private and commercial vehicle activity, and both transit bus and LRT services across each of the signalized intersections within the Albert/ Slater Street corridors. A copy of the traffic analysis is included in the Appendix C.

The operation of the Albert/ Slater Corridor was analysed and evaluated under the most congested period of the day, the afternoon peak hour, when high volumes of traffic are coincident with large pedestrian volumes, vehicle movements from private accesses (mostly parking lots and garages), as well as the through-operation of frequent LRT service (every 3 minutes) and between 140 and 170 buses per hour picking up passengers within the Corridor. While general roadway capacity improvements in the City of Ottawa's central area are not anticipated within the planning period, the analysis also considered an approximate 10% growth in peak hour general traffic throughout the Albert/Slater Street Corridor.

The findings of the traffic simulations were that a single through general traffic lane on Albert/Slater Streets and provisions for separate turn lanes at intersections were sufficient in accommodating the peak hour traffic throughout the planning period. Also with the introduction of LRT services, Mackenzie King Bridge would no longer be available as a general traffic crossing of the Rideau Canal, however the resulting traffic diversion (500 vehicles per hour in the peak direction) could be accommodated on adjacent roadways, Laurier Avenue and Rideau Street, while maintaining a ratio of volume to capacity (v/c) of less than 1.0, conforming to the TMP policy for central-area intersections.

The preferred alternative's use of separate LRT platforms along alternating blocks through the downtown ensures that Bus Rapid Transit services will continue to operate without increases in the service time required to load passengers at platforms. This is significant to minimize bus queues, as both the number of buses per hour and the associated wide variance in bus service time at the Transitway platforms adversely impacts the travel times through downtown and the resulting bus-related congestion in the corridor.

The eventual introduction of LRT service at three-minute frequencies is therefore not anticipated to impact adversely on either the current Bus Rapid Transit service or the general movement of traffic through the Albert/Slater Corridor within the planning period (2021). Even so any major change to the transportation mix such as the LRT needs to be fully examined with respect to the operations of transit vehicles and general traffic.

Construction Mitigation

The following outlines the potential traffic concerns and proposed mitigation measures during construction:

- During construction traffic detours will be required to construct the utilities and rail network. The City of Ottawa through the procurement team is preparing plans for traffic and bus routing during construction.
- Consultation with the Stakeholders and media will be required to mitigate confusion as the project proceeds. The City of Ottawa will establish a consultation strategy for the design and construction periods.
- The O-Train Service is to be kept operational as long as possible. However, closure of the system is required for construction and testing. This closure will be mitigated as much as possible by temporarily operating a parallel bus service. This type of alternative service has been proven to be effective in the past.

Operation Mitigation

The following outlines the potential traffic concerns and proposed mitigation measures during operations:

- The City of Ottawa will be developing a strategy for providing both LRT and bus service on Albert and Slater, part of that strategy will include taking advantage of the LRT capacity to reduce the buses on Albert and Slater. The City of Ottawa is committed to a minimum 30% reduction in the number of buses on Albert and Slater. Even so the potential for conflicts at bus stops is possible; the EA has suggested a set back of parking/loading from the stop areas. The City of Ottawa will monitor the bus operations and if required increase the set back during the peak hours to accommodate transit operations.
- Through alternative generation and selection of a recommended alternative, impacts to the downtown road network have been minimized. All current turning movements will be retained.
- LRT and BRT platform locations were recommended that least impact access to adjacent lands and have potential for integration into the development. As the City of Ottawa continues to talk to developers about the potential for integration and refines the operating strategy for the LRT BRT system it may be necessary to move stop locations to accommodate the outcome of those processes. This process can be carried out with the detailed design and take advantage of the public consultation during the implementation stage.
- Safety protocols will be developed by the operating authority for typical urban rail transit operation. These protocols will discuss threats to the facility and to surrounding pedestrians and recreational network.

<u>Cyclists</u>

<u>Potential Construction Effects and Proposed Mitigation</u>

The Official Plan identifies Albert and Slater Streets as part of the on-road cycle network through downtown. Exclusive cycle lanes are not present on these streets, so cyclists travel in mixed flow with general traffic. The addition of LRT service on Albert and Slater Streets will not change the nature of the current cycle network, with cyclists continuing to be accommodated in mixed traffic along this section of the Corridor.

The cycle network extends easterly to Sandy Hill and the University of Ottawa, crossing the Rideau Canal on the Mackenzie King Bridge, where median cycle lanes accommodate bicycle traffic. An estimated 500 cyclist per day traverse the Mackenzie King segment of the network. The addition of LRT tracks on the Mackenzie King Bridge will require the removal of all vehicular traffic from the bridge other than Bus Rapid Transit. While a conversion of the bridge to transit-only use does not necessarily conflict with the median bicycle lanes, the proposed median LRT platform at Mackenzie Station means the cross-town cycling route is no longer continuous through the Mackenzie King Bridge, terminating instead at crosswalks at the east and west ends of the station platforms. This proposed facility essentially removes an important east-west cycling route in the downtown core of the City of Ottawa.

The following alternatives have been identified to mitigate this issue:

- Cyclists may dismount their bicycle at Mackenzie Station and walk their bicycle along the platform to the second crosswalk, this could result in pedestrian cyclist conflicts and is not considered to be viable for the commuter cyclist;
- Use the cycle lanes on the recently reconstructed Laurier Avenue Bridge, and then reconnect to the cycle network at Cumberland is an option using existing facilities;
- Cross the Canal on the soon-to-be-constructed Rideau Canal Pedestrian Bridge at Somerset Avenue incorporated with upgraded cycle facilities to access the crossing.
- The City of Ottawa is currently undertaking a review of its cycle network, consideration will be given to identifying additional cross-town routes on other streets that link directly to Canal crossings locations.

Operational Mitigation

The City of Ottawa will continue to work with the cycling community to ensure that Light Rail and cycling complement each other to promote environmentally friendly modes of travel. All of the City of Ottawa’s Light Rail vehicles are expected to carry bicycles inside the vehicle, along with their riders and buses equipped with bike rakes. With the implementation of a complementary cycling network and ability to carry bikes within the LRT vehicles, no adverse effects are anticipated during operations and maintenance.

Significance

Potential traffic impacts are primarily related to impacts to the road network during construction. With the implementation of the above noted mitigation measures the potential for impacts to traffic operations can be minimized and no significant residual effects should occur.

During operations, the project is anticipated to be beneficial to the road networks as it will reduce the number of vehicles on the road.

5.1.2.14 National Research Council – Centre for Surface Transportation Technology Access

Construction Effects and Proposed Mitigation

There is no freight movement on the current O-Train line north of the Walkley diamond. South of the diamond freight trains provide service the National Research Council – Centre for Surface Transportation Technology (NRC-CSTT). The NRC-CSTT provides world class surface transportation development and testing services for the rail and road transport industries, defence departments and a wide range of private and public-sector vehicle and equipment manufacturers. Situated on a 51-acre campus southeast of the Ottawa Macdonald-Cartier International Airport on Lester Road, the facility houses some of the most sophisticated and useful vehicle research and development and test facilities in the world. NRC-CSTT is a non-subsidized self-supporting business unit within the National Research Council.

A large number of client vehicles are delivered to NRC-CSTT for testing by rail transport, with access provided by the Ottawa Central Railway (OCR) through an agreement with CP Rail on a 4.1 km siding track extending south of the Walkley Facility within the former CP Ellwood corridor. A portion of this track is currently used by the O-Train Pilot Project. Prior to its purchase by the City of Ottawa, CP Rail maintained this rail siding specifically for NRC-CSTT access. NRC-CSTT also uses this siding to access sections of the OCR track between Pembroke and Montreal to conduct certain types of vehicle testing.

Historically, up to 20 access moves per year have been required, including both freight and LRT type rail vehicles. Vehicle moves currently operate between 9 a.m. and 4 p.m. with the occasional move occurring between midnight and 5 a.m. After-hour moves are required for the movement of specialty and oversize vehicles. A Track Occupancy Permit, which requires 48-hour prior notice, must be obtained by the OCR from Capital Railway to provide the vehicle access move.

Rail access is critical to the business of the NRC-CSTT. The City of Ottawa will ensure the facility has access; however the conversion of the current line to electric LRT precludes vehicle access moves to the NRC-CSTT on the LRT line due to conflicts with the overhead power lines and narrow station platform clearance. Trucking rather than rail delivery was considered as an option but dismissed because in many cases it is the rail vehicle that is being tested and trucking was considered impractical. Relocating the facility was also considered but dismissed in that the facility is well established in its current location.

To mitigate this problem, the recommended plan identifies the relocation of the existing siding track to the west of the twin-track LRT line. The existing rail corridor is sufficiently wide to accommodate this third track, and it would continue to cross Hunt Club road on the existing rail overpass structure. The City of Ottawa would retain ownership of this siding and enter into agreements with the OCR and NRC-CSTT to grant access rights.

Although the recommended plan identifies a third track as the preferred solution, the City will consider other options during the detailed design stage of the project implementation process that may provide a more cost-effective means of serving the NRC-CSTT facility. These options may include using a portion of the LRT track where technically feasible. If another option is selected, the Federal Team will have the opportunity to review and comment on any potential adverse environmental effects and proposed mitigation measures.

The following outlines the potential traffic concerns and proposed mitigation measures during construction:

- To reduce the impact on the NRC-CSTT operations the track relocation will be carried out during out of service periods; and
- To ensure NRC-CSTT is informed of shut downs and overall operations, the City of Ottawa will include them in the Communications plan being established for the duration of the project implementation period.

Operation and Maintenance Proposed Mitigation

The following outlines the potential traffic concerns and proposed mitigation measures during operations:

- The separation of the two tracks will eliminate any conflicts between the two operations; even so the City of Ottawa and NRC-CSTT will continue to consult with each other during the operation and maintenance of the LRT system; and
- City of Ottawa and NRC-CSTT will coordinate or considered using the same maintenance firm to reduce conflict in operations.

Significance

With the implementation of above noted mitigation measures adverse effects during construction and operation can be minimized and no significant residual effects should occur.

5.1.2.15 Rail Rolling Stock Accessibility

Based on the Ontarians with Disabilities Act (ODA) of 2001, the City of Ottawa developed its first Municipal Accessibility Plan in 2003. The Plan identified existing barriers and reported on strategies to remove existing barriers and prevent creation of new ones. The 2nd City of Ottawa Municipal Accessibility Plan (COMAP) was approved in January 2005. A third COMAP (2006) was approved on November 30, 2005. The 2006 City of Ottawa Municipal Accessibility Plan (COMAP) (current copy) is available online at: http://www.ottawa.ca/city_services/accessibility/municipal_plan_en.shtml.

The creation of a full time Accessibility Specialist and a full time Transit Specialist in 2005 will put the City of Ottawa in a good position to address accessibility requirements from the new provincial accessibility law, Accessibility for Ontarians with Disabilities Act, 2005.

The recommended North-South Corridor LRT facility will be fully accessible to the disabled following all of the City of Ottawa's present transit accessibility standards and all other pertinent legislation. It should be noted that the City's standards are consistent with the CTA's " Code of Practice: Removing Communications Barriers for Travellers with Disabilities" and "Guide to Removing Communication Barriers for Travelers with Disabilities". For example, all pathway grades within the vicinity of the stations will consider accessibility requirements, and elevators will be provided at every station where there is a need to connect to an overhead roadway, sidewalk and intersecting bus service. In addition the new LRT vehicles will be 70% low floor vehicles with wide doors for easy roll-on and roll-off access for wheelchairs, scooters and strollers.

Specific accessibility requirements will be addressed during the detail design and construction stage of the project.

Safety is an important component of the LRT operations and can be addressed in the final design and operations of the system. These measures may include:

- Security cameras on vehicles, at stations and parking lots;
- Telephones at parking lots and stations;
- Panic buttons at stations;
- Lighting for traffic and pedestrians;
- Safety through design;
- Fencing at parking lots and near residential areas;
- Controlled access across the tracks;
- Roving security patrols;
- Signals at rail crossings;
- Involvement of special interest groups during design; and

- High maintenance standards to retain secure sites.

Significance

As discussed above, the proposed LRT system will be designed to ensure full accessibility of the system in accordance with City of Ottawa standards. It should be noted that the City's standards are consistent with the CTA's "Code of Practice: Removing Communications Barriers for Travellers with Disabilities" and "Guide to Removing Communication Barriers for Travelers with Disabilities". With the implementation of the proposed design, no adverse effects are anticipated.

5.1.2.16 Maintenance Facility

This section outlines the process used to generate and assess alternative Maintenance and Storage Facility locations. It should be noted that a preferred location for the facility has not been selected. Additional information and consultation with stakeholders is required to complete the analysis and evaluation of alternatives. The selection of the final location will be as described in Section 3.1.11 of this report and shall be subject to the approval of City Council.

The potential effects of all alternative Maintenance and Storage Facility locations are based on the conceptual designs identified in the EA recommended plan and are presented on Table 5.1.2.16-1. These concepts will be further developed and refined as design progresses. It is recognized that each alternative has different potential effects on the different components of the environment. However, based on a review of the potential effects to the natural, social, economic and cultural environments it can be concluded that there are no significant adverse environmental effects associated with any of the three alternatives and that the potential adverse effects can be effectively mitigated. Therefore, any one of the three sites could be constructed.

Generation of Alternatives

A maintenance and storage facility is required to support the operation of the LRT system. Potential locations were identified through dialogue with the operating authority and stakeholders. As this project is the first component of a larger LRT network comprised of many projects, the proposed facility should be sized to accommodate the following activities:

- Heavy maintenance for the full 2021 (105 vehicle) LRT fleet (typically only one heavy maintenance shop is required for this size of network);
- Light maintenance and washing of the 2021 North-South LRT line fleet;
- Storage for the 2021 North-South LRT line fleet;
- Administration and driver facilities;
- Communication and control facilities; and
- Employee parking.

The ideal location for the maintenance and storage facility would have the following characteristics:

- Close proximity/access to N-S line;
- Conveniently accessible by trains from the E-W line for heavy repairs;
- Existing rail facility (benefits of having the required infrastructure and minimizing the number of new contaminants potentially added to the system);
- Away from core natural areas and sensitive ecosystems;
- Away from watercourses (especially those with potentially sensitive habitat conditions and fisheries);
- Away from areas with high groundwater tables or recharge/discharge areas;

- Away from areas with high concentrations of existing or proposed residential developments (due to the visual, noise and air pollution associated with rail facilities);
- Easily accessible for employees; and
- Services (electricity, water, telephone, etc.) available on-site or nearby.

Based on the above factors, four potential locations were identified (see Figure 5.1.2.16-1 for relative locations of the sites):

- Alternative 1 - the existing CP Walkley Facility
- Alternative 2 - on City of Ottawa lands east of the Airport Parkway, within the NCC Greenbelt and south of Hunt Club Road – Lester Facility
- Alternative 3* - on Transport Canada Lands south of Leitrim Road inside the bend from the existing rail corridor towards Riverside South
- Alternative 4 - on Transport Canada Lands south of Leitrim Road outside the bend from the existing rail corridor towards Riverside South – Bowesville Facility

Alternative 1: Walkley Facility

The Walkley site would be a continuation of the existing land use. It is described as a 'single-ended' facility due to its location offset from the North-South line. There are operational concerns due to its single access point, its long narrow shape with insufficient width to provide a continuous loop to turn trains around, and the fact that no direct access to the southbound LRT tracks is available due to the presence of the existing east-west freight rail line.

There are environmental concerns regarding the presence of ground contamination resulting from the historical operations of the facility by CP Rail. The site can be serviced from surrounding lands.

Alternative 2: Lester Facility

The Lester site is adjacent to the Airport Parkway and provides direct access to both northbound and southbound tracks and would lie predominantly on City of Ottawa-owned land. The conceptual design identifies a need for a small triangle of Transport Canada; however, this requirement may be eliminated through detailed design. The site would be accessed from the Airport Parkway, and services would come from the Hunt Club Road area. The site is located within an area used by local residents for recreational activities. The NRC-CSTT access siding would have to either go around the outside of the facility or cross the facility access tracks.

Alternative 3*: Transport Canada Lands Inside Curve

The site located on Transport Canada lands 'inside the curve' was originally considered but eliminated from consideration due to environmental considerations. It is situated on lands formerly operated as a municipal landfill with a special compound. There is a long history of a known contaminated groundwater plume emanating from this site, and an area-wide risk assessment identified a number of concerns. Transport Canada operates a ground water pump-and-treat facility on site; removing groundwater from a number of shallow and deep extraction wells to be treated on site and then returned into the ground through a series of recharge wells. The constraint of locating a facility amidst an operating treatment facility, while maintaining the series of existing extraction and recharge wells, made this site undesirable.

****Alternative 3 was eliminated, and not considered in the evaluation of alternatives.***

Alternative 4: Transport Canada Lands Outside Curve – Bowesville Facility

The Bowesville site is situated on Transport Canada lands ‘outside the curve’ and would be a ‘single-ended’ facility, however with access to both north and southbound tracks operations, and sufficient width for a continuous loop turning trains around, would not be constrained in the manner of the Walkley site. Access to the site would be from Earl Armstrong Road and site servicing would be available from nearby.

Refinements Suggested During Consultation

The public was provided the opportunity to review the preliminary Maintenance Facility locations at the second and third set of consultation sessions (October 19-21, 2004 and March 21-23, 2005), as well as to discuss possible refinements with project team members.

Public comment was received regarding Alternative 2 (Lester Facility, part of the NCC Greenbelt and south of Hunt Club Rd). The Emerald Woods and Blossom Park Community expressed concern regarding potential noise and loss of passive green lands at the site.

Identification of Potential Effects (Impact Assessment)

Table 5.2.1.2.16-1 provides a formal analysis of the potential effects associated with the three alternative locations.

Figure 5.1.2.16-1 Locations Considered for Maintenance Facility

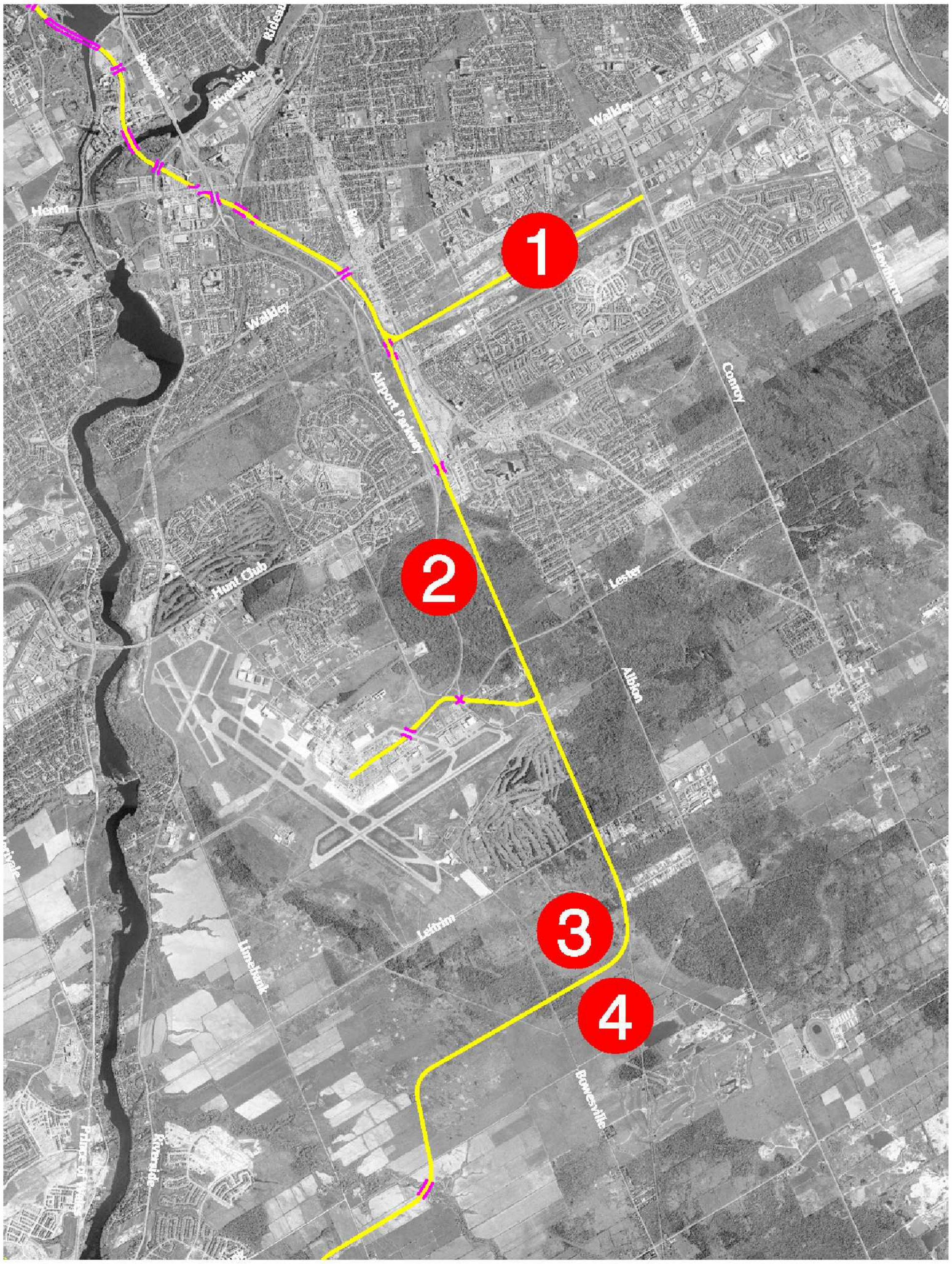


Table 5.1.2.16-1 Evaluation of Alternative Locations for the LRT Maintenance and Storage Facility

	Alternative 1 Walkley Facility	**Alternative 2** Lester Facility	**Alternative 4** Bowesville Facility
Factor: Natural Environment			
Effect on Fish and Aquatic Habitat	Sawmill Creek (Crossings #5 & 5a) crossed by existing railway at west end of site. No additional direct impacts to creek associated with the facility, however some potential for incremental indirect impacts to creek via surface and groundwater; can be managed with implementation of site drainage and stormwater management measures.	No direct impacts to any watercourses. Some potential for indirect impacts to watercourses located north (Cahill Drain #7/8) and south Sawmill Creek Tributary #9/10) of site via surface and groundwater, however can be managed with implementation of site drainage and stormwater management measures.	No watercourses are located in the vicinity of the facility site
Effect on Designated Natural Areas	This site will directly impact the southeast edge of the Conroy Woods UNA, a disturbed upland deciduous forest. Some potential for indirect impacts (e.g. via ground or surface water) to the Conroy Swamp /Greenboro Turtlehead Nature Area and Johnston Street West UNAs located south of the rail facility. Potential indirect impacts can be minimized through the use of proper site drainage and stormwater management measures.	The southern half of this facility is located within the Airport Parkway Natural Area (part of the NCC Greenbelt). Communities within this natural area that will be impacted include the northern limit of a flooded willow thicket swamp and a low-lying, young to mid-aged poplar deciduous forest.	No designated natural areas are located within or adjacent to the site. The Albion Road (Leitrim) Wetland is located at some distance to the east.

Table 5.1.2.16-1 Evaluation of Alternative Locations for the LRT Maintenance and Storage Facility

	Alternative 1 Walkley Facility	**Alternative 2** Lester Facility	**Alternative 4** Bowesville Facility
Effect on Terrestrial Vegetation	Vegetation is limited within the majority of the site as it occurs within an existing rail facility. Surrounding vegetation communities are all mapped within designated natural areas (see above)	The portion of this facility site that is not part of a designated natural area is primarily rolling upland cultural meadow habitat with scattered trees, shrubs, Staghorn Sumac thickets and hedgerows.	Land use is predominately cattle pasture. However, construction of the rail facility would require removal of individual trees within hedgerows, a regenerating forest habitat and small, isolated, grazed woodland on site.
Effect on Wetland Features	Conroy Swamp and Johnston Street West UNAs are both located south of the rail facility and are at least partially composed of wetland communities. These areas may experience indirect effects from the proposed new rail facility (see Designated Areas above).	A small flooded willow thicket swamp community located south of the site may experience indirect effects from the proposed new rail facility (e.g. via surface and groundwater). However, potential impacts can be managed with implementation of site drainage and stormwater management measures.	No wetland communities on site. The Albion Road (Leitrim) Wetland is separated from the alternative facility site by the existing abandoned railway embankment, and is located some distance to the east. Therefore, this PSW should not be affected by this alternative.
Effect on Wildlife and Wildlife Habitat	Very minimal impact as proposed rail facility occurs within existing rail facility site. Potential for indirect impacts to adjacent habitats can be mitigated with implementation of mitigation measures.	Removal of forest, thicket swamp and cultural meadow habitat will have some impact to local wildlife that inhabits this area. Impact is not considered significant given abundance of similar habitat in surrounding natural area.	Very minimal to no impact as site is located primarily within cattle pasture.
Effect on Species at Risk	No species at risk recorded on site.	No species at risk recorded on site.	No species at risk recorded on site.
Effect on Ground and Surface Water Quality	No significant difference between alternatives. Effects will be mitigated / minimized through Stormwater Management (SWM) initiatives.		

Table 5.1.2.16-1 Evaluation of Alternative Locations for the LRT Maintenance and Storage Facility

	Alternative 1 Walkley Facility	**Alternative 2** Lester Facility	**Alternative 4** Bowesville Facility
Effect on Local Air Quality	No significant effects from the low-level emissions from electrical trains. The change from diesel to electrical trains will further reduce effects on air quality. Residential communities are located at least 200 m north and 500 m south from the main facility.	No significant effects from the low-level emissions from electrical trains. Residential communities are located at least 300 m from the main facility.	Residential communities are approximately 1 km away and will not be affected by the rail facility.
Summary	All alternatives result in minor to moderate impacts to the natural environment. Alternative 2 will not have highly significant impacts on natural environment features. The moderate impacts that are anticipated include the removal of young to mid-aged forest habitat as well as cultural meadow and flooded thicket swamp habitats that are represented within the larger surrounding natural areas. These impacts will be minimized through the application of mitigation measures. Natural areas and remaining forest habitat will be protected in accordance with OPSS 565 (Construction Specifications for the Protection of Trees), OPSS 180 (Management and Storage of Excess Waste) and through any additional mitigation measures identified by a qualified landscape architect during detail design. Alternative 1 would have the second highest impact from a natural environment perspective. While this facility is largely located within an exiting rail facility, it would have some minor impacts to adjacent natural areas and would cross two watercourses. It would directly impact (remove) part of the Conroy Woods UNA and has the potential to indirectly impact the Conroy Swamp and Johnston Street West UNAs. **Alternative 4 is the preferred option, as it would have the lowest impact to the natural environment. This facility site is located primarily within a cattle pasture and the impacts would be restricted to the removal of hedgerow trees, regenerating forest habitat and trees within a small, isolated, grazed woodland. There are no watercourses within this site.**		
Factor: Social Environment			
Effect on Noise and Vibration	Improved – new facility would use improved track systems that reduces noise caused by joints.	Minimal effect – nearest residential communities are at least 300 m from the main facility and existing rails would be upgraded to reduce noise caused by joints.	No effect – nearest residential areas are located approximately 1 km from the proposed facility.

Table 5.1.2.16-1 Evaluation of Alternative Locations for the LRT Maintenance and Storage Facility

	Alternative 1 Walkley Facility	**Alternative 2** Lester Facility	**Alternative 4** Bowesville Facility
Effect on Communities	No disruption or displacement of existing community features. Overall aesthetics of the site would be improved through landscaping and conversion from a freight to a light rail facility.	No disruption or displacement of existing buildings. Any aesthetic impacts would be mitigated through landscaping and buffer zones. Although no component of the city's pathway network is impacted, the access to pedestrian trodden pathways at the extreme north and south across the site will be impacted by the fencing of the right-of-way.	No disruption or displacement of existing buildings. Any aesthetic impacts would be mitigated through landscaping and buffer zones.
Effect on Land Use Plans	Zoned as Light and Heavy Industrial. A zoning by-law amendment may be required. Any impacts to the image of the Nation's Capital would be mitigated through landscaping and green buffer zones.	Zoned as IG – Institutional Government. Part of the Greenbelt and identified as "buildable site area" and "rural landscape" in the Greenbelt Master Plan. Any impacts to the image of the Nation's Capital would be mitigated through landscaping and green buffer zones.	Zoned as IG – (Institutional Government) and under control of Transport Canada. Currently within the potential development area for the Ottawa International Airport Any impacts to the image of the Nation's Capital would be mitigated through landscaping and green buffer zones.
Impacts on Navigation and Accessibility	N/A – all facilities along current or proposed LRT alignments.		
Effect on Safety and Security of Users	No significant difference from other LRT facilities.	No significant difference from other LRT facilities.	In line with the current Ottawa MacDonald Cartier International Airport runway.

Table 5.1.2.16-1 Evaluation of Alternative Locations for the LRT Maintenance and Storage Facility

	Alternative 1 Walkley Facility	**Alternative 2** Lester Facility	**Alternative 4** Bowesville Facility
Summary	All alternatives will have a minimal effect on the social environment. However, Alternative 4 has the greatest potential for impact as a result of its proximity to the Macdonald-Cartier International Airport. The Macdonald-Cartier International Airport is currently considering development of the property, and has identified it as being a higher-safety concern because it is in line with the airport runway. **Alternative 1 is preferred in terms of the social environment as this site is currently a rail facility and redevelopment of this site would result in improved aesthetics and reduced noise.**		
Factor: Economic Environment			
Effect on Agriculture	None.	None.	Land is partially forested, partially cattle pasture.
Effect on Commercial/Industrial Operations	None.	None.	None.
Effect on Capital, Operating and Maintenance Costs	None.	No significant impact on adjacent land values as facility will be buffered by the transportation corridor and landscaping. Some additional road and winter maintenance will be required for access roads.	No significant impact on adjacent property values as facility will be buffered by landscaping. Additional road and winter maintenance will be required for access roads.
Summary	All alternatives will have a minimal effect on the economic environment. With the exception of the TC lands outside of the bend, none of the potential facilities are currently being used for significant agricultural, commercial or industrial operations. The Walkley Facility is currently being used for some LRT purposes, and a CN line passes along the southern edge of the facility. The TC Lands currently provide some pasturelands, which are of minimal agricultural value (in comparison to cash crops). As indicated, new access roads will be required for Alternatives 2 and 4. These will require some additional road and winter maintenance. It is expected that similar maintenance of parking lots and facilities will be required at all locations. **Alternative 1 is the preferred option in terms of effects on the economic environment, however there is minimal difference between the effects of Alternatives 1 and 2.**		
Factor: Cultural Environment			

Table 5.1.2.16-1 Evaluation of Alternative Locations for the LRT Maintenance and Storage Facility

	Alternative 1 Walkley Facility	**Alternative 2** Lester Facility	**Alternative 4** Bowesville Facility
Effect on Heritage Resources	None.	None.	Two listed heritage buildings are located on southeastern portion of the property. These could potentially be impacted by vibrations from an adjacent facility.
EFFECT ON ARCHAEOLOGICAL RESOURCES	None.	Pre-contact archeological potential within 200 m of Sawmill Creek.	Area of particular concern – prehistoric and 19th C farm complexes and archeological sites around High Rd. and former CPR tracks.
Effect on Landscape Composition	None – currently a rail facility.	Significant – currently part of the NCC Greenbelt.	Significant – currently undeveloped fields.
Summary	Alternative 4 presents the greatest potential for loss of cultural environment among the alternative locations. The site houses listed heritage buildings and significant potential for discovery of archeological finds. An archeological assessment should be completed if this site is selected for development. Alternative 2 presents some potential for effects on the cultural environment as a result of the Sawmill Creek crossings on-site. As well, the site is part of the NCC Greenbelt, which is a significant landscape feature within the City of Ottawa. **Alternative 1 is the preferred option in terms of impact on the cultural environment as there are no heritage resources or archeological potential at the site as a result of the existing rail facility.**		
Factor: Transportation			
Effect of Geometrics	None.	Minimal - potential impact for cyclists traveling along the Airport Parkway as a result of employee access to the facility.	
Effect of Surrounding Land Use on Accessibility	Easily accessible via Albion Rd.	Will require construction of access roads to/ from the Airport Parkway (permission already granted).	Accessible via Bowesville Rd.

Table 5.1.2.16-1 Evaluation of Alternative Locations for the LRT Maintenance and Storage Facility

	Alternative 1 Walkley Facility	**Alternative 2** Lester Facility	**Alternative 4** Bowesville Facility
Effect on Traffic/Transit Operations	Trains moving from the facility to the main lines may cause disruptions to trains already in operation as a result of complicated maneuvers required of southbound trains.	None.	None.
Impact on City of Ottawa Facilities and Plant	N/A –differences between alternatives are not significant.		
EFFECT OF LOCATION ON LRT OPERATIONS	Facility located parallel to an existing CN freight line that crosses the proposed LRT line just south of the facility. This crossing requires a rail overpass. In order to access this overpass, trains from the facility will first need to travel north and then switch directions prior to heading south towards Barrhaven.	None.	None.
Location Accessibility	Poor – single point of entry (on western end)	Good – two points of entry	Good – two points of entry
Serviceability	Services already onsite.	Services are accessible from a nearby community.	Hydro and water accessible from Albion Rd. Unknown if sewer could be brought on-site.
Summary	Alternative 1 presents some significant problems in terms of facility operations. This is a result of the site's alignment and close proximity to the existing CN Rail freight line. The facility currently has one point of access, and all trains, including those heading southbound, must exit heading northbound and then maneuver into the proper direction. Alternative 4 presents problems in terms of site serviceability. **Alternative 2 is the preferred option in terms of transportation. The station could be easily entered and exited by trains heading in either direction, is readily serviceable, and is located along a straight section of an existing rail line. Permission has also been granted to allow for a right in/out access road from the Airport Parkway.**		
Factor: Cost			

Table 5.1.2.16-1 Evaluation of Alternative Locations for the LRT Maintenance and Storage Facility

	Alternative 1 Walkley Facility	**Alternative 2** Lester Facility	**Alternative 4** Bowesville Facility
Capital Cost	Low capital cost.	Low capital cost (City of Ottawa owns property) Some additional landscaping will be required to ensure the aesthetic value of the property is not lost.	Higher capital/property costs.
Annual Cost	Additional operating costs associated with time lost to required maneuvering of southbound trains (as a result of facility accessibility and proximity of the CN rail line).	No significant difference between alternatives.	
Life Cycle Cost	No significant difference between alternatives.		
Summary	Time lost to maneuvering around the existing CN rail line has the potential to introduce significant additional costs to Alternative 1. This uncertainty in annual costs makes alternative 1 less desirable. Alternative 4 is not preferred due to the higher purchase price associated with the required lands. There could also be additional problems associated with negotiating land purchase with Transport Canada. **Alternative 2 is the preferred option in terms of costs. The City of Ottawa already owns the land and there are no other significant cost differences between the other alternatives.**		

From a review of the potential impacts to the natural, social, economic and cultural environments it can be concluded that there are no significant adverse environmental effects associated with the alternatives and that the adverse effects can be effectively mitigated. It is recognized that each alternative has different potential effects on the different components of the environment. The potential effects and proposed mitigation measures, and significance of the effects for all three Maintenance Facilities are outlined in more detail in Sections 5.1.2.16.1-5.1.2.16.3.

5.1.2.16.1 Proposed Mitigation for Alternative 1 – Walkley Facility

Figure 5.1.2.16.1-1 depicts the conceptual plan for the Walkley Facility.

Natural Environment

Alternative 1 (Walkley Facility) is located within an existing rail facility and therefore the direct impacts will be minimal. However this site is bordered to the north and to the south by designated UNAs, one of which- the Conroy Swamp/Greenboro Turtlehead Natural Area- is listed as having a 'high' environmental rating. The wetland communities in this natural area are dependent on both groundwater and surface water, and are particularly sensitive to land use changes that would affect either the quantity or quality of ground or surface water. Therefore, while this alternative should not encroach directly into the Conroy Swamp/Greenboro Turtlehead Natural Area, some potential exists for indirect impacts to the wetland communities through drainage-related impacts to surface or groundwater, either during construction or during operation of the site. However, the potential for these indirect impacts can be managed with implementation of drainage-related mitigation measures. Existing flow across the facility will be retained to avoid outletting into the existing Turtlehead Nature Area watershed. Any surplus flow will be treated and directed away from this area.

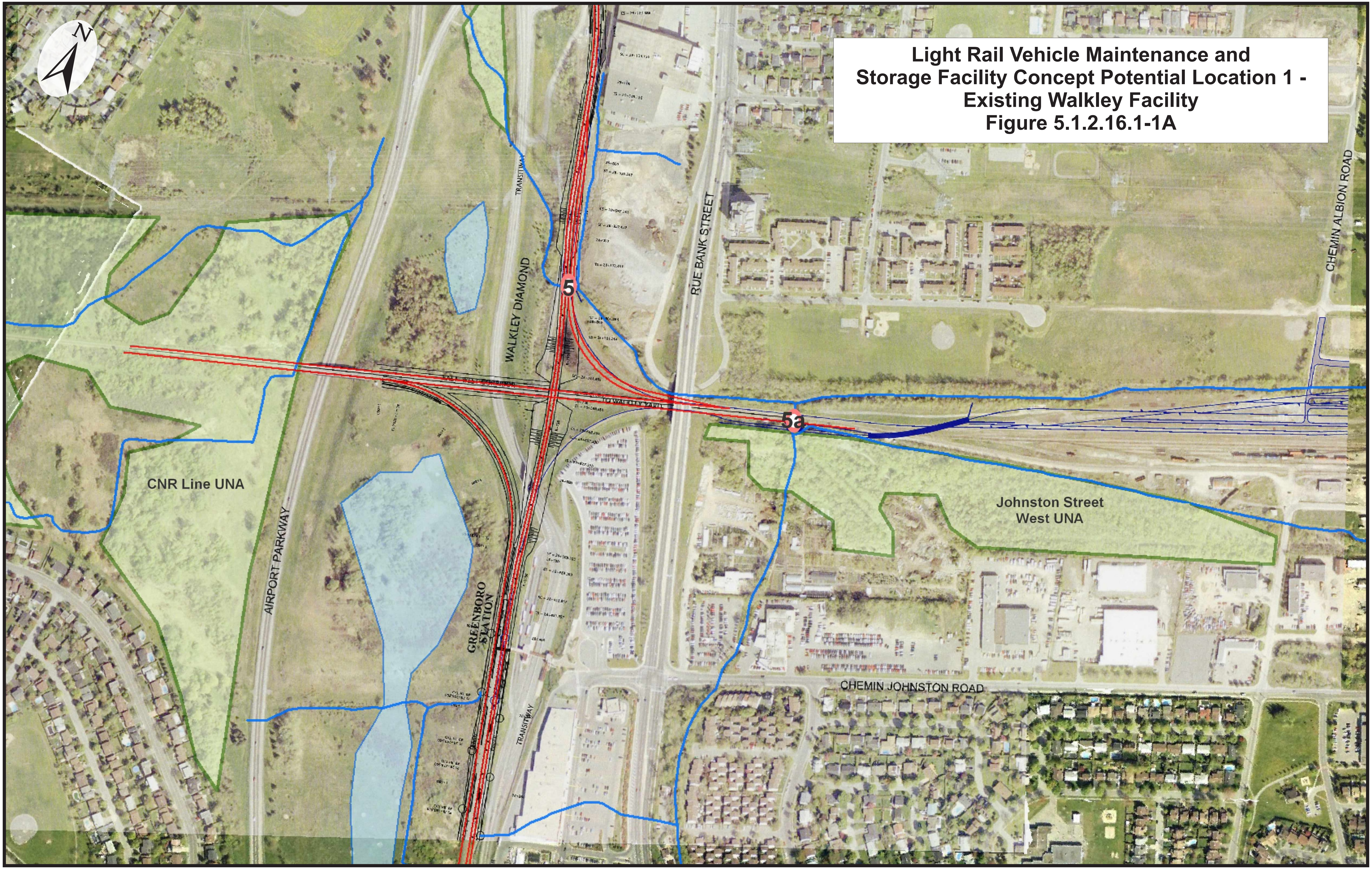
This site will directly impact the southeast edge of the Conroy Woods UNA, a disturbed upland deciduous forest.

Sawmill Creek (Crossings #5 & 5a) is conveyed through culverts under the existing railway at the west end of this site. The development of the facility at this location would not involve any additional direct impacts to the creek. However, some potential exists for incremental indirect impacts to the creek via surface and groundwater during construction and/or operation of the facility. These effects can be managed with implementation of construction-related and site drainage and stormwater management measures.

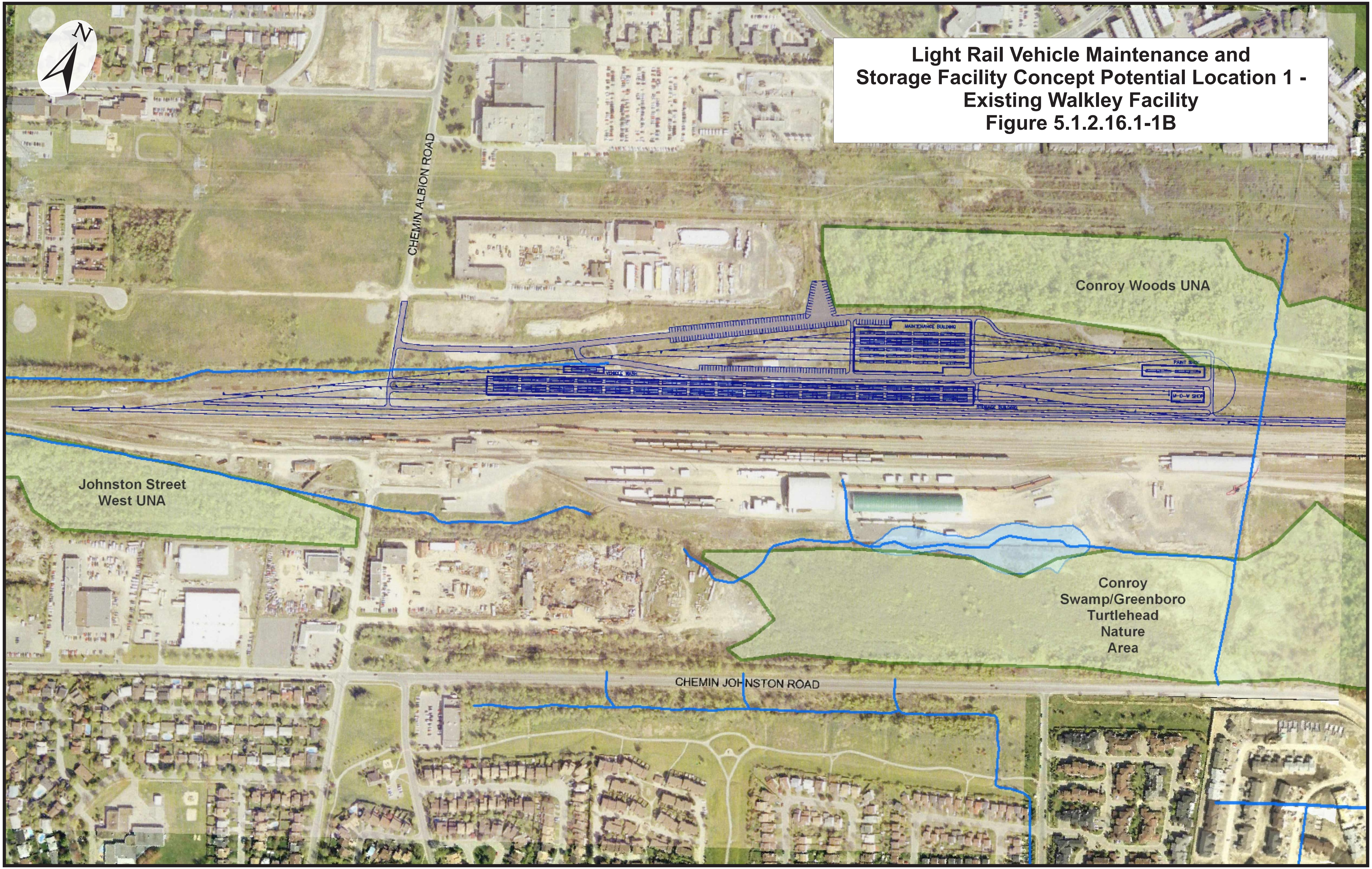
The following mitigation measures are proposed to minimize potential adverse effects to natural features and watercourses around the Walkley Alternative during construction:

- Minimize encroachment into the Conroy Woods UNA to extent feasible.
- Employ sedimentation and erosion control measures.
- Ensure existing hydrologic regimes supporting wetlands and watercourses will be maintained.
- Install temporary protection fencing along the edges of the adjacent natural areas prior to grading and maintain throughout construction.
- MBCA compliance for protection of any nesting migratory birds.
- Implement vegetation clearing measures.
- Proper disposal of all construction-related debris following construction.

All other relevant standard mitigation measures outlined in Section 5.1.1 will also be implemented. This alternative will not result in significant residual adverse effects with implementation of the above noted mitigation measures.



Light Rail Vehicle Maintenance and Storage Facility Concept Potential Location 1 - Existing Walkley Facility
Figure 5.1.2.16.1-1A



Light Rail Vehicle Maintenance and Storage Facility Concept Potential Location 1 - Existing Walkley Facility
Figure 5.1.2.16.1-1B

Stormwater

The impervious surfaces and maintenance/cleaning operations that will take place at the maintenance and storage facilities will have effects both on the quantity and quality of runoff. The specific water quality issues are related to an increase in discharged hydrocarbons and detergents.

Efffects on the quantity and quality of runoff from the storage and maintenance facilities will be mitigated through the use of technologies such as oil/grit separators or stormcepters, diversion to existing stormwater management ponds (SWMP) and improved ditching. Oil/grit separators and stormceptor basins are installed as part of the storm sewer system. Through a series of baffles and filters they effectively remove both fine and coarse grit, as well as petroleum products. It is recommended that water passing through the separators and/or stormceptors be outlet into existing SWMP's. Improved ditches will provide additional treatment and attenuation for water not captured by the storm water sewer system (i.e. from permeable surfaces). In an effort to conserve water and reduce impacts on the environment, recycling of washwater should be investigated. Existing flow across the facility will be retained to avoid outletting into the existing Turtlehead Nature Area watershed. Any surplus flow will be treated and directed away from this area.

The following mitigation measures are proposed to minimize adverse effects on the quality of the surface waters:

- Establish a spills action plan
- Undertake a detailed drainage investigation of the site
- Employee "Best Practices" for drainage design
- Construct SWM ponds to ensure the quality and control flows
- Use oil and grit collectors
- Control areas of refilling
- Monitor/record spill clean up

With the implementation of the above noted mitigation measures this alternative will not result in significant residual adverse effects.

Social Environment

This site is located in proximity to an existing residential community. The potential adverse effects to this community are anticipated to be low given that the site currently functions as a rail facility. A noise and vibration assessment has been undertaken and concluded that there will be no significant impact to the adjacent residential properties. The following outline the proposed measures to mitigate any potential adverse effects on the adjacent community during construction and operation.

- Operation will be limited to the hours allowable under City of Ottawa by-laws;
- Aesthetic impacts of the maintenance facility will be mitigated through buffer zones and landscaping;
- The mitigation measures outlined in Sections 5.1.2.6 and 5.1.2.7 for construction noise and vibration will be followed; and
- The mitigation measured outlined in Section 5.1.2.10 for disposal of contaminated material, waste management and storage will be followed.

With the implementation of the above noted mitigation measures this alternative will not result in significant residual adverse effects.

Figure 5.1.12.16.1-2 Sensitive Land Uses Surrounding Alternative 1 (Walkley Facility)

Economic Environment

This alternative does not have any impacts on the economic environment and therefore no mitigation is required. A noise and vibration assessment has been undertaken and concluded that there will be no significant impact to the adjacent properties.

Cultural Environment

This alternative does not have any impacts on the cultural environment and therefore no mitigation is required.

Significance

With the implementation of the above noted mitigation measures this alternative is not anticipated to result in any adverse environmental effects.

5.1.2.16.2 Proposed Mitigation for Alternative 2 – Lester Facility

Figure 5.1.2.16.2-1 depicts the conceptual plan for the Lester Facility.

Natural Environment

While much of the vegetation within Alternative 2 is culturally influenced or young and is not of high ecological significance, the southern portion of the site forested and is mapped as part of the Airport Parkway Natural Area (part of the NCC Greenbelt). This alternative will remove ~ 7 ha of a low-lying, young to mid-aged poplar deciduous forest and the northern portion of a flooded willow thicket swamp within the Airport Parkway Natural Area. While this would be the largest area of vegetation and associated habitat removed from a designated natural area associated with the project, the Airport Parkway Natural Area covers a total area of 436.6 ha (the largest natural area within the study area). Therefore, in the context of the overall natural area, the proposed removal represents a relatively minor effect. There are no unique features or functions associated with the affected portion. The affected habitat is represented within the extensive natural area generally.

The balance of the site that is not part of a designated natural area is primarily rolling upland cultural meadow habitat with scattered trees, shrubs, Staghorn Sumac thickets and hedgerows.

As well, a small flooded willow thicket swamp community located south of the site may experience indirect effects (e.g. via surface and groundwater) as a result of construction and operation of the facility at this location. However, these potential indirect impacts can be managed with implementation of drainage-related mitigation measures.

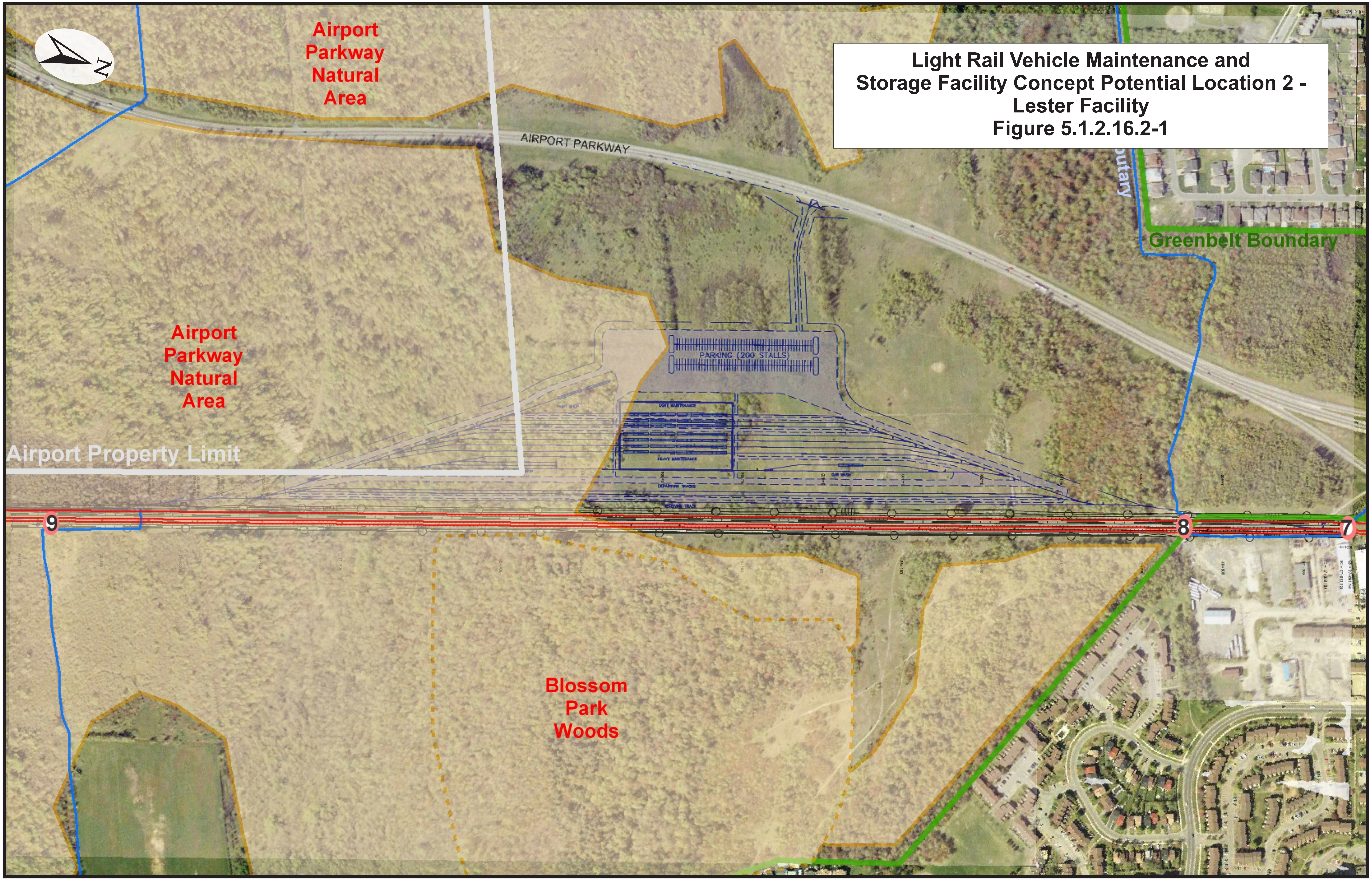
This alternative will not have any direct impacts on any watercourses. While some potential exists for indirect impacts to watercourses located north (Cahill Drain #7/8) and south (Sawmill Creek Tributary #9/10) of the site construction or operational-related effects to surface and groundwater, there indirect impacts can be managed with implementation of drainage mitigation measures.

The following mitigation measures are proposed to minimize potential adverse effects to the natural features, including the Airport Parkway Natural Area, and watercourses around the facility during construction:

- Minimize encroachment into the Airport Parkway Natural Area to the extent feasible
- Employ sedimentation and erosion control measures. (OPSS 577 – Temporary Erosion and Sedimentation Control)
- Ensure existing hydrologic regimes supporting wetlands and watercourses will be maintained.
- Install temporary protection fencing along the edges of the adjacent natural areas prior to grading and maintain throughout construction.
- MBCA compliance for protection of any nesting migratory birds.
- Implement vegetation clearing measures. (OPSS 201 – Clearing)
- Proper disposal of all construction-related debris following construction. (OPSS 180 – Waste Disposal)
- Ensure an environmental inspector is on site during construction to ensure compliance with mitigation measures.

OPSS 577, OPSS 201 and OPSS 180 are provided in Appendix H. All OPSS documents can also be viewed online via:
http://www.raqsa.mto.gov.on.ca/techpubs/ops.nsf/wv?openview&RestrictToCategory=Volume%201&count=1000

All other relevant standard mitigation measures outlined in Section 5.1.1 will also be implemented. This alternative will not result in significant residual adverse effects with implementation of the above noted mitigation measures.



Light Rail Vehicle Maintenance and Storage Facility Concept Potential Location 2 - Lester Facility
Figure 5.1.2.16.2-1

Stormwater

The impervious surfaces and maintenance/cleaning operations that will take place at the maintenance and storage facilities will have effects both on the quantity and quality of runoff. The specific water quality issues are related to an increase in discharged hydrocarbons and detergents.

Effects on the quantity and quality of runoff from the storage and maintenance facilities will be mitigated through the use of technologies such as oil/grit separators or stormcepters, diversion to existing stormwater management ponds (SWMP) and improved ditching. Oil/grit separators and stormceptor basins are installed as part of the storm sewer system. Through a series of baffles and filters they effectively remove both fine and coarse grit, as well as petroleum products. It is recommended that water passing through the separators and/or stormceptors be outlet into existing SWMP's. Improved ditches will provide additional treatment and attenuation for water not captured by the storm water sewer system (i.e. from permeable surfaces). In an effort to conserve water and reduce impacts on the environment, recycling of washwater should be investigated.

The following mitigation measures are proposed to minimize adverse effects on the quality of the surface waters:

- Establish a spills action plan
- Undertake a detailed drainage investigation of the site
- Employee "Best Practices" for drainage design
- Construct SWM ponds to ensure the quality and control flows
- Use oil and grit collectors
- Control areas of refilling
- Monitor/record spill clean up

With the implementation of the above noted mitigation measures this alternative will not result in significant residual adverse effects.

Social Environment

The land use designation from the Greenbelt Master Plan, shows the proposed maintenance facility occupies both a buildable site area and a rural landscape designations.

From the Greenbelt Master Plan policies, land uses that fit the buildable site area designation include:

- facility-intensive uses;
- small scale commercial uses;
- community oriented facilities;
- Residential Uses and Settlement patterns;
- Transportation Facilities;
- Utilities; and
- Waste Management.

The maintenance facility falls under the transportation category which states that intrusions of these facilities on Greenbelt activities should be minimized but are acceptable. Rural Landscapes include forestry and mineral resources. Transportation facilities have a medium importance within a rural landscape.

The closest residential community (Blossom Park/Windsor Park [including the Emerald Woods residences]) is located more than 300m from this site. The proposed site for the maintenance facility is west of the LRT rail corridor. Crossing this corridor was prohibited in the past when the freight rail was operational. Recently, some residents may have been traversing this area for recreational uses but fencing along the corridor will again be used when the LRT is operational. In accordance with the NCC Greenbelt Land Designation map (Figure 4.2.1-8), the areas and links where recreation can take place throughout the greenbelt are designated as core natural areas, buffers and links. These areas are situated adjacent the east side of the LRT rail corridor. The potential adverse effects to this community are anticipated to be low given the buffer zone between of this community and the maintenance facility, landscaping will be implemented to reduce any potential impacts (e.g. aesthetic). The site is currently zoned as “IG” (institutional government) which is compatible with its proposed use.

A noise and vibration assessment has been undertaken and concluded that there will be no significant impacts. The following outline the proposed measures to mitigate any potential adverse effects on the adjacent community during construction and operation.

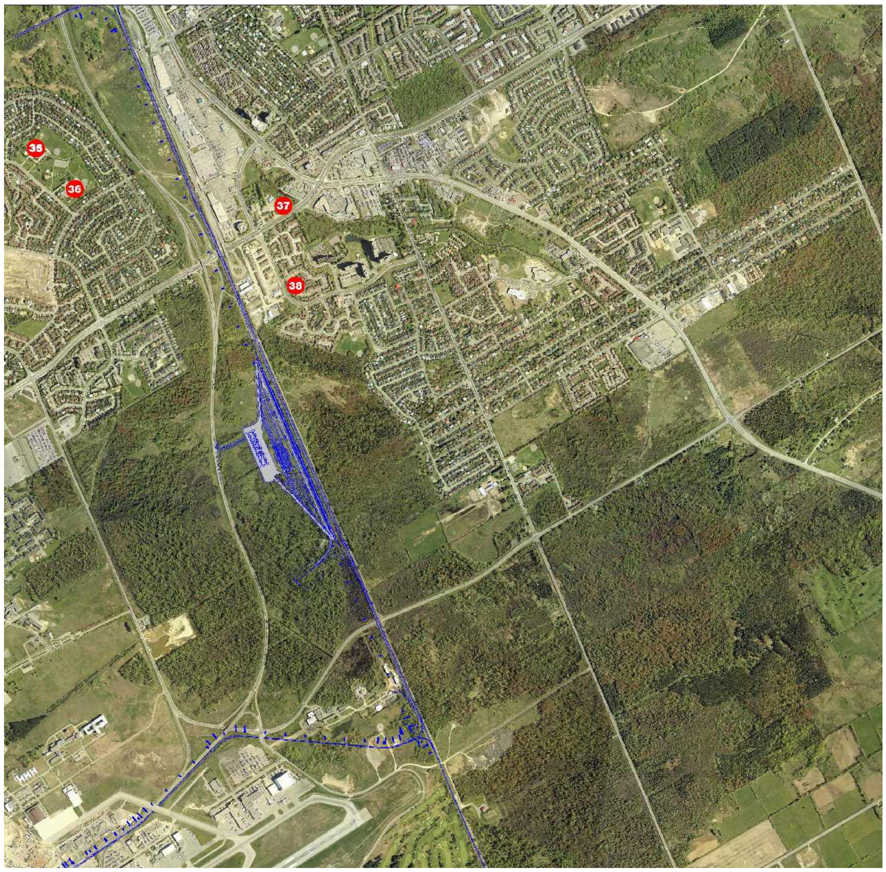
- Operation will be limited to the hours allowable under City of Ottawa by-laws;
- Aesthetic impacts of the maintenance facility will be mitigated through buffer zones and landscaping;
- The mitigations measures outlined in Section 5.1.2.4 for recreational trails will be followed;
- The mitigation measures outlined in Sections 5.1.2.6 and 5.1.2.7 for construction noise and vibration will be followed; and
- The mitigation measures outlined in Section 5.1.2.10 for waste management and storage will be followed.

With the implementation of the above noted mitigation measures this alternative will not result in significant residual adverse effects.

Economic Environment

This alternative does not have any impacts on the economic environment. A noise and vibration assessment has been undertaken and concluded that there will be no significant impact to the adjacent properties. Aesthetic impacts of the maintenance facility will be mitigated through buffer zones and landscaping to minimize impacts on adjacent properties.

Figure 5.1.2.16.2-2 Sensitive Land Uses Surrounding Alternative 2 (Lester Facility)



Cultural Environment

This alternative does not impact any heritage features but is an undisturbed site and has the potential for archaeological finds. The following mitigation is proposed:

- Undertake a Stage 2 Archaeological Assessment. If archaeological finds are discovered, Stage 3-4 mitigation will be undertaken as required in accordance with the guidelines and policies of the Ministry of Culture.
- Submit additional Archaeological Assessments (i.e. Stage 2, Stage 3 and, Stage 4 Reports for the areas noted above) a minimum of 90 days prior to construction to the Ministry of Culture.
- Should buried archaeological deposits be found along any section of the corridor during construction activities, the Ministry of Culture (416-314-7148) will be notified immediately. No further disturbance of the deposits will occur until a licensed archaeologist has been consulted.
- In the event that human remains are encountered during construction activities, both the Ministry of Culture (416-314-7148), and the Registrar or Deputy Registrar of the Cemeteries Regulation Unit of the Ministry of Consumer and Commercial Relations, (416-326-8392), will be notified immediately.

Significance

With the implementation of the above noted mitigation measures this alternative is not anticipated to result in any adverse environmental effects.

5.1.2.16.3 Proposed Mitigation for Alternative 3 – Bowesville Facility

Figure 5.1.2.16.3-1 depicts the conceptual plan for the Bowesville Facility.

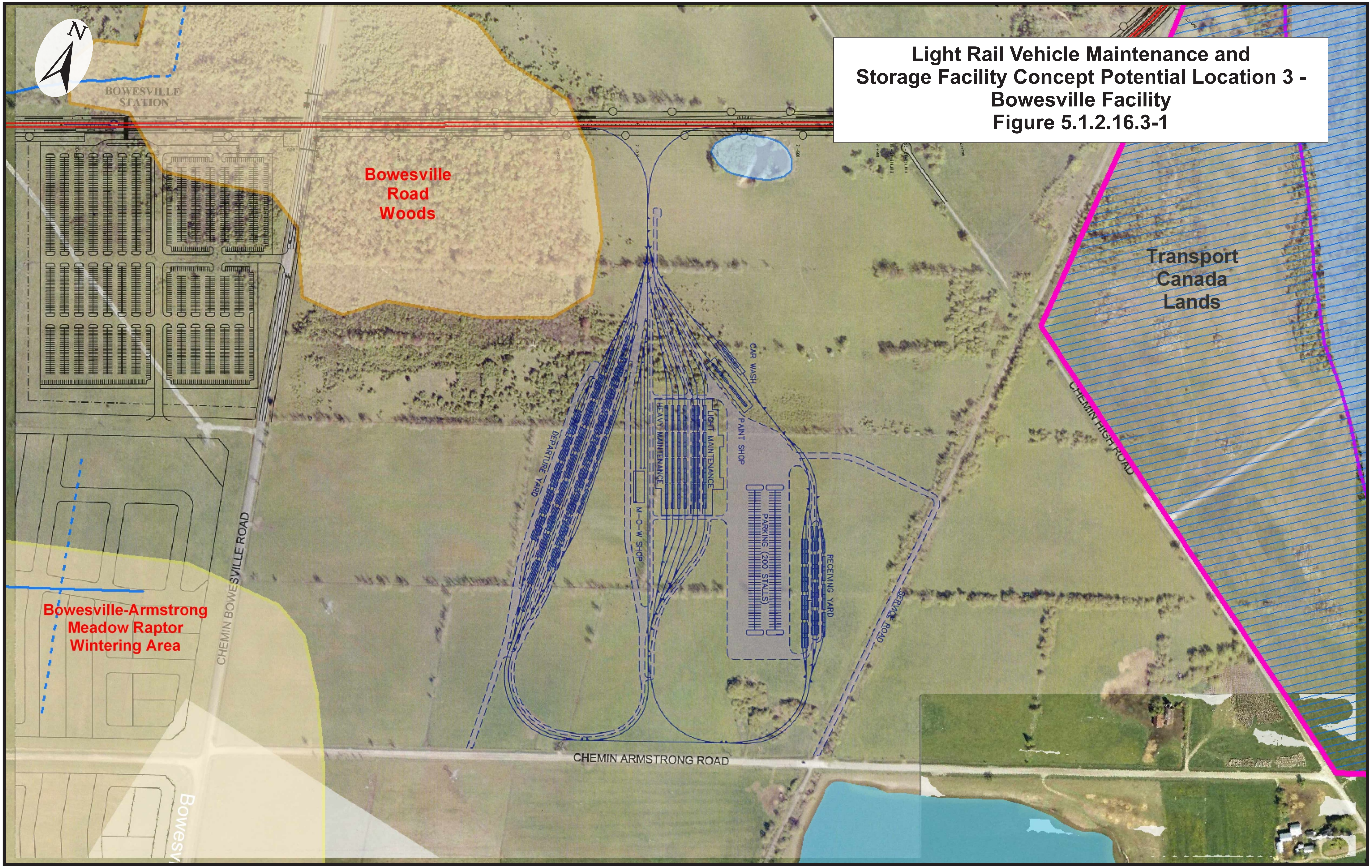
Natural Environment

Land use on this alternative site is predominately cattle pasture, and therefore potential adverse effects of facility construction at this site to natural features are generally minor. However, construction of the rail facility would require removal of some individual trees within hedgerows, a regenerating forest habitat and small, isolated, grazed woodland located on the northwest portion of the site. There are no watercourses located on or in the vicinity of the site. There are no designated natural areas located on or adjacent to the site, although the Albion Road (Leitrim) Wetland is located to the east. However, it is separated from the alternative facility site by the existing abandoned railway embankment, and is located some distance to the east. Therefore, this PSW should not be affected by this alternative

The following mitigation measures are proposed to minimize adverse effects to the natural features associated with the Alternative 3 site during construction:

- MBCA compliance for protection of any nesting migratory birds.
- Implement vegetation clearing measures.
- Proper disposal of all construction-related debris following construction.
- Ensure an environmental inspector is on site during construction to ensure compliance with mitigation measures.

All other relevant standard mitigation measures outlined in Section 5.1.1 will also be implemented. This alternative will not result in significant residual adverse effects with implementation of the above noted mitigation measures


Light Rail Vehicle Maintenance and
Storage Facility Concept Potential Location 3 -
Bowesville Facility
Figure 5.1.2.16.3-1
N
BOWESVILLE
STATION
Bowesville
Road
Woods
Transport
Canada
Lands
CAR WASH
PAINT SHOP
LIGHT MAINTENANCE
HEAVY MAINTENANCE
DEPARTURE YARD
M-O-W SHOP
PARKING (200 STALLS)
RECEIVING YARD
SERVICE ROAD
CHEMIN HIGH ROAD
CHEMIN BOWESVILLE ROAD
CHEMIN ARMSTRONG ROAD
Bowesville-Armstrong
Meadow Raptor
Wintering Area

Stormwater

The impervious surfaces and maintenance/cleaning operations that will take place at the maintenance and storage facilities will have effects both on the quantity and quality of runoff. The specific water quality issues are related to an increase in discharged hydrocarbons and detergents.

Effects on the quantity and quality of runoff from the storage and maintenance facilities should be mitigated through the use of technologies such as oil/grit separators or stormcepters, diversion to existing stormwater management ponds (SWMP) and improved ditching. Oil/grit separators and stormceptor basins are installed as part of the storm sewer system. Through a series of baffles and filters they effectively remove both fine and coarse grit, as well as petroleum products. It is recommended that water passing through the separators and/or stormceptors be outlet into existing SWMP's. Improved ditches will provide additional treatment and attenuation for water not captured by the storm water sewer system (i.e. from permeable surfaces). In an effort to conserve water and reduce impacts on the environment, recycling of washwater should be investigated.

The following mitigation measures are proposed to minimize adverse effects on the quality of the surface waters:

- Establish a spills action plan
- Undertake a detailed drainage investigation of the site
- Employee "Best Practices" for drainage design
- Construct SWM ponds to ensure the quality and control flows
- Use oil and grit collectors
- Control areas of refilling
- Monitor/record spill clean up

With the implementation of the above noted mitigation measures this alternative will not result in significant residual adverse effects.

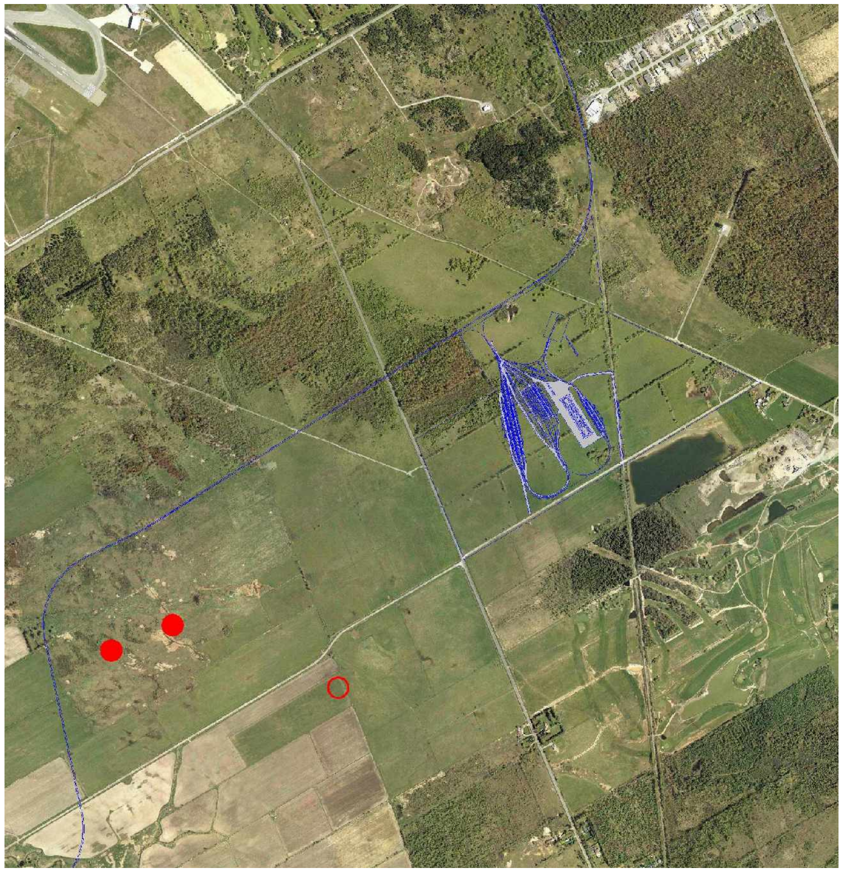
Social Environment

There are no residential community in proximity to the site. Therefore, no adverse effects are anticipated. A noise and vibration assessment has been undertaken and concluded that there will be no significant impact to the adjacent properties. The following outline the proposed measures to mitigate any potential impacts during construction and operation.

- Facility operation will be limited to the hours allowable under City of Ottawa by-laws;
- Aesthetic impacts of the maintenance facility will be mitigated through buffer zones and landscaping;
- The mitigation measures outlined in Sections 5.1.2.6 and 5.1.2.7 for construction noise and vibration will be followed.
- The mitigation measures outlined in Section 5.1.2.10 for waste management and storage will be followed

With the implementation of the above noted mitigation measures this facility alternative will not result in significant residual adverse effects.

Figure 5.1.12.16.3-2 Sensitive Land Uses Surrounding Alternative 3 (Bowesville Facility)



Economic Environment

This alternative does not have any impacts on the economic environment. A noise and vibration assessment has been undertaken and concluded that there will be no significant impact to the adjacent properties. Aesthetic impacts of the maintenance facility will be mitigated through buffer zones and landscaping to minimize impacts on adjacent properties.

Cultural Environment

Two heritage properties are located on the southeast portion of the site. These sites are not anticipated to be displaced; however, they could be impacted by vibration during construction. Therefore, the mitigation measures outlined in Sections 5.1.2.6 and 5.1.2.7 for construction noise and vibration will be followed.

The property is also an undisturbed site and has the potential for archaeological finds. The following mitigation is proposed:

- Undertake a Stage 2 Archaeological Assessment. If archaeological finds are discovered, Stage 3-4 mitigation will be undertaken as required in accordance with the guidelines and policies of the Ministry of Culture.
- Submit additional Archaeological Assessments (i.e. Stage 2, Stage 3 and, Stage 4 Reports for the areas noted above) a minimum of 90 days prior to construction to the Ministry of Culture.

- Should buried archaeological deposits be found along any section of the corridor during construction activities, the Ministry of Culture (416 314-7148) will be notified immediately. No further disturbance of the deposits will occur until a licensed archaeologist has been consulted.
- In the event that human remains are encountered during construction activities, both the Ministry of Culture (416 314-7148), and the Registrar or Deputy Registrar of the Cemeteries Regulation Unit of the Ministry of Consumer and Commercial Relations, (416 326-8392), will be notified immediately.

Significance

With the implementation of the above noted mitigation measures this alternative is not anticipated to result in any adverse environmental effects.

5.1.2.17 NRCan

Natural Resources Canada (NRCan) operates a Geomagnetic Laboratory on a 100 hectare site located at the corner of Anderson Road and Dolman Road. The site was chosen in the mid-1960s because of the very low horizontal magnetic field gradient in the region and because of its quiet location away from industrial sources of magnetic noise. The facility is unlike any other in Canada, in fact, it is unique in North America. It is a site for both theoretical and applied research into geomagnetic hazards, the home of the Space Weather Forecast Centre, a centre for development, maintenance, calibration and testing of magnetometers and magnetotelluric instruments, the flagship site for magnetic field monitoring in Canada, and a support laboratory for several other programs within the Earth Sciences Sector (ESS).

A special feature of the facility is the lack of magnetic interference, or noise, from human technology or activity. This enables NRCan to test and calibrate instruments of very high precision such as those used for mineral exploration, for submarine detection, for satellites, as well as those used in our own observatories.

The construction of the North-South Corridor LRT system in Ottawa has the potential to result in adverse effects on many of the activities currently carried out at the Laboratory, especially those requiring precise calibrations and those requiring a low magnetic noise environment. Specific activities that can be adversely affected relate to testing and calibration of instruments, and to the recording of data at the Ottawa Magnetic Observatory.

The potential adverse effect to these activities is caused by the presence of magnetic noise or interference, caused by stray currents emanating from the electrically powered LRT system, and the magnetic field that results from the flow of current out on the overhead wire and back to the rail. This noise limits the ability to record changes in the magnetic field with amplitudes comparable to the level of the noise. Furthermore, magnetic noise makes it impossible to properly calibrate precision instruments or to carry out tests to determine the characteristics of the instruments.

The level of magnetic noise that can be tolerated depends on the precision that the instrument is designed to achieve. This, in turn, is driven by the needs of users of the data. For science, industry, and defence purposes, the current required precision is about 0.01 nT. This means that the level of noise must be less than that.

The proposed North-South Corridor LRT system will be powered by direct current (DC) operating at a voltage of 1500 V with a peak current of 1000 A. There will be 7 substations at 3 km intervals. The rails will be well insulated and the leakage current is expected to be 20 A at the most. Nevertheless, the system will produce a magnetic field. Given the very sensitive nature of modern magnetic instruments, the maximum cultural noise that can be tolerated is in the order of 0.01 nT (nanotesla – to note, the average strength of the earth's magnetic field is 50,000 nT).

Preliminary calculations completed by NRCan have indicated that the North-South Corridor LRT project, which is located approximately 10 km from the facility, {Reference to E-W line taken out as this EA only addresses the N-S line}could result in a magnetic noise level of approximately 1 nT, representing 100 times the tolerance limit.
To verify the results of these estimates, NRCan undertook measurements of a similar LRT System in Calgary, Alberta. The analysis of the data is quite complex and was not completed at the time of this writing. Conclusive scientific results are expected to be available in June 2006.

Significance

Should the results of the in-depth analysis by NRCan demonstrate that the North-South LRT line would increase the surrounding magnetic noise to a level that is incompatible with the requirements of the facility, parts of the facility as required, will be relocated to a new facility in a suitable location as identified by NRCan. Moving those parts of the facility that will be adversely impacted will mitigate the significant environmental effect resulting from the project. As a result, it is not anticipated that there will be any residual significant adverse environmental effect.

In the event that part of the facility must be relocated, the City of Ottawa will work cooperatively with the federal government on the resolution of a cost-sharing agreement for the construction and relocation of the affected government operations. These negotiations will be undertaken outside of the environmental assessment process.

5.1.2.18 Potential Staging and Construction Accesses

The potential environmental effects outlined in this report are based on the details of the project as identified at a conceptual or functional design level. As the project is being constructed through a design-build process, the detail design and details of construction, potential construction staging areas and construction accesses will be further developed. Ottawa will stipulate procedures and protocols that are to be followed by the selected contractor through the design, construction and operation and maintenance stages of the project.

A number of properties have been identified where it is anticipated that the selected contractor may require property for construction staging and access purposes. It is recognized that detailed impact assessment has not occurred on these sites. However the City is committed to providing the necessary details on the potential effects and proposed mitigation measures as design progresses. The contractor shall be responsible for meeting any and all conditions set out in the occupancy permit or easement agreement for the individual properties. The City of Ottawa has been and will continue to be actively involved in the application for occupancy of federal lands by the contractor. The details of the occupancy permits cannot be established until the selected contractor is carrying out detail design and is developing a detailed project schedule. During the application and review stage any environmental constraints shall be identified and a management plan developed.

The following figures (5.1.2.18-1 to 5.1.2.18-5) show the locations of these potential construction staging areas and accesses. The details contained in these figures are also depicted in Appendix I.

Figure 5.1.2.18-1 Potential Construction Staging Areas and Accesses

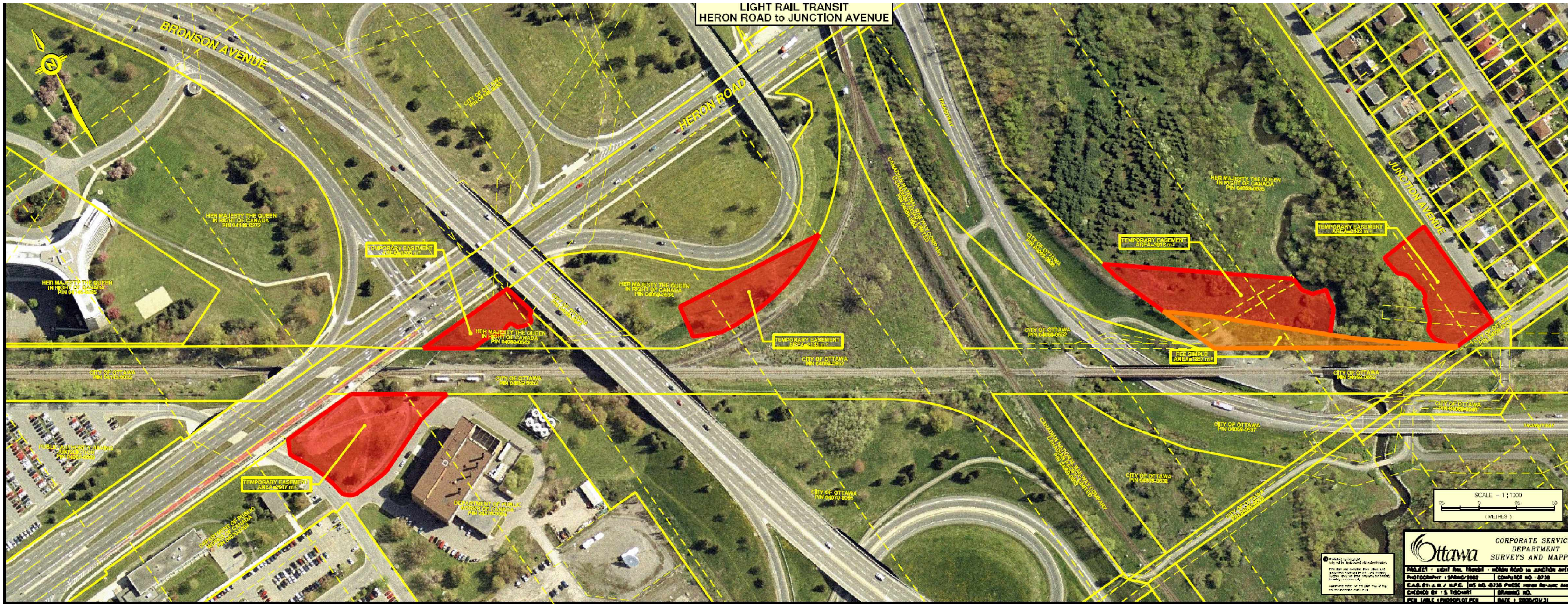


Figure 5.1.2.18-2 Potential Construction Staging Areas and Accesses

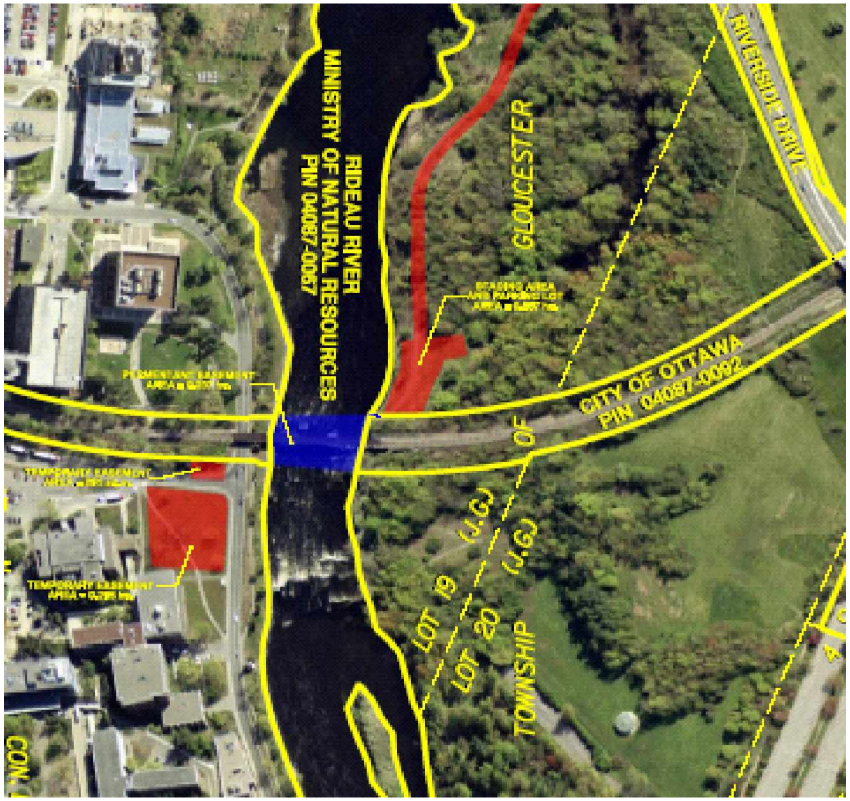


Figure 5.1.2.18-3 Potential Construction Staging Areas and Accesses

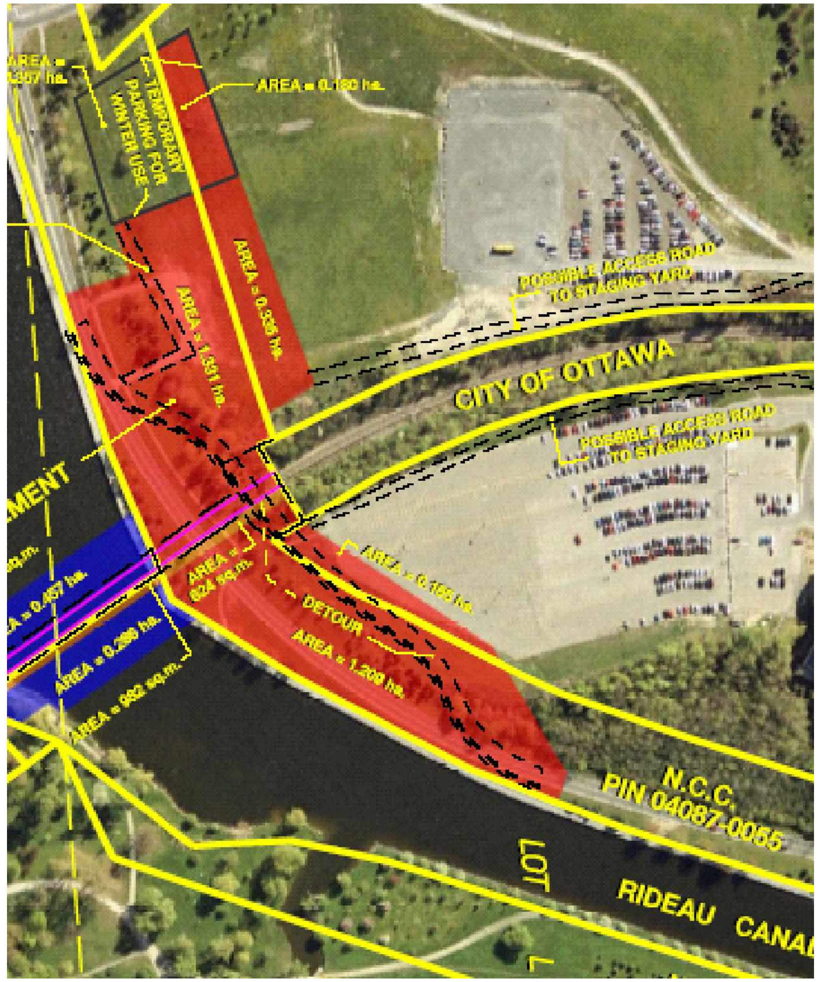


Figure 5.1.2.18-4 Potential Construction Staging Areas and Accesses

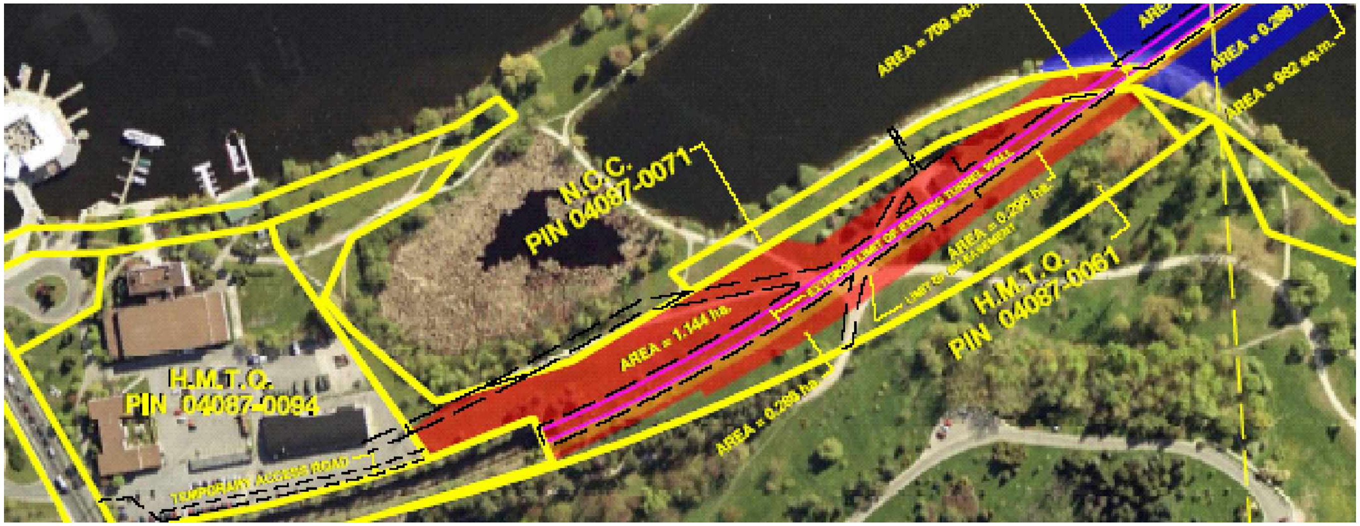
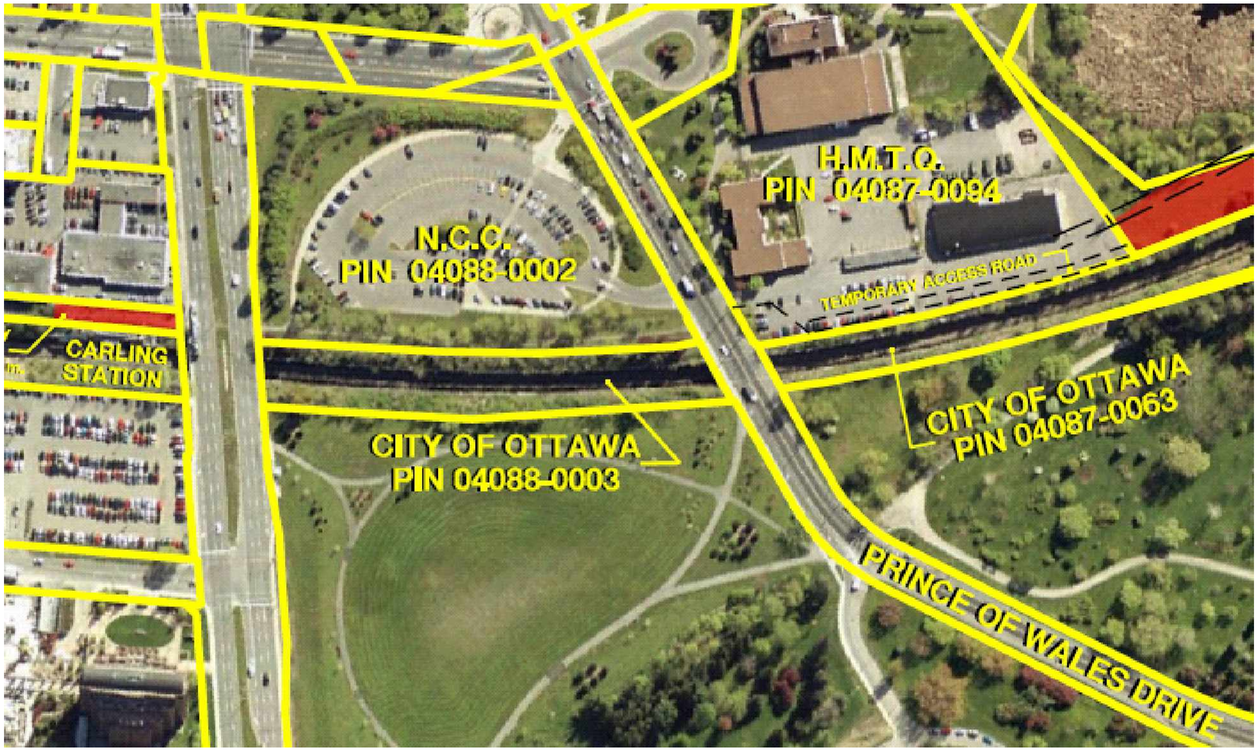


Figure 5.1.2.18-5 Potential Construction Staging Areas and Accesses



5.1.3 Summary of Significant of the Potential Environmental Effects of the Project

Tables 5.1.3-1 and 5.1.3-2 provide a summary of the potential environmental effects during the construction and operational/maintenance phases and their significance associated with the project on the various environmental components examined. Significance was determined based on the significance of the potential residual environmental effects taking into consideration, where applicable, the following characteristics of the effects:

- Direction – measure of relative effect, i.e. positive or negative;
- Geographic extent / location – spatial area affected by a project – local, regional, national, global
- Frequency – measure of repetitions -one time, recurring
- Duration – measure of the length of time a potential effect could last, i.e. short-term, long-term;
- Magnitude – potential severity of the effect; based on relationship to a regulation or guidelines or accepted industry standards;
- Occurrence – measure of likelihood of the effect;
- Reversibility/Mitigation – the potential for recovery and ability to avoid effect or reduce time to recover
- Ecological – measure of the ecological impact of the effect with consideration of the relative ecological importance of the environmental component;
- Confidence – level of confidence in prediction of effect;
- Residual Effects – measure of overall effect with consideration of reversibility/mitigation;
- Cumulative Effects – measure of the net environmental effects associated with the project in combination of the environmental effects of other past, present or future projects or activities; and
- Significance – overall impact significance of the potential residual environmental effects.

Table 5.1.3-1 The Significance of Predicted Effects for the Construction of the North-South Corridor LRT													
Environmental Component	**Predicted Effect**	**Direction**	**Geographic Extent**	**Frequency**	**Duration**	**Magnitude**	**Occurrence**	**Reversibility / Mitigation**	**Ecological**	**Confidence**	**Residual Effects**	**Cumulative Effects**	**Significance**
Designated Natural Areas	Site specific impacts – many are fringe impacts	Negative	Isolated	Continuous	Long-Term	Low	Certain	Yes	Low	High	Low	Low	Not significant
Fish and Fish Habitat	Site specific impacts – culvert extension and realignments	Negative	Isolated	Continuous	Long-Term	Low	Certain	Yes	Low	High	Low	Low	Not significant
Surface and Ground Water	Site-specific impacts as a result of run-off and cuts	Negative	Isolated	Occasional	Short-Term	Low	Possible	Yes	Low	High	Low	Negligible	Not significant
Stormwater Management	Site-specific impacts as a result of run-off	Negative	Isolated	Occasional	Short-Term	Low	Possible	Yes	Low	High	Low	Negligible	Not significant
Vegetation, Wetlands, Wildlife and Migratory Birds	Site specific impacts – many are fringe impacts	Negative	Isolated	Continuous	Long-Term	Low	Certain	Yes	Low	High	Low	Low	Not significant
Species At Risk	Site specific habitat impacts	Negative	Isolated	Continuous	Long-Term	Low	Certain	No	Low	Medium	Low	Low	Not significant
Air Quality	Minor dust impacts	Negative	Isolated	Occasional	Short-Term	Low	Possible	Yes	Low	High	Negligible	Negligible	Not significant
Landuse	Minor nuisance effects (noise, traffic, etc)	Negative	Isolated	Occasional	Short-Term	Low	Possible	Yes	Low	High	Low	Negligible	Not significant
Central Experimental Farm	Site specific tree removal or destruction and reduced staff and pedestrian access	Negative	Isolated	Continuous	Long-Term	Low	Certain	Yes	Low	High	Low	None	Not significant
Rideau Canal	Site specific construction impacts - Access maintained	Negative	Isolated	Occasional	Short-Term	Low	Possible	Yes	Low	High	Negligible	None	Not significant
Recreation	Site specific construction impacts - alternative access provided	Negative	Isolated	Occasional	Short-Term	Low	Certain	Yes	Low	High	Negligible	None	Not significant
Health and Wellbeing	Site specific construction noise	Negative	Isolated	Occasional	Short-Term	Low	Certain	Yes	Low	High	Negligible	None	Not significant
Noise	Site specific construction noise	Negative	Isolated	Occasional	Short-Term	Low	Certain	Yes	Low	High	Low	Negligible	Not significant
Vibration	Site specific construction vibration	Negative	Isolated	Occasional	Short-Term	Low	Certain	Yes	Low	High	Low	None	Not significant
Archaeology, History, and Palaeontology	Potential for archaeological finds at some undisturbed areas	Negative	Isolated	Continuous	Long-Term	Low	Possible	Yes	Low	High	Low	None	Not significant
Heritage	No predicted effect	Negative	Isolated	Occasional	Short-term	Low	Certain	Yes	Low	High	Low	None	Not significant
Contaminated Sites and Waste Management	Site specific impacts related to disposal of contaminated material	Negative	Isolated	Occasional	Short-Term	Low	Probable	Yes	Low	High	Negligible	None	Not significant
Navigation	Site specific construction impacts - Access maintained	Negative	Isolated	Occasional	Short-Term	Low	Possible	Yes	Low	High	Negligible	None	Not significant
Utilities	Site specific utility relocations	Negative	Isolated	Occasional	Long-Term	Low	Certain	Yes	Low	High	None	None	Not significant
Traffic Operations	Site specific traffic diversions	Negative	Isolated	Occasional	Short-Term	Low	Certain	Yes	Low	High	Low	Low	Not significant
Freight Movements	Site specific construction impacts - Access maintained	Negative	Isolated	Occasional	Short-Term	Low	Possible	Yes	Low	High	Negligible	None	Not significant
Rail Rolling Stock Accessibility	No predicted effect	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.

Table 5.1.3-2 The Significance of Predicted Effects for the Operation and Maintenance of the North-South Corridor LRT													
Environmental Component	Predicted Effect	Direction	Geographic Extent	Frequency	Duration	Magnitude	Occurrence	Reversibility / Mitigation	Ecological	Confidence	Residual Effects	Cumulative Effects	Significance
Designated Natural Areas	Minor noise impacts	Negative	Isolated	Continuous	Long-Term	Low	Certain	No	Low	High	Negligible	Negligible	Not significant
Fish and Fish Habitat	Increased stormwater run-off; site specific impacts during maintenance	Negative	Isolated	Continuous	Long-Term	Low	Certain	Yes	Low	High	Negligible	Negligible	Not significant
Surface and Ground Water	Increased stormwater run-off; site specific impacts during maintenance	Negative	Isolated	Continuous	Long-Term	Low	Certain	Yes	Low	High	Negligible	Negligible	Not significant
Stormwater Management	Increased stormwater run-off; site specific impacts during maintenance	Negative	Isolated	Continuous	Long-Term	Low	Certain	Yes	Low	High	Negligible	Negligible	Not significant
Vegetation, Wetlands, Wildlife and Migratory Birds	Minor noise impacts; site specific impacts during maintenance	Negative	Isolated	Continuous	Long-Term	Low	Certain	No	Low	High	Negligible	Negligible	Not significant
Species At Risk	No predicted effect	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Air Quality	Reduce number of vehicles on the network	Positive	City Wide	Continuous	Long-Term	Low	Probable	N.A.	N.A.	Medium	Benefit	N.A.	N.A.
Landuse	Achieve Official Plan Objectives	Positive	City Wide	Continuous	Long-Term	High	Certain	N.A.	N.A.	High	Benefit	N.A.	N.A.
Central Experimental Farm	No predicted effect	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Rideau Canal	No predicted effect	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Recreation	No predicted effect	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Health and Wellbeing	Achieve Official Plan Objectives	Positive	City Wide	Continuous	Long-Term	Low	Probable	N.A.	N.A.	Medium	Benefit	N.A.	N.A.
Noise	Minor noise impacts	Negative	Isolated	Continuous	Long-Term	Low	Certain	No	Low	High	Low	Low	Not significant
Vibration	Minor noise impacts	Negative	Isolated	Continuous	Long-Term	Low	Certain	Yes	Low	High	Negligible	Negligible	Not significant
Archaeology, History, and Palaeontology	No predicted effect	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Heritage	No predicted effect	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Contaminated Sites and Waste Management	No predicted effect	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Navigation	No predicted effect	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Utilities	No predicted effect	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Traffic Operations	Reduce number of vehicles on the network	Positive	City Wide	Continuous	Long-Term	Moderate	Certain	N.A.	N.A.	High	Benefit	N.A.	N.A.
Freight Movements	No predicted effect	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Rail Rolling Stock Accessibility	No predicted effect	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.

5.2 Accidents and Malfunctions

Accidents

Accidents that may occur during construction, operation, and maintenance of the facility are addressed by provincial legislation, policies, and procedures. Any LRT/motor vehicle or LRT/pedestrian/passenger accidents that occur will be immediately reported to the Ottawa City Police and/or the Ontario Provincial Police as appropriate. The Ottawa City Police and/or the Ontario Provincial Police will be responsible for producing a formal accident report.

LRT vehicle derailments are unusual; however, an emergency protocol will be developed to both manage a derailment accident investigation and to restore the LRT system to service.

Based on the USA Federal Statistics, fatality rates per 100 million passenger miles for highway vehicles are approximately 3-4 times the rate for transit passengers. As a result of encouraging more of the travelling public onto transit, the proposed LRT project will improve passenger safety and operations and will reduce vehicular accidents within the project influenced area. Pedestrian and traveler safety has been considered and addressed in Section 5.1.2.5 (Health and Wellbeing).

Spills During Construction

All precautions will be taken to avoid spills during construction and during operation and maintenance. During construction, measures will be implemented to control the release of debris from construction activities, fabrication and landscaping activities from entering fishery waters. All fuels, oils, lubricants, paints, solvents, chemicals, etc. will be stored in clearly marked areas that have spill contingency plans in place. Any vehicle maintenance and fuelling will be carried out at the maintenance areas in the works facility or at commercial garages wherever possible. If refuelling of vehicles must occur on site, it will be carried out at a designated refuelling site where conditions will allow for the containment of any accidentally spilled fuel. Refuelling will not be permitted within 30 metres of any watercourse, 100 metres of any private wells or adjacent to sensitive areas. Refuelling will only be carried out by trained personnel. Furthermore vehicles will be maintained to minimize leaks and when detected, leaks will be repaired immediately. Care will be taken to prevent the release of fuel to the environment when refuelling small equipment in the field. The Contractor will be required to have a Fuel and Hazardous Material Spill Contingency Plan in place and emergency equipment on site.

If a spill does occur, the owner of the material or in control of the material is responsible for the spill. This person will take reasonable action to stop the spread of the spilled materials by blocking catch basins, digging trenches, creating dykes, and / or spreading absorbent materials. If this person is unknown or unable to respond, and it is safe to do so, the Contractor shall follow the steps noted above. In all cases the Contract Administrator, the Spill Action Centre of the Ontario Ministry of the Environment (1-800-268-6060), and the City of Ottawa will be notified. Depending upon the nature of the accident or spill, different agencies will also need to be contacted.

Clean-up and disposal of the spilled material is the responsibility of the owner or person having control of the material. If another person does not take responsibility for clean-up, the Contract Administrator will be notified. Until determined otherwise, the Contractor will assume the overall responsibility for coordinating the clean-up of spilled material. The Contractor, in consultation with the Contract Administrator, regulatory agencies and the Environmental Coordinator will:

- Locate and quantify the source of contamination;
- Assess the site conditions and environmental effects;
- Cut off the supply of electrical current, turn off ignition and extinguish flames;
- Assess the potential for containment and collection;
- Deploy on-site personnel to contain and clean-up spilled material if it is within their capability;
- Call in a spills response contractor if required;
- Arrange for disposal of contaminated material and clean-up materials at approved disposal facilities;
- Arrange for confirmation of clean-up;
- Prepare and distribute an Incident Report; and
- Take necessary precautions to ensure that the incident does not recur.

Spills During Operation

Since the LRT vehicles are electrically powered the potential for spills during operations are typically limited to the parking lot locations and maintenance facility. Potential for spills will generally come from gas or diesel powered passenger, delivery or maintenance vehicles. The potential contaminants include hydrocarbons (i.e. oil and gas) and detergents. As noted in Section 5.1.1.4, these facilities will be designed with containment measures. At the parking lots technologies such as oil/grit separators will be installed. Similar technology will be installed at the maintenance facility. Most maintenance activities (i.e. servicing and cleaning of vehicles) will be undertaken within buildings that will be designed to capture and contain contaminants prior to entering the municipal stormwater system.

Spill situations under the current O-Train operation (Capital Railway) are governed by Section #11 “Spill Response” in the “Railway Passenger Handling Safety and Emergency Response Plan” “Dangerous goods” responsibilities are covered within Section #10 of the Operator’s Manual. Both documents are approved by Transport Canada as part of Capital Railway’s Safety Management System. These documents are attached in Appendix H for reference purposes. The City of Ottawa will develop similar documents for the new Light Rail Transit line, but tailor them to the electric LRT. The spill response manual will describe types of spills, procedures for containment, and mandatory contacts with the City, Ontario Ministry of Environment and Energy Spills Action Centre at 1-800-268-6060 as well as the Federal Spill Response Centre at (819) 997-3742 (if the incident is on or adjacent to Federal property).

The following mitigation measures are proposed to minimize impacts of potential spills will be included in the Spills Action plan:

- Employee “Best Practices” for drainage design;
- Use oil and grit collectors;
- Control areas of refilling;
- Mandatory and immediate contact with the appropriate regulatory authorities(e.g. MOE Spills Action Centre, DFO);
- Immediate contact with specified spill clean up contractors; and
- Monitor and record spill clean up and submit required reports.

Workplace Health and Safety

Workplace health and safety is addressed through provincial legislative requirements such as the *Occupational Health and Safety Act* and associated regulations.

5.3 Effects of the Environment on the Project

The Canadian Environmental Assessment Act requires the consideration of "any change to the project that may be caused by the environment". The primary environmental effect that may affect the proposed City of Ottawa North-South Corridor LRT Project is changes to rainfall patterns and quantity as a result of climate change. Flooding is a potential adverse effect of future rainfall and has been addressed in the design of the proposed facilities in accordance with current engineering practises. All culverts will be designed for the 25 year storm event. The parking lot location components of the project have the greatest increase of impervious area. Therefore, drainage and stormwater management systems for the parking lots will be designed to manage a regional 100 year storm event (event statistically occurring once every 100 years). In addition, the stormwater drainage system for the Dow's Lake tunnel will be designed to manage a regional 100 year storm event. Given the rarity of a 100 year storm event, it is anticipated that the drainage and stormwater management system will effectively manage potential changes in rainfall patterns and quantity as a result of climate change.

Many weather related events may potentially affect the proposed City of Ottawa North-South Corridor LRT Project. Severe snowstorms have the potential to result in operational impacts and damage to the facilities. Mitigation for snowfall is focused on snow removal, primarily via the passage trains. During inclement weather, additional trains would be run during off-hours to avoid any snow build-up along the tracks.

In the event of a tornado in the study corridor some facility or track damage may be incurred. Tornado events are generally temporary and the likelihood of such an event impacting the proposed City of Ottawa North-South Corridor LRT Project is remote. Accordingly, mitigation measures are limited to proper and regular maintenance programs. Although short-term operational impacts may be realized, it is not anticipated that a tornado would result in any significant residual effects.

Although the proposed City of Ottawa North-South Corridor LRT Project is not located in an area prone to severe earthquake events, the possibility for a minor earthquake is always present. An earthquake has the potential to damage the facilities and impact operations. Mitigation measures are limited to proper and regular maintenance programs. Although short-term operational impacts and facility damage may result from an earthquake, it is not anticipated that an earthquake would result in any significant residual effects.

Beavers and other wildlife may impact operation (e.g. flooding due to beaver dams). These concerns can be address via mitigation measures such as:

- Beavers causing problem flooding can be trapped and relocated (with a permit from the Ontario Ministry of Natural Resources; and
- Plantings can be protected from rodents using rodent guards (e.g plastic tree guard or wire fencing). Note – planting are often under a two year maintenance warranty where the contractor is responsible for ensuring that the each plant survives for the first two years (including replacement of dead plantings).

Additional potential environmental effects include: severe ice, watercourse flooding, heat waves, smog alerts, fog and fire. Operating procedures, including proper facility maintenance and consideration of weather conditions warranting service suspension, will be developed during the implementation phase to address any potential operational impacts resulting from severe weather conditions. For example, a severe ice rain storm that allows build-up on the lines which could require that service be suspended. The danger is not ice on the tracks but rather the ice pulling down the electrified overhead wires. Storm trains can be used in the off service to clear the ice from the wires.

5.4 Decommissioning

Decommissioning is not applicable to the City of Ottawa North-South Corridor LRT given that the facility is part of the City of Ottawa's long-term transportation vision and is considered permanent within the planning horizon (lifespan of the facilities). Should decommissioning occur, the decommissioning would proceed in accordance with applicable legislation, regulations and guidelines in place at that time.

5.5 Cumulative Effects

The *Canadian Environmental Assessment Act* requires an assessment of cumulative environmental effects. This assessment must consider the net environmental effects associated with the project in combination with the environmental effects of other past, present or future projects or activities to determine the potential for cumulative environmental effects.

This section includes an assessment of cumulative effects considering those reasonably foreseeable projects and activities, the effects of which have the potential to overlap in time and space with the environmental effects of the proposed City of Ottawa North-South Corridor LRT Project (construction and operation phases).

As outlined in Chapter 5 of this report, the potential adverse environmental effects of the City of Ottawa North-South Corridor LRT Project are anticipated to be relatively minor with the implementation of identified mitigation measures. The City of Ottawa North-South Corridor LRT Project is expected to deliver a number of benefits including cleaner air, reduced traffic congestion and improved connections between communities.

The cumulative effects assessment considered the land development and infrastructure projects listed below.

The known major planned land development projects within and adjacent to the study area (refer to Section 4.2.2 for additional details) include:

- LeBreton Flats Redevelopment Plan;
- Bayview/Somerset Area Secondary Plan;
- Leitrim Community Design Plan;
- Riverside South Community Design Plan; and
- South Nepean Town Centre Community Design Plan.

Other projects that are known to potentially occur in or adjacent to the study area in the future include:

- Ottawa East-West Corridor Light Rail Transit (LRT) Project;
- Jockvale Road-Longfields Drive Link;
- Greenbank Road Widening;
- Southwest Transitway Extension
- Ottawa-Gatineau interprovincial bridges;
- Strandherd Drive widening;
- Earl Armstrong Road widening;
- Limebank Road widening;
- O'Connor Flood Control Study; and
- Riverfront Park Management Plan.

All of the above projects were considered during the development of the City of Ottawa's Official Plan. The Official Plan was developed through a comprehensive planning exercise to accommodate future growth based on the vision of sustaining the natural environment, optimizing economic vitality and ensuring healthy communities. The Official Plan emphasises maintaining the environmental integrity of the City of Ottawa and protecting key environmentally sensitive features. The Official Plan recognizes that while development and growth will occur, this should occur in ways that protects and enhances the qualities most valued by City of Ottawa residents: its distinctly liveable communities, its green and open character, and its unique characteristics that distinguish Ottawa from all other places.

These projects are anticipated to support the planning vision of the City of Ottawa including maintaining the environmental integrity of the City of Ottawa and protecting key environmentally sensitive features. Therefore it can be concluded that there will be no significant cumulative effects on the environment from the North-South LRT Project in combination with reasonably foreseeable projects and activities.

Table 5.5-1 provides a summary of potential adverse effects of the known surrounding projects. The potential effects of projects currently in the initial planning stages can not reasonably be identified at this time. However, it is anticipated that, through the applicable planning and approval processes, potential adverse effects will either be avoided or mitigated to acceptable levels.

In addition to the summary outlined in Table 5.5-1, additional discussion on the potential for cumulative effect on four environmental components is provided below as well as the Rideau Canal. These components included aquatic habitat, terrestrial habitat, species at risk and noise. Overall, no significant adverse environmental effects are anticipated for any of the identified environmental components.

Aquatic Habitat Cumulative Effects Assessment

The main watercourses that traverse the study corridor are the Rideau River and Canal, Sawmill Creek, Mosquito Creek and Jock River. These watercourses are part of the Lower Rideau River Watershed. The primary effects of the City of Ottawa North-South Corridor LRT Project are related to the extensions of the existing structures and culverts over the watercourses along the north portion of the project, construction of new crossing structures along the south portion and creek channel realignments. With the implementation of mitigation measures, potential for adverse effects can be minimized and no significant residual effects should occur.

The proposed City of Ottawa North-South Corridor LRT Project results in potential adverse effects to fish habitat. A compensation package will be prepared and will require the approval of the Department of Fisheries and Oceans to ensure no net loss of fish habitat. Future land development and infrastructure projects within and surrounding the Lower Rideau River Watershed will be required to submit and obtain approval for any compensation or mitigation where a HADD has been identified and cannot be avoided. Given that compensation will be provided to ensure no net loss of fish habitat, it can be concluded that there will be no significant adverse cumulative effects to fish habitat.

The proposed City of Ottawa North-South Corridor LRT Project results in potential environmental adverse effects to water quality as a result of increased stormwater run-off. The management of salt application, spill contingency plans and the discharge of run-off into stormwater management facilities prior to entry into surface waters will mitigate the adverse effects to water quality. It is recognized that additional land development and infrastructure projects will also result in additional stormwater run-off into surrounding watercourses. For these projects, the proponent will be required to treat stormwater run-off in accordance with the appropriate Ontario Ministry of

Environment guidelines. Therefore, no significant adverse cumulative effects to water quality are anticipated.

Terrestrial Habitat Cumulative Effects Assessment

As outlined in Chapter 5, significant adverse effects to terrestrial habitat are not anticipated. The study area includes natural, agricultural, urban, urban residential, rural residential, industrial and commercial land uses. As a result, vegetation is a mosaic of culturally influenced and remnant or naturally regenerating features. The seven key designated natural areas impacted by the project are:

1) Vincent Massey Park;
2) The Mid-Sawmill Creek Corridor;
3) The westerly forested portions of the Airport Parkway Natural Area (including Blossom Park Woods and all forested/wetland areas east of the airport);
4) Albion Road (Leitrim) Wetland;
5) Bowesville Road Woods (not officially designated);
6) Armstrong Road South Woods; and
7) Nepean Woods/Chapman Mills - East Woodlot.

LeBreton Flats and the Dominion Arboretum also lie along the proposed alignment but are both considered culturally influenced habitats with limited habitat value. With the proper implementation of the mitigation measures, there should not be any significant residual adverse effects to vegetation and wildlife as a result of the proposed City of Ottawa North-South Corridor LRT Project.

Significant planned land use developments and future infrastructure projects will result in some alteration of the existing terrestrial habitat within and surrounding the City of Ottawa North-South Corridor LRT Project study area, but these developments are not anticipated to result in significant adverse effects to these features as these projects will be planned in accordance with the City of Ottawa's Official Plan which provides for protection of key environmentally sensitive areas. Therefore, no significant adverse cumulative effects to terrestrial habitat area anticipated.

Species At Risk Cumulative Effects Assessment

Significant adverse effects to species at risk and their habitat are not anticipated as a result of the City of Ottawa North-South Corridor LRT Project. The one specific habitat area that is crossed by the City of Ottawa North-South LRT Project is the Bowesville-Armstrong Meadow, which is an area known to provide winter foraging habitat for Short-eared Owl and Rough-legged Hawk. The proposed City of Ottawa North-South Corridor LRT will cut through the western edge of this habitat area, removing approximately 2.5ha of winter foraging habitat and 'potential' nesting habitat. However, most of this habitat is actually agricultural fields that are only suitable for foraging, not nesting. Furthermore, this small habitat removal impact represents a very small proportion of the whole Bowesville-Armstrong Meadow habitat area, which is approximately 124ha in area and, given the open character of the vegetation system, it is not specifically sensitive to fragmentation or removal of woody cover, and therefore the alignment should not significantly affect the overall habitat quality.

Future land use developments within the vicinity of the Bowesville-Armstrong Meadow may result in additional removal of habitat. The City of Ottawa will ensure that specific land use plans are reviewed against their Natural Heritage Guidelines as well as applicable provincial and federal legislation, policy and guidelines, in an attempt to protect habitat for bird species in the vicinity. Based on these requirements, it is not anticipated to result in any significant cumulative effects the removal of any potential or actual species at risk habitat.

Noise

As outlined in Section 5.1.2.6 significant adverse noise effects are not anticipated during the construction or operation/maintenance of the City of Ottawa North-South Corridor LRT Project. Noise assessments for both construction and operation/maintenance were conservative and included anticipated build-out, including other currently known or anticipated projects within the study area.

Worst-case construction noise levels have the potential to be very loud during some short periods of time. However, adverse effects from construction are relatively short compared to operational noise impacts, and therefore, they are usually better tolerated by the community at large. It is anticipated that other currently known and anticipated projects will incorporate mitigation measures and adhere to the City of Ottawa's Noise Control bylaws to reduce potential noise impacts during construction. Based on the conservative noise assessment and anticipated mitigation and adherence to the City of Ottawa's Noise control bylaws, cumulative noise impacts are not anticipated to result in any significant cumulative effects.

Rideau Canal Crossings Cumulative Effects Assessment

Background

Significant adverse effects to the Rideau Canal are not anticipated as a result of the City of Ottawa's North-South Corridor LRT Project. Specific details on potential adverse effects and proposed mitigation to environmental features associated with the Rideau Canal are documented in Section 5.1.1. Potential adverse effects and proposed mitigation to socio-economic features (i.e. recreation, navigation, noise and vibration, heritage and aesthetics) are documented in Section 5.1.2.

Existing Crossings

There are a number of existing crossings of the Rideau Canal within the City of Ottawa boundaries. At the southern most limit is Highway 416, a four lane divided roadway with fully controlled access. Approximately 9 km north of Highway 416 is the Roger Stevens Road crossing near the village of Kars. This is a two lane bridge. A further 8 km north is the village of Manotick. Here the Rideau Canal splits around the island in Manotick and as a result the there are two bridges both two lanes wide (plus sidewalks) crossing the main and back channels of the river. About 12 km to the north is the Hunt Club Road Bridge which presently carries 4 lanes of traffic but which has been constructed to accommodate an ultimate six lane cross section.

North of the Hunt Club Bridge (about 1 km) is an existing railway crossing which serves both Via Rail and east west rail freight movements. A further 4 km north and the Hogs Back Bridge can be found crossing the Rideau Canal as a two lane bridge. There is also a two lane swing bridge over the Rideau Canal.

Within the main urban area there are numerous bridges over the Rideau Canal including:

- Heron Road (6 lanes plus sidewalks)
- Bronson Avenue (6 lanes plus sidewalks)
- Bank Street (4 Lanes plus sidewalks)
- Smyth Road / Main Street (4 Lanes plus sidewalks)
- Southeast Transitway Bridge (2 lanes plus a bicycle lanes)

- Highway 417 Including the Hurdman Bridge (6 Lanes)
- Rideau Street / Montreal Road (4 Lanes plus sidewalks)
- St Patrick Street Bridge (4 Lanes plus sidewalks)
- Union Bridges (2) at Green Island
- Sussex Drive Bridges (2) at Green Island (4 Lanes plus sidewalks)

Within the study area a Ontario Hydro 500 Kv line high tension cable corridor crosses the Rideau Canal in the vicinity of the existing railway about 1 km north of Hunt Club Road.

Potential New Crossings

The City of Ottawa's Transportation Master Plan (TMP) and Official Plan identify three additional potential crossings of the Rideau River / Canal. The first is for an arterial road located somewhere between the Strandherd/Armstrong Bridges and the Hunt Club Road Bridge. This TMP identifies the need for this crossing by 2021 and the specific location - conceptually a link between Fallowfield Road in the west to Leitrim Road in the east will be determined through a future Environmental Assessment. This crossing is approximately 5 km north of the proposed Strandherd/Armstrong Bridges outlined as part of this project.

The second potential crossing is for the Alta Vista Transportation Corridor. This crossing will likely be located approximately 2 km south of the Southeast Transitway crossing. The specific location will be determined through a future Environmental Assessment.

The third potential crossing is for the future East-West Corridor LRT Project. At this time of writing, the preliminary technically preferred location for this facility is just north of the existing VIA railway trestle approximately 1 km north of the Hunt Club Road bridge, or approximately 10 km north of the proposed Strandherd/Armstrong Bridges outlined as part of this project. The exact nature of the future East-West LRT crossing will is being determined through an Environmental Assessment currently underway. It is anticipated that this information will be available by early 2007.

It is anticipated that potential adverse effects associated with the two new Strandherd/Armstrong bridge crossings can be effectively mitigated to acceptable levels through the planning process and in consultation with Parks Canada. It is anticipated that environmental protection and design measures that have been developed as part of the North South Coridor LRT Project will also be applied to these future potential crossings to mitigate any possible adverse effects to the Rideau River / Canal system. This will be ensured by the need to obtain the appropriate approvals and permits from Parks Canada prior to construction of these additional crossings.

Therefore, no significant adverse cumulative effects to the Rideau River / Canal system are anticipated.

Table 5.5-1 Summary of the Potential Adverse Effects of Surrounding Projects

ENVIRONMENTAL COMPONENT	LeBreton Flats Redevelopment Plan	Bayview/ Somerset Area Secondary Plan	Leitrim Community Design Plan	Riverside South Community Design Plan	South Nepean Town Centre Community Design Plan	Ottawa East-West Corridor Light Rail Transit Project	Jockvale Road-Longfields Drive Link	Greenbank Road Widening	Southwest Transitway Extension	Ottawa-Gatineau Interprovincial Bridges	Strandherd Road and Earl Armstrong Road Widening	Limebank Road Widening	O'Connor Flood Control Study	Riverfront Park Management Plan
Designated Natural Areas	2	2	2	2	2	0	0	0	0	0	2	2	2	2
Fish and Fish Habitat	2	2	2	2	2	0	0	0	0	0	2	2	2	2
Surface and Ground Water	2	2	2	2	2	0	0	0	0	0	2	2	B	2
Stormwater Management	2	2	2	2	2	0	0	0	0	0	2	2	B	2
Vegetation, Wetlands, Wildlife and Migratory Birds	2	2	2	2	2	0	0	0	0	0	2	2	2	2
Species At Risk	2	2	2	2	2	0	0	0	0	0	2	2	2	2
Air Quality	2	2	2	2	2	0	0	0	0	0	2	2	2	2
Landuse	B	B	B	B	B	0	0	0	0	0	B	B	B	B
Central Experimental Farm	N/A	N/A	N/A	N/A	N/A	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Rideau Canal	N/A	N/A	N/A	N/A	N/A	2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Recreation	2	2	2	2	2	0	0	0	0	0	2	2	2	2
Health and Wellbeing	2	2	2	2	2	0	0	0	0	0	2	2	2	2
Noise	2	2	2	2	2	0	0	0	0	0	2	2	2	2
Archaeology, History and Palaeontology	2	2	2	2	2	0	0	0	0	0	2	2	2	2
Heritage	2	2	2	2	2	0	0	0	0	0	2	2	2	2
Contaminated Sites and Waste Management	2	2	2	2	2	0	0	0	0	0	2	2	2	2
Navigation	2	N/A	N/A	N/A	2	0	0	0	0	0	2	2		
Utilities	2	2	2	2	2	0	0	0	0	0	2	2	2	2
Traffic Operations	2	2	2	2	2	0	0	0	0	0	B	B	2	2
Freight Movements	N/A	N/A	N/A	N/A	N/A	0	0	0	0	0	N/A	N/A	N/A	N/A
Rail Rolling Stock Accessibility	N/A	N/A	N/A	N/A	N/A	0	N/A	0	0	N/A	N/A	N/A	N/A	N/A

Scale

0 – effect unknown as project is in the initial stages of planning
1 – not a significant effect without mitigation
2 – not a significant effect with mitigation
3 – significant effect even with mitigation
B – beneficial effect
N/A – not applicable

5.6 Summary of Potential Environmental Effects, Proposed Mitigation and Commitments to Future Work

Table 5.6-1 provides a summary of the potential effects of the project on the environmental.

Table 5.6-1 Effects of the Project on the Environment

Environmental Component	Potential Project Effects						Residual Effects	
	Potential Adverse Effect?			Can it be Mitigated?			Is it Significant?	
	Yes	*No*	*Uncertain*	*Yes*	*No*	*Uncertain*	*Yes*	*No*
Designated Natural Areas	✓			✓				✓
Fish and Fish Habitat	✓			✓				✓
Surface and Ground Water	✓			✓				✓
Stormwater Management	✓			✓				✓
Vegetation, Wetlands, Wildlife and Migratory Birds	✓			✓				✓
Species At Risk	✓			✓				✓
Air Quality	✓			✓				✓
Landuse	✓			✓				✓
Central Experimental Farm	✓			✓				✓
Rideau Canal	✓			✓				✓
Recreation	✓			✓				✓
Health and Wellbeing	✓			✓				✓
Noise	✓			✓				✓
Vibration	✓			✓				✓
Archaeology, History and Palaeontology	✓			✓				✓
Heritage	✓			✓				✓
Contaminated Sites	✓			✓				✓
Waste Management	✓			✓				✓
Transportation and Utilities	✓			✓				✓
Rail Rolling Stock Accessibility	✓			✓				✓

Other Factors	Potential Project Effects						Residual Effects	
	Potential Adverse Effect?			Can it be Mitigated?			Is it Significant?	
	Yes	*No*	*Uncertain*	*Yes*	*No*	*Uncertain*	*Yes*	*No*
Accidents and Malfuntions	✓			✓				✓
Effects of the Environment on the	✓			✓				✓

Table 5.6-1 Effects of the Project on the Environment								
Environmental Component	Potential Project Effects						Residual Effects	
	Potential Adverse Effect?			Can it be Mitigated?			Is it Significant?	
	Yes	*No*	*Uncertain*	*Yes*	*No*	*Uncertain*	*Yes*	*No*
Project								
Cumulative Effects	✓			✓				✓

The following tables sum
arize the proposed mitigation (Tables 5.6-2 and 5.6-3) and commitments to future work/studies (Table 5.6-4). It should be noted that these tables should be read in conjunction with the main text of this chapter.

Table 5.6-2 Summary of Proposed Construction Mitigation	
Federal Information Requirement	**Proposed Construction Mitigation**
The following outlines the mitigation commitments made during planning. These will be further developed during the design process. It should be noted that the City has committed to prepare specific Project Environmental Management Plans (PEMPs) for each construction project. The intent of the PEMPs is to ensure that all the commitments made during planning and design have been addressed. Each PEMP provides the continuity from planning into design and through to construction, operation and maintenance. It becomes a partnership between the City of Ottawa, the designer and the contractor. The PEMPs will track the commitments made and ensure that mitigation measures are incorporated in the design and ultimately implemented during construction. When preparing the design and construction packages, the design team will consult with the appropriate external agencies to ensure that the specific mitigation requirements adequately address the EA commitments. In addition, the design team will undertake the work required to obtain outstanding permits and approvals required to construct the project. Additional details regarding PEMP responsibilities, preparation, implementation, and quality control/monitoring are provided in Section 9.0 of this report.	
Accidents and Malfunctions	• During construction, measures will be implemented to control the release of debris from construction activities, fabrication and landscaping activities from entering fishery waters. All fuels, oils, lubricants, paints, solvents, chemicals, etc. will be stored in clearly marked areas that have spill contingency plans in place. Any vehicle maintenance and fuelling will be carried out at the maintenance areas in the works facility or at commercial garages wherever possible. If refuelling of vehicles must occur on site, it will be carried out at a designated refuelling site where conditions will allow for the containment of any accidentally spilled fuel. Refuelling will not be permitted within 30 metres of any watercourse, 100 metres of any private wells or adjacent to sensitive areas. Refuelling will only be carried out by trained personnel. Furthermore vehicles will be maintained to minimize leaks and when detected, leaks will be repaired immediately. Care will be taken to prevent the release of fuel to the environment when refuelling small equipment in the field. The Contractor will be required to have a Fuel and Hazardous Material Spill Contingency Plan in place and emergency equipment on site. • If a spill does occur, the owner of the material or in control of the material is responsible for the spill. This person will take reasonable action to stop the spread of the spilled materials by blocking catch basins, digging trenches, creating dykes, and / or spreading absorbent materials. If this person is unknown or unable to respond, and it is safe to do so, the Contractor shall follow the steps noted above. In all cases the Contract Administrator, the Spill Action Centre of the Ontario Ministry of the Environment (1-800-268-6060), the City of Ottawa and the Federal Spills Response Centre (819-997-3742, if the incident is on or adjacent to Federal property will be notified. Depending upon the nature of the accident or spill, different agencies will also need to be contacted. • Clean-up and disposal of the spilled material is the responsibility of the owner or person having control of the material. If another person does not take responsibility for clean-up, the Contract Administrator will be notified. Until determined otherwise, the Contractor will assume the overall responsibility for coordinating the clean-up of spilled material. • Any LRT/motor vehicle or LRT/pedestrian/passenger accidents that occur will be immediately reported to the Ottawa City Police and/or the Ontario Provincial Police as appropriate. The Ottawa City Police and/or the Ontario Provincial Police will be responsible for producing a formal accident report.
Air Quality	• Dust impacts will be mitigated by ensuring that proper watering and/or other dust suppressant techniques (e.g. OPSS 506) are used during the construction phase. Specific measure will be developed as part of the design process and included in the PEMPs. • Following construction, any open, unpaved areas will be seeded.

Table 5.6-2 Summary of Proposed Construction Mitigation	
Federal Information Requirement	**Proposed Construction Mitigation**
	• The contractor will be required to keep equipment in good operating conditions and efforts will be made to minimize the idling of equipment, especially during smog alerts. • When smog advisories are issued, the City of Ottawa will discuss the scheduled activities with the Contractor to determine what steps can be taken to further limit air emissions without unduly affecting the Contractor's schedule. • In accordance with the PEMP, specific mitigation measures will be developed during detail design when additional design and construction staging details are known.
Archaeology and History	• Should buried archaeological deposits be found along any section of the corridor during construction activities, the Ministry of Culture (416 314-7148) will be notified immediately. No further disturbance of the deposits will occur until a licensed archaeologist has been consulted. • In the event that human remains are encountered during construction activities, both the Ministry of Culture (416 314-7148), and the Registrar or Deputy Registrar of the Cemeteries Regulation Unit of the Ministry of Consumer and Commercial Relations, (416 326-8392), will be notified immediately. • Undertake a Stage 2 Archaeological Assessment for works in the undisturbed area comprising Riverside South and Barrhaven and the link to the Airport. During this assessment, Parks Canada should be consulted regarding potential underwater resources in the vicinity of the new Rideau River crossing. If archaeological finds are discovered, Stage 3-4 mitigation will be undertaken as required in accordance with the guidelines and policies of the Ministry of Culture. Consultation will occur with the Ontario Ministry of Culture and relevant First Nations to discussion mitigation strategies if sites are found as part of the Stage 2 Assessments. Copies of the Archaeological Assessments will be provided to the RAs.Given that much of the alignment on the existing rail right-of-way and in the downtown has been previously disturbed, limited additional archaeological investigations are required. In areas where construction will occur outside the existing transit corridor or rail bed, including LeBreton Flats, the area between the LeBreton Station and Bronson Avenue, Dow's Lake, new maintenance facility or station facilities, or other construction adjacent to the rail bed, a Stage 2 Archaeological Assessment will be undertaken. Parks Canada will be consulted regarding potential underwater resources in the vicinity of the Dow's Lake. If archaeological finds are discovered, Stage 3-4 mitigation will be undertaken as required in accordance with the guidelines and policies of the Ministry of Culture. • Undertake Stage 3-4 Archaeological Assessments if warranted by finding of Stage 2 Archaeological Assessment. Consultation will occur with the Ontario Ministry of Culture and relevant First Nations to discussion mitigation strategies as part of this work • In the event that human remains are encountered during construction activities, both the Ministry of Culture (416 314-7148), the Registrar or Deputy Registrar of the Cemeteries Regulation Unit of the Ministry of Consumer and Commercial Relations, (416 326-8392) and relevant First Nations will be notified immediately. • Design the twin bridge at the north Rideau River crossing sympathetic to the existing structure to mitigate heritage impacts. • Design the new bridge at the south Rideau River crossing in accordance with the Strandherd-Armstrong Bridge Aesthetic Guidelines (du Toit Allsopp Hillier, November 2005). • Implement urban design recommendations to integrate the LRT system with the streetscapes of Albert and Slater Streets. • Avoid/mitigate adverse effects to the Rideau Canal in the downtown, by using the existing Mackenzie King Bridge. • Consult with Parks Canada and NCC during the design of the Rideau Canal/River crossings and obtain necessary permits during detail design.

Table 5.6-2 Summary of Proposed Construction Mitigation	
Federal Information Requirement	**Proposed Construction Mitigation**
	• Develop interpretive panels in consultation with the City of Ottawa Heritage Department to recognize the rich rail history of the former CPR corridor.
Central Experimental Farm	• Transplant the 36 young trees and shrubs to a temporary nursery and after construction replanted to their original locations. • Employ sedimentation and erosion control measures. • Ensure existing hydrologic regime will be maintained. • Clearing and disposal of all construction-related debris following construction. • Ensure an environmental inspector is on site during construction to ensure compliance with mitigation measures. • Implement measures to protect nesting migratory birds (timing of vegetation clearing to avoid breeding period or implement nest surveys to confirm no nesting in affected areas prior to clearing – this relates to meeting requirements of the Migratory Birds Convention Act – MBCA). • Fencing and signage will be installed during construction to ensure the safety of pedestrians during construction. • Continue consultation with Dominion Arboretum staff as design progresses to discuss site access, establish a program to identify and transplant and to protect or replace others, and explore other mitigation measures to minimize adverse effects during construction. • Additional compensation for removal of mature trees and additional mitigation measures for transplanted trees and shrubs will be negotiated through discussions with Dominion Arboretum staff.
Contaminated Sites and Waste Management	• A Phase II Environmental Site Assessment (ESA) will be completed on the north portion of the former Gloucester Landfill that will be required for a commuter parking lot. The Phase II ESA will include intrusive environmental sampling for soil and groundwater quality. Representative soil and groundwater samples will be submitted for laboratory analysis by a Canadian Association for Environmental Analytical Laboratories (CAEAL) approved laboratory. The results of the analyses will be compared against applicable MOE Standards and Canadian Council of Ministers of the Environment (CCME) Guidelines, as stipulated in the CCME Contaminated Sites Policy. All sampling will be completed by a Qualified Person under CCME Guidelines. If remediation of this property is required, the appropriate remedial option will be selected on the basis of the extent of contamination, type of contamination, and the cost to remediate; in accordance with CCME Guidelines and O. Reg 347. The selection of the proper method for remediation and/or disposal will be performed by a Qualified Person under O.Reg. 153/04 of the OEPA, and in accordance with O.Reg. 153/04. CEPA (Part 5, Part7, Part 9, Schedule 5, and Schedule 6) will be followed in conjunction with OEPA statutes and regulations. CCME publications regarding contaminated sites will be used for guidance during the selection of proper methods for remediation and/or disposal. In addition, the investigation will determine any potential impacts on the federal groundwater treatment

Table 5.6-2 Summary of Proposed Construction Mitigation	
Federal Information Requirement	**Proposed Construction Mitigation**
	plan and develop appropriate measures to mitigate potential impacts. Procedures for the disposal of any material generated are outlined below. Transport Canada will be consulted prior to the commencement of any Phase II ESA work at the former Gloucester Landfill, in order to ensure that any Phase II ESA work considers existing background data. Phase II ESA requirements will be determined by a Qualified Person, and in accordance with O.Reg. 153/04 under the OEPA. CEPA (Part 5, Part7, Part 9, Schedule 5, and Schedule 6) will be followed in conjunction with OEPA statutes and regulations. In addition, CCME contaminated sites publications and the Canadian Standards Association (CSA) Standard Z769-00 will be used for guidance during the selection and evaluation of Phase II ESA requirements. • A Phase I ESA will be completed for the south portion of LeBreton Flats, north of Wellington Street. The Phase I ESA will include a review of all historical background information for the site, including: historical insurance plans, MOE inventories, maps and plans, and aerial photographs. The Phase I ESA will be completed in accordance with the Contaminated Sites Policy under the CCME Guidelines. The Phase I ESA will make recommendations for further environmental investigation, at the discretion of the Qualified Person. If cleanup is required, procedures for the disposal of any material generated are outlined below. • A Phase I ESA will be completed for any property, or portion of a property, to be acquired or leased by the City of Ottawa for the purposes of accommodating the North-South corridor LRT. Where a property has been recommended for further environmental investigation, as per the Phase I ESA completed by AMEC Earth and Environmental for the CPR Ellwood/Prescott Subdivision lands (O-Train Corridor), the City of Ottawa will complete a Phase II ESA on a site-by-site basis. • The City of Ottawa is currently negotiating with the property owner of the former fuel service station located on the north side of the Queensway near Gladstone Ave. (west side of the existing right-of-way), with regard to the presence of contamination observed to be migrating within the existing O-Train Corridor. Any contaminated material that is encountered during construction will be managed and disposed of in accordance with the mitigation measures outlined below. Additional measures will be taken to prevent the further spreading of contamination within the preferred LRT corridor. • During construction, contaminated fill and ballast material from the railway right-of-way (ROW) may be encountered. The environmental quality of the material will be assessed by a Qualified Person under O.Reg. 153/04, or applicable CCME Guidelines (i.e. contaminated sites policy), and the need for further environmental investigation will be determined, as needed. • All excess material generated during construction activities will be properly managed in accordance with O.Reg. 347 (General Waste Management), as amended to O.Reg. 558 of the Ontario Environmental Protection Act (Ontario EPA). • Excess material generated during construction activities which exhibits visual or olfactory evidence of contamination will be characterized by a Qualified Person to determine if it is hazardous or non-hazardous, in accordance with O.Reg. 347 (amended to O.Reg. 558) of the Ontario EPA, as well as Ministry of the Environment (MOE) Guidelines, if applicable, and CCME Guidelines. • The appropriate Provincial (i.e. MOE) authority will be kept informed of any excess material generated that is designated as hazardous waste as per O.Reg. 347 (amended to O.Reg. 558), or is suspected of being hazardous, and will be consulted regarding containment and/or disposal measures. • The volume of excess material generated will be recorded in a daily log and/or note book. If disposal of excess material is required (i.e. hazardous waste), the volume of clean fill needed will be determined based on the amount of material removed. • Excess material (hazardous or non-hazardous) will be transported off-site (as required) by a licensed hauler/transport subcontractor using pre-determined haul routes, to be finalized prior to construction activities.

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	• If wastes (hazardous) are to be transported across provincial boundaries, this will be done in accordance with Canadian Environmental Protection Act (CEPA) Regulation SOR/2002-301 (Interprovincial Movement of Hazardous Wastes). • All wastes transported from the construction site, or stored on the construction site, will be done so in accordance with O.Reg. 347 (amended to O.Reg. 558). • Excess soil will be characterized as hazardous or non-hazardous if visual or olfactory evidence of contamination is observed by a Qualified Person under O.Reg. 153/04 or CCME Guidelines, during the course construction. Non-hazardous soil will be managed on-site and either disposed of at a licensed landfill, reincorporated into construction activities (i.e. infilling or grading), or sold as clean fill material. Soil classified as hazardous will be handled according to the procedures outlined in the section above. • All construction supplies such as fuels, oils and lubricants, and other chemical compounds will be stored in an exclusion zone away from construction activities so as to avoid site contamination via mishandling and improper storage. • Fuels and other toxic chemical substances brought to the construction site will be stored in appropriately sealed containers in accordance with O.Reg. 347 and the Technical Standards and Safety Authority (TSSA) Act. • Identify waste management procedures for storage, transporting, handling and disposal of water materials; compare requirements of the Ontario Water Resources Act (OWRA). • The MOE Spills Action Centre (SAC) and the Federal Spills Response Centre (819-997-3742, if the incident is on or adjacent to Federal property)will be notified in the event of a spill that impacts, or has the potential to impact, human health or the environment. • A Spill Prevention, Control and Countermeasures (SPCC) Plan will be prepared for all construction activities within the boundaries of the LRT corridor, by the Contractor. The Contractor will develop, implement, and maintain the SPCC Plan to ensure that construction activities do not increase the risk of a release of fuel, oils, or other hazardous materials and chemicals to the environment. The SPCC Plan will describe the procedures and equipment in-place to minimize spills, leaks, or releases of hazardous materials. In addition, the plan will address the reporting and response procedures in the event of an incident. The plan should incorporate the following: an inventory of all on-site hazardous chemicals; clearly identified hazardous materials storage areas with secondary containment features; install and maintain spill kits in areas that are readily accessible to workers. The kits should contain absorbent pads, booms, drain covers, etc.; and all wastes generated as a result of spill clean-up will be managed according to O.Reg. 347 (amended to O.Reg. 558).
Fish and Fish Habitat	• Site specific mitigation measures for each watercrossing are outlined in Table 5.1.1.2-1. These measures will be refined based on detail design and in consultation with DFO and RVCA. • Final HADD determinations will be made in during detail design. All construction will be undertaken in accordance with the Authorizations issued under the *Fisheries Act*. • A warmwater construction-timing window restriction (between March 15 and July 1) will be used for all required instream works. This will also protect the spawning period of Mottled Sculpin that is found in the cool/potential coldwater sections of Sawmill Creek and Cahill drain. • A sediment and erosion control plan will be prepared prior to construction (and including inspection and maintenance until final cover is established), documented in the PEMPs and implemented during construction to prevent erosion and migration of sediment-laden runoff from the construction zone to the watercourses(also see surface and groundwater mitigation) • Bypass pumping or other means will be used to isolate the construction zone and maintain clean downstream flow in the watercourses that will require instream works (e.g. new or extended culverts, instream piers, channel realignments). Isolation of the construction zone and maintenance of clean downstream flow will be undertaken in

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	accordance with OPSS 182, OPSS 518, and any requirements identified under the Fisheries Act in consultation with the RVCA/OMNR/DFO. If the watercourse is not flowing at the time of construction, contingency measures will be available for use in the event of rain. If temporary cofferdams or flow barriers are used, they will be constructed of non-sediment generating materials (i.e. gravel bags, clean stone with no fines). Energy dissipation measures will be used for release of flow downstream of the construction zone. Detailed flow management plans for each relevant crossing will be prepared prior to construction. • The tunnel under the Rideau Canal will be constructed during the winter when water levels have been lowered and flows are minimal. The work will be allowed to begin once water levels have been lowered and then raised to prepare for Winterlude. All work will be completed prior to March 15 in accordance with the fishery moratorium. Construction will be completed during the winter to ensure that spring through navigation is maintained within the Rideau Canal. Dewatering plans will be developed; incorporating cofferdams to isolate the excavation zone and dam and pump measures as outlined above, and will be implemented to prevent erosion and sediment transport to the canal or to downstream reaches of the canal. • All water intake hoses used for temporary dewatering/flow transfer will be screened. • Any fish stranded in the work zone will be captured and transferred up or downstream of the work zone. • Settling and energy dissipation measures will be used for discharge of water for all temporary flow transfer and/or dewatering activities. • An spills management plan, including spill control and absorbent materials, instructions regarding their use and notification procedures, will be developed and maintained on-site, and all site personnel will be familiar with its implementation. No storage, maintenance or refuelling of equipment will be permitted near the stream, with sufficient separation and/or containment measures so as to prevent migration of potential contaminants to the watercourses. (also see Accidents and Malfunctions) • No fording of the watercourses will occur without authorization by Parks Canada, MNR or RVCA. • All culvert extensions will be designed and installed to ensure no barriers to fish movement are created (10% of culvert is embedded into the substrate to prevent a perched culvert), and the extensions are stable and will not result in development of erosion. • All debris and potential contaminants (e.g. concrete and structural materials, paint and solvents, sand-blasting) generated from removal or rehabilitation of existing culverts or structures will be properly contained to prevent debris from entering the watercourse, and all debris will be properly disposed of off-site. • Removal of riparian vegetation, particularly woody vegetation will be kept to the minimum necessary for the proposed LRT project. • In areas where woody riparian vegetation is removed, it will be replaced with native species. • All disturbed surfaces will be stabilized and re-vegetated as soon as feasible following construction. • If blasting is required to construct the tunnel at Crossing #2 under the Rideau Canal, DFO's "Guidelines for the Use of Explosives in or near Canadian Fisheries Waters" (Wright and Hopky 1998) will be adhered to. • A qualified environmental inspector will be on-site as required throughout construction, responsible for ensuring the sediment and erosion control measures are functioning and all of the mitigation and compensation measures are being implemented. • The existing bed profile and substrate on the bed of the Rideau Canal (above the tunnel) will be re-instated, and native riparian vegetation replaced, following construction of the twin tunnel under the canal. A copy of the documentation of the

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	existing bed profile and substrate conditions will be provided to Parks Canada. • Where new or replacement culverts are proposed, fish passage and habitat opportunities in the watercourses should be maintained, or enhanced in the case of existing culverts, by either using a open footing culvert or by embedding and backfilling the new culvert with granular substrate. Typical embedment depths are approximately 30cm, however the depth and substrate size mix should be designed in consultation with a hydrologist. Substrate should consist of clean stone/rock material sized to withstand scouring velocities mixed with smaller granular to minimize interflow movement and provide substrate diversity. • Where rock/scour protection is required for structure piers or channel banks, it should be designed and installed so as to minimize alteration of the channel profile (e.g. inset to match existing grade) and / or designed to provide fish habitat opportunities wherever possible. • The footings for the new structures will be inset below the bed elevation and the bed substrates re-instated, so that the direct long-term removal of habitat on the channel bed is limited to the area of the pier shaft (which is much smaller than the footing). • The existing habitat conditions and associated functions that will be removed or temporarily removed for the channel re-alignments (i.e. Cahill Drain and Mosquito Creek Tributaries) and tunnel construction respectively will be documented in detail during the detailed design phase of the project, so the replacement channel and habitat conditions can be properly designed and constructed. • Habitat conditions in the existing channel sections will be replaced or potentially enhanced in the new channel sections, including substrates and morphology, and instream and overhead/riparian cover. The proposed new channel sections will be designed using naturalized channel techniques, by an qualified fluvial geomorphologist, and an qualified fisheries biologist and hydrologist. The specific details will be determined during detail design as part of the compensation plan and *Fisheries Act* Authorization process. • Rather than developing individual compensation plans at each of the watercrossings where a HADD occurs, DFO's and RVCA's preference is to develop a larger overall compensation plan. Some potential opportunities noted by DFO and RVCA are included in this report (Section 5.1.1.2). The compensation plan and formal authorization under the Fisheries Act will be obtained during Detail Design. This compensation plan will be developed by a fisheries consultant, with other technical input (e.g. hydrology, landscape architecture, fluvial geomorphology), with input from DFO, RVCA and MNR, as well as Parks Canada during Detail Design.
Health and Wellbeing	• Follow all applicable safety legislation • In advance of opening the LRT lanes a public awareness campaign as part of the over all project communications plan will be activated, to inform the public of the changes and procedures. In addition an enforcement blitz will be initiated as part of the communications effort. • Apply mitigation measures outlined in the air quality, land use, noise and transportation sections
Land Use	• Noise impacts will be mitigated by limiting the hours of construction to those provided within community by-laws. Within the City of Ottawa, construction within residential communities is not permitted between 2200 hours of one day and 0700 hours of the next day (By-law 2004-253) and by following the Construction Code of Practise outlined in Section 5.1.2.6. • Air quality and dust mitigation will be mitigated by following the measures outlined in the air quality section • No heavy equipment will be used in close proximity to vibration-sensitive buildings. • Access to commercial buildings will be maintained through detours as required. • Access to residential properties will remain open to local traffic at all times.

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	• Access to adjacent properties to be retained as long as possible during construction. • Temporary signage to direct clients to stores and parking during interruptions.
Noise and Vibration	• General construction will be limited to the time periods 0700h to 2200h (7 am to 10 pm) Monday through Saturday and 0900h to 2200h on Sundays, as allowed by the local City of Ottawa by-laws. If construction activities are required outside of these hours, exemptions will be sought in advance by the contractor, directly from the City. • The Construction Code of Practise identified in Section 5.1.2.6 (noise) and 5.1.2.7 (vibration) will be followed. • There will be explicit indication that contractors are expected to comply with all applicable requirements of the contract and local noise by-laws. Enforcement of noise control by-laws will be the responsibility of the Municipality for all work done by contractors. • All equipment will be properly maintained to limit noise emissions comply with (MOE NPC-115 guidelines). As such, all construction equipment will be operated with effective muffling devices that are in good working order. • The contract documents will contain a provision that any initial noise complaint will trigger verification that the general noise control measures agreed to are in effect. • In the presence of persistent noise complaints, all construction equipment will be verified to comply with MOE NPC-115 guidelines. • In the presence of persistent complaints and subject to the results of a field investigation, alternative noise control measured may be required, where reasonably available. In selecting appropriate noise control and mitigation measures, consideration should be given to the technical, administrative and economic feasibility of the various alternatives. • Construction mitigation alternatives include but are not limited to: – Re-scheduling of noisy operations to daytime hours, where possible; – Use of alternate, quieter equipment or methods, where available; and – The use of portable, localized noise barriers for critical areas. • The contractor will be encouraged to use rock drills producing noise on the “quiet” range of the spectrum to reduce noise levels as much as possible. • Where feasible, portable noise barriers to reduce noise impacts from rock drilling. These may consist of transport trailers, stack hay bales, or other methods, provided that the line-of-site between the source and receiver is broken, and all gaps and cracks are minimized. Barriers could reduce rock drilling noise by 5 to 10 dB. • Blasting and rock drilling will be restricted to weekdays during daytime hours, from 0700h to 1900h (7 am to 7 pm). In the presence of persistent complaints, the City may implement additional restrictions or time controls. • Where possible, blasting will be scheduled for roughly the same time each day, and local residents will be made aware of the time of blasting. • Residents in the area of blasting and rock drilling will be consulted well in advance to inform of them of the nature of the drilling and blasting, the expected noise levels and the schedule of operations (i.e., what week or weeks they may expect rock drilling and blasting to take place near their residence). • Blasting vibration levels meeting NPC-119 guidelines are not expected to ?? cause structural damage but will be noticeable indoors. By scheduling blasts at the same time of day, residents can adjust their activities accordingly. • All blasts will be designed to meet the overpressure and vibration limits outlined in Table 5.1.2.6.2-9. Monitoring will be undertaken to ensure that the limits are met. • In the presence of persistent complaints, where rock drilling may occur for extended periods of time (greater than 2 weeks), and where additional noise mitigation measures such as noise barriers are not feasible, issues will be dealt with on a case-by-case

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	basis. • The contract documents will contain a provision that any initial vibration complaint will trigger verification that the general control measures agreed to are in effect. • In the presence of persistent vibration complaints, measurements of vibration levels will be conducted to ensure that applicable limits are met. • Where possible, equipment should be located farther than the "distinctly perceptible" distances outlined in Table 5.1.2.7.2-4. Otherwise setback distances meeting the applicable building Class II and Class III limits should be maintained. Where activities must take place within these setbacks, consideration for alternative equipment/methods and/or vibration monitoring will be given. • Prior to the start of blasting, a visual "walk-around" inspection of buildings in the area will be undertaken, to establish their condition prior to the work being conducted. Wherever possible, photographs of any existing foundations cracks or structural problems will be taken. • In the presence of persistent complaints and subject to the results of a field investigation, alternative vibration control measures may be required, where reasonably available. In selecting mitigation measures, consideration should be given to the technical, administrative and economic feasibility of the various alternatives. Alternatives could include but are not limited to: - Restricting vibration-causing activities to daytime hours only; - The use of alternative methods or equipment (for example, the use of a vibratory pile driver rather than a drop hammer or diesel system); and - Using smaller charge sizes for blasts. • To mitigate effects to the NAC the following measures will be undertaken: - Incorporate a floating slab system or other similar design which achieves a similar reduction in vibration in the track design on the structure in the vicinity of the NAC. - Undertake a detailed assessment once the train selection has been finalized to provide more specific recommendations accounting for specific frequency characteristics of the proposed LRT. The City of Ottawa will consult with the NAC to select an appropriate consultant to undertake that review. - Although the existing bus vibration is not caused or made worse by this project, efforts will be made during the design the design process to improve the existing situation if feasible. - The City of Ottawa will consult with the NAC to develop an appropriate construction schedule to minimize impacts to NAC operations. - Establish dialogue with NAC during design and into construction to coordinate construction efforts and minimize impacts.
Rail Rolling Stock Accessibility	• Specific accessibility requirements will be addressed during the detail design and construction stage of the project to ensure that the LRT facility will be fully accessible following all of the City of Ottawa's 2006 City of Ottawa Municipal Accessibility Plan and in accordance with the CTA's " Code of Practice: Removing Communications Barriers for Travellers with Disabilities" and "Guide to Removing Communication Barriers for Travelers with Disabilities".
Rideau Canal	• The twin bridge at the north Rideau River crossing will be designed sympathetic to the existing structure to mitigate heritage impacts. • The new bridge at the south Rideau River crossing will be designed in accordance with the Strandherd-Armstrong Bridge Aesthetic Guidelines (du Toit Allsopp Hillier, November 2005). • Consult with Parks Canada and NCC during the design of the twin bridge at the north Rideau River crossing and the new bridge at the south Rideau River crossing. All required permits and approvals will be obtained. • Construction will be staged to avoid impacts during key times (e.g. Winterlude activities).

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	• There will be no construction adverse effects in the spring or summer as construction will be timed such that through navigation will be maintained throughout the duration of the project.. All construction will be undertaken in accordance with the authorizations issued under the *Navigable Waters Protection Act*. • Consult with Parks Canada regarding potential underwater archaeological resources within the Rideau Canal/Dow's Lake. • Stage 2 Archaeological Assessment at Dow's Lake; submit to Ministry of Culture a minimum of 90 days prior to construction.
Species of Special Concern	• Site specific mitigation measures for each watercrossing are outlined in Table 5.1.1.6-1. • During construction vegetation clearing in the Bowesville-Armstrong Meadow habitat area will be timed to avoid the identified breeding period for all open country birds, consistent with the Migratory Birds Convention Act (MBCA). If the breeding window cannot be avoided, nest surveys will be conducted to ensure that there are no active nests in the affected areas prior to clearing. All active nests of migratory birds, including the Short-eared Owl will be protected. • In relation to the Monarch Butterfly, native seed mixes containing Common Milkweed (*Asclepias syriaca*) will be used when re-establishing vegetation within disturbed areas of the right-of-way in the Greenbelt area. This will mitigate the loss and/or disturbance of cultural meadow habitat required for construction. • In general, the use of pesticides associated with weed control will be limited or eliminated, and natural regeneration of old-field communities should be encouraged within the LRT right-of-way. These measures help minimize potential effects to the Bowesville-Armstrong Meadow raptor habitat as well as Monarch Butterfly habitat. Pesticide management is consistent with the City of Ottawa's policy for pesticide use, which limits its use to situations where there is a serious risk to human or animal health, or if the survival of trees or shrubs is threatened. • Although there are no recent records of Blanding's Turtle in the study area, it is recommended that the existing railway bed be visually checked as part of the field work conducted during the detailed design phase (timed during the nesting season- May to September), to confirm that this species is not using the railway bed for nesting. If any nests are located, the Ministry of Natural Resources and Environment Canada should be consulted to assist in the relocation of nestlings and/or eggs. • A relocation plan for the Foxtail Sedge will be developed during detail design, encompassing transplant or rootmats/seedbank relocation prior to construction. • Stormwater management measures will be implemented to control stormwater run-off into rare species habitat.
Surface and Groundwater	• Vegetative cover will be preserved for as long as possible to promote natural water infiltration/recharge to the aquifer system; • Buffer strips will be maintained between the construction area and surface watercourses to promote the dissipation of water energy during runoff events, and to aid in the removal of suspended particulate matter; and • To support proper/natural water infiltration to the aquifer system, disturbed areas will be replanted as soon as possible after disturbance has stopped, not after construction is completed. • Construction on all temporary and permanent drainage ditches and culverts will be completed as soon as possible and in accordance with OPSS 182 to maintain natural drainage conditions, and drainage ditches will be designed to minimize adverse effects on existing watercourses and groundwater by avoiding large cuts, incorporating protection against scour, and avoiding discharges to unprotected watercourses. Stormwater management procedures will be put into place to mitigate surface water runoff and drainage effects during construction. Specific details are outlined in Section 5.1.1.4. • • Disruption of groundwater (e.g. infiltration) will be minimized through the use of fill

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	material (e.g. quarried rock containing no fine soil) during grading activities. Newly graded slopes will be protected against erosion (e.g. berms, rip-rap, aggregate cover, seeding, mulching, sodding, etc.), so as not to result in sediment transport through surface water runoff. Any dewatering of cuts/excavations required as a result of groundwater interception will be done in accordance with approved control measures. The groundwater will be discharged to a vegetated area at least 15 m from a surface watercourse, or into a water containment area to dissipate water energy and minimize the potential for accumulation of suspended particulate matter. Any breach of the aquifer system (i.e. shallow or deep) will be mitigated by plugging or lining the breach using impervious material such as clay to ensure the breach does not continue discharging appreciable quantities of groundwater, and to minimize dewatering requirements. • The impact of any temporary disruption in groundwater supply by construction related dewatering operations will be reduced through (a) advanced notification of potentially affected users and provision of alternate supply if needed, (b) rapid completion of construction activities, and (c) the application of effective erosion control at outfalls. Extraction of more than 50 m3 (50,000 litres) per day will require a Permit to Take Water (PTTW) from the MOE, particularly for areas of cut south of the Macdonald-Cartier International Airport, including: Barrhaven Town Centre; High Road; Claridge; Beatrice; and Newland. • Bridge design will minimize the use of instream or nearstream substructures which may raise the water table or the surrounding area, or impede base flow to surface watercourses; and • Channel modification (i.e. alteration of surface water flow pattern) may result in changes in groundwater flow patterns. Channel modification will be minimized where possible to avoid potential disruption of the streambed and banks, and groundwater base flow. • A groundwater monitoring program (GMP) will be implemented prior to construction to collect information on groundwater levels and conditions in the vicinity of cuts and excavations, particularly south of the Macdonald-Cartier International Airport. The GMP will involve installing monitoring wells in proximity to construction activities to monitor any adverse effects on groundwater resources, which may influence groundwater flow to surface watercourses, or private and municipal wells. Piezometers will be installed near surface watercourses to measure water levels and baseflow conditions. In addition, a well monitoring strategy will be developed and implement from private wells in the vicinity of construction. This will include preparing an inventory of wells in the vicinity of construction and monitoring effects during construction. If any of the wells are impacted such that there is insufficient water to meet the local residential water demand and/or the quality is impaired such that it is unsuitable for human consumption then a suitable alternative water supply will be provided. A map of potable water wells will be created as part of the GMP.
Transportation	• During construction traffic detours will be required to construct the utilities and rail network. The City of Ottawa through the procurement team is preparing plans for traffic and bus routing during construction. • Consultation with the Stakeholders and media will be required to mitigate confusion as the project proceeds. The City of Ottawa will establish a consultation strategy for the design and construction periods. • Cyclists may dismount their bicycle at Mackenzie Station and walk their bicycle along the platform to the second crosswalk, this could result in pedestrian cyclist conflicts and is not considered to be viable for the commuter cyclist. • Use the cycle lanes on the recently reconstructed Laurier Avenue Bridge, and then reconnect to the cycle network at Cumberland is an option using existing facilities; • Cross the Canal on the soon-to-be-constructed Rideau Canal Pedestrian Bridge at Somerset Avenue incorporated with upgraded cycle facilities to access the crossing.

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	• The City of Ottawa is currently undertaking a review of its cycle network, consideration will be given to identifying additional cross-town routes on other streets that link directly to Canal crossings locations. • The O-Train Service is to be kept operational as long as possible. However, closure of the system is required for construction and testing. This closure will be mitigated as much as possible by temporarily operating a parallel bus service. This type of alternative service has been proven to be effective in the past. • To ensure NRC-CSTT is informed of shut downs and overall operations, the City of Ottawa should include them in the Communications plan being established for the design and construction period. • Navigable clearance will be maintained throughout the duration of construction. All construction will be undertaken in accordance with the authorizations issued under the Navigable Waters Protection Act.
Vegetation and Wetlands	• Site specific mitigation measures for each watercrossing are outlined in Table 5.1.1.2-1 and Table 5.1.1.5-1. • Ensure intrusion into natural forest communities is minimized during the construction phase. • 2:1 compensation for tree removals. This commitment does not preclude additional mitigation and/or compensation that will be negotiated with specific agencies related to land transfers or permits. • Sedimentation and erosion control measures will be employed throughout the construction phase, Sediment and erosion control measures will be undertaken in accordance with OPSS 577 (Temporary Sediment and Erosion Control Measures), the City of Ottawa's documenst titled *Application of Erosion & Sediment Controls on RMOC Construction Projects*, SP D-006 (Compliance with regulations/by-laws for erosion & sediment control), and SP F-1004 (Erosion and Sediment control plan and monitoring). These will include erection and maintenance of silt fencing until all disturbed surfaces that drain to natural areas are re-stabilized and vegetated. • Where appropriate, along the edges of natural areas that are directly adjacent to the ROW, temporary protection fencing will be installed prior to grading. This fencing will be maintained throughout construction. In many cases, it may be appropriate to integrate sediment and erosion control fencing with construction barrier fencing. Natural areas and remaining forest habitat will be protected in accordance with OPSS 565 (Construction Specifications for the Protection of Trees), OPSS 180 (Management and Storage of Excess Waste) and through any additional mitigation measures identified by a qualified landscape architect during detail design. • Potentially unstable slopes along Sawmill Creek will be analyzed using geotechnical studies and mitigation measures will be developed in consultation with PWGSC. • Clearing techniques will be used for all vegetation that must be removed. All vegetation cleared will be felled and removed away from the retained natural area edge. No onsite burming of materials will be permitted. Vegetation clearing will be undertaken in accordance with OPSS 201 (Clearing, Close Cut Clearing, Grubbing and Removal of Surface and Piled Boulders), OPSS 565 (Construction Specifications for the Protection of Trees) and any additional mitigation measures identified by a qualified landscape architect during detail design. • 2:1 compensation for tree removals will be provided. This commitment does not preclude additional mitigation and/or compensation that will be negotiated with specific agencies related to land transfers or permits. • Along natural areas where clearing will occur and new edges will be created, and particularly through the Armstrong Road South Woods and Chapman Mills – East Woodlot (Nepean Woods) where more mature forest areas will be fragmented or a new edge created, 'edge management' measures will be undertaken to better 'seal' and protect new forest edges. Specifically, native shrubs and tall, fast-growing trees already

Table 5.6-2 Summary of Proposed Construction Mitigation	
Federal Information Requirement	**Proposed Construction Mitigation**
	occur within the natural area will be planted along portions of the newly exposed edges that are most vulnerable to opening and exposure-related impacts (e.g. wind and sun exposure of more mature trees previously protected by adjacent buffering vegetation). Species recommended for wetland habitats (e.g. Armstrong Road South Woods) include Silver Maple, Green Ash, Black Ash, Highbush Cranberry and Bebb's Willow. Species recommended for upland habitats (e.g. Chapman Mills – East Woodlot (Nepean Woods)) include White Ash, Sugar Maple, Alternate-leaf Dogwood and Common Elderberry. Revegetation will occur in accordance with OPSS 572 (Construction Specifications for Seed and Cover) and landscape plans to be developed in detail design by a qualified landscape architect. • The existing hydrologic regimes through wetland natural areas, specifically through the Armstrong Road South Woods, Albion Road (Leitrim) Wetland, portions of the Airport Parkway Natural Area, will be maintained. That is, drainage to or from the wetlands will not be diverted or impounded. • Salvage of seedbanks for the small areas of wetland removed by the alignment will be considered. Seedbank material can be re-instated in adjacent areas, temporarily disturbed areas that will be re-instated, the flat-bottomed ditch lines, or used on other City of Ottawa projects. • Any temporary dewatering that may be required during construction through the wetland areas will be properly managed and performed in accordance with the *Ontario Water Resources Act* (including Section 34, O.Reg 387/04). Discharge water will be filtered prior to release back to the natural area to prevent potential erosion, siltation and/or temporary drawdown or flooding impacts. • All other standard construction-related practices for protection of water quality, as outlined in Section 5.1.1.3 will be implemented near natural areas and particularly wetland areas. • All wildlife encountered during construction activities shall be protected. Consistent with the Migratory Birds Convention Act (MBCA), all active nests of migratory birds will also be protected. Construction, maintenance, operation and decommissioning activities with the potential to destroy or disturb migratory birds, such as site grubbing or vegetation clearing, should not take place in migratory bird habitat during the breeding season (May 1 – July 31). If the proponent must conduct works that could destroy migratory birds or their nests during the identified breeding season, a nest survey will be conducted by a qualified avian biologist prior to commencement of the works. The nest survey will identify and locate active nests of species covered by the *Migratory Birds Convention Act, 1994*. A mitigation plan will then be developed to address any potential adverse effects on migratory birds or their active nests, and will be reviewed by Environment Canada prior to implementation. • All construction-related debris will be disposed of following construction in accordance with the waste management provisions included in Section 5.1.2.10. • An environmental inspector will be retained by the Contractor to ensure all relevant mitigation measures are being properly applied throughout construction. • Unit 16 - Consult with Parks Canada during the detail design process to examine opportunities to further reduce or eliminate vegetation displacement. • Continue consultation with Dominion Arboretum staff as design progresses to discuss site access, establish a program to identify and transplant and to protect or replace others, and explore other mitigation measures to minimize adverse effects during construction. • Additional compensation for removal of mature trees and additional mitigation measures for transplanted trees and shrubs will be negotiated through discussions with Dominion Arboretum staff.
Wildlife and Migratory Birds	• All wildlife encountered during construction activities shall be protected. • Consistent with the Migratory Birds Convention Act (MBCA), all active nests of

Table 5.6-2 Summary of Proposed Construction Mitigation	
Federal Information Requirement	**Proposed Construction Mitigation**
	migratory birds will also be protected. Construction, maintenance, operation and decommissioning activities with the potential to destroy or disturb migratory birds, such as site grubbing or vegetation clearing, or removal or works on existing structures with potential for nesting, will be conducted outside of the migratory bird breeding season (May 1 – July 31). If the proponent must conduct works that could destroy migratory birds or their nests during the identified breeding season, a nest survey will be conducted by a qualified avian biologist prior to commencement of the works. The nest survey will identify and locate active nests of species covered by the *Migratory Birds Convention Act, 1994*. A mitigation plan will then be developed to address any potential impacts on migratory birds or their active nests, and will be reviewed by Environment Canada prior to implementation.

Table 5.6-3 Summary of Proposed Operation/Maintenance Mitigation	
Federal Information Requirement	**Proposed Operation/Maintenance Mitigation**
Accidents and Malfunctions	• Prior to commencement of operations, documents will be developed to address spill situations for the LRT line. Included will be a spill response manual describing types of spills, procedures for containment and mandatory contacts with the City, Ontario Ministry of the Environment Spills Action Centre (1-800-268-6060) and the Federal Spills Response Centre (819-997-3742, if the incident is on or adjacent to Federal property). • The following mitigation measures are proposed to minimize impacts of potential spills and will be included in the Spills Action plan: − Employee “Best Practices” for drainage design; − Use oil and grit collectors; − Control areas of refilling; − Mandatory and immediate contact with the appropriate regulatory authorities; − Immediate contact with specified spill clean up contractors; and − Monitor and record spill clean up and submit required reports. • An emergency protocol will be developed to both manage a derailment accident investigation and restore the LRT system to service • Any LRT/motor vehicle or LRT/pedestrian/passenger accidents that occur will be immediately reported to the Ottawa City Police and/or the Ontario Provincial Police as appropriate. The Ottawa City Police and/or the Ontario Provincial Police will be responsible for producing a formal accident report.
Air Quality	• Not Applicable
Archaeology and History	• Not Applicable
Central Experimental Farm	• Not Applicable
Contaminated Sites and Waste Management	• Any chemicals or potentially harmful products used within the LRT corridor for maintenance purposes will be stored and handled in accordance with the measures outlined in the previous section. Operation and maintenance activities will be performed in accordance with OHSA guidelines, as well as the City of Ottawa’s internal health and safety protocol. All general refuse (i.e. bottles, plastics) will be disposed of at a licensed landfill. Old railway ties will be collected, stored, and handled in accordance with the Environmental Canada document, entitled “Industrial Treated Wood Users Guidance Document”. • All chemicals and railway debris (i.e. railway ties, equipment etc.) will be stored at a maintenance facility. • Prior to commencement of operations, documents will be developed to address spill situations for the LRT line. Included will be a spill response manual describing types of spills, procedures for containment and mandatory contacts with the City, Ontario Ministry of the Environment Spills Action Centre (1-800-268-6060) and the Federal Spills Response Centre (819-997-3742, if the incident is on or adjacent to Federal property). • The following mitigation measures are proposed to minimize impacts of potential spills and will be included in the Spills Action plan: − Employee “Best Practices” for drainage design; − Use oil and grit collectors; − Control areas of refilling; − Mandatory and immediate contact with the appropriate regulatory authorities; − Immediate contact with specified spill clean up contractors; and − Monitor and record spill clean up and submit required reports.

Table 5.6-3 Summary of Proposed Operation/Maintenance Mitigation	
Federal Information Requirement	**Proposed Operation/Maintenance Mitigation**
Fish and Fish Habitat	• Stormwater Management measures have been designed to mitigate stormwater water run-off, including a series of flat-bottomed, vegetated ditches along the LRT embankment to 'filter' runoff and provide informal cleansing. In urban areas run-off will be handled through the City sewer system. • All relevant construction-related measures will be identified and applied to address impacts specific to proposed rehabilitation works and potentially affected watercourse. This will likely include sediment and erosion control and restoration of disturbed surfaces draining to the watercourse, temporary timing, fish protection and flow management measures for any instream works, and standard management practices for handling of equipment, potential contaminants and construction related debris. The details will be reviewed with relevant external agencies at the time of rehabilitation.
Health and Wellbeing	• Follow all applicable safety legislation • Pedestrian crossing of the tracks will be provided at signal controlled crossings and intersections. Pedestrian walkways along the roadway will be provided to connect LRT stops with the crossing locations in the downtown. • Traffic signals and turning lanes will be provided to ensure turning vehicles can manoeuvre through the intersection safely. • Signage along the LRT lane will be installed to ensure traffic and pedestrians recognize that the lane is a designated transit lane. Diamond Lane markings, with which the public is familiar, will be used to define the transit lane through downtown. • Access controls will include pavement texture used on the transit lane to define it from the other lanes along with signage to identify the transit lane. • In addition to the existing fencing along the existing rail right-of-way, new security fencing will be provided: − Alongside the LRT from Greenboro Station to Bowesville Road; − Both sides of airport link have fencing or barriers; − Adjacent the River Road Park and Ride Lot (except at the station); − Between LRT tracks at station curbside platforms; and − Bordering the Chapman Mills East Woodlot from Cresthaven Road to Woodroffe Avenue. • The City of Ottawa will monitor traffic and parking activities to identify any conflicts with the transit operations, parking restrictions and turning lane lengths will be adjusted to minimize interruption to transit movement, and ensure the safety of the public. • Additional fencing will be installed through development agreement process as the area around LRT develops. • The LRT system is operated by electricity, minimizing potential airborne contaminants.
Land Use	• Security around Stations and Park and Ride lots will be improved through the use of lighting, surveillance cameras, accessible telephones and security patrols. • Aesthetic impacts will be mitigated through the employment of buffer zones, landscaping and regular maintenance of the facility and tracks. • Effects of vibration have been mitigated by running the proposed North-South LRT alignment along the former rail line and designated transportation corridors. No vibration-sensitive structures have been built adjacent to these features • Vibrational impacts will be minimized through the use of joint-free rails wherever possible. • Community safety impacts related to conflicts with pedestrians on the exclusive right-of-way sections will be mitigated through the use of secure fencing. In addition to the existing fencing along the existing rail right-of-way, new security fencing will be provided: − Alongside the LRT from Greenboro Station to Bowesville Road; − Both sides of airport link have fencing or barriers; − Adjacent the River Road Park and Ride Lot (except at the station);

Table 5.6-3 Summary of Proposed Operation/Maintenance Mitigation	
Federal Information Requirement	**Proposed Operation/Maintenance Mitigation**
	− Between LRT tracks at station curbside platforms; and − Bordering the Chapman Mills East Woodlot from Cresthaven Road to Woodroffe Avenue. • Accesses will be fenced except at authorized crossings and within an urban street right of way. Unauthorized access will be controlled as part of normal traffic operation on City of Ottawa streets including any new bylaws that may be required. • Where warranted, increased traffic around Park and Ride lots will be mitigated through the use of turning lanes and traffic signals. • Noise impacts will be mitigated by limiting the hours of track maintenance to those provided within community by-laws. • Operating authority to reduce bus volumes by as much as 30% for opening day in the Downtown.
Noise and Vibration	• In the presence of persistent complaints from receptors near NR12 (Brookfield Residences), post-construction monitoring of operational noise could be used to ensure that the City's guidelines are met. If required, noise mitigation, in the form of a short right-of-way noise barrier high enough to break the line of sight between the receptors and the LRT wheels, could be used. • Noise levels will be mitigated to the extent possible through design and electric operation, and relative to other transportation facilities are of much reduced frequency and intensity generally.
Rail Rolling Stock Accessibility	• Specific accessibility requirements will be addressed during the detail design and construction stage of the project to ensure that the LRT facility will be fully accessible following all of the City of Ottawa's 2006 City of Ottawa Municipal Accessibility Plan and in accordance with the CTA's " Code of Practice: Removing Communications Barriers for Travellers with Disabilities" and "Guide to Removing Communication Barriers for Travelers with Disabilities".
Rideau Canal	• No additional outflows will be permitted to the Rideau River/Canal to avoid additional discharges to the river. All runoff will be diverted to avoid direct discharge into the Rideau River. This includes deck drains for the new crossing. The structures will be designed to direct run-off to the storm sewer system on the adjacent roads. • Consultation will occur with Parks Canada and Transport Canada regarding any future rehabilitation work.
Species of Special Concern	• Stormwater management to control stormwater run-off into rare species habitat (outlined below) • In addition, the standard mitigation measures recommended for the protection of 'designated natural areas', vegetation communities and fisheries and aquatic habitat are again relevant and applicable to the protection of potential habitat for rare species and species at risk.
Surface and Groundwater	• All stormwater management facilities will be designed to meet Ontario Ministry of the Environment requirements for both quality and quantity control. These facilities will be sized with adequate capacity to handle the spring melt water. Drainage design has been undertaken to meet current engineering standards and to address the City of Ottawa and Conservation Authority requirements. Receiving waters generally consist of habitats to which "normal" protection, as defined by the Ministry of the Environment Stormwater Management Planning and Design Manual (2004), is applied. Where sensitive aquatic habitats exist "enhanced" protection must be provided. • In locations where the LRT runs on impervious surfaces (i.e. roadways), runoff will be directed to existing or future municipal drainage systems. • No additional outflows will be permitted to the Rideau River/Canal to avoid additional discharges to the river. All runoff will be diverted to avoid direct discharge into the Rideau River. This includes deck drains for the new crossing. The structures will be designed to direct run-off to the storm sewer system on the adjacent roads.

Table 5.6-3 Summary of Proposed Operation/Maintenance Mitigation	
Federal Information Requirement	**Proposed Operation/Maintenance Mitigation**

	• Where the LRT runs on the existing rail corridor, grass swales (ditch) will be provided to provide quality and quantity control. A properly designed swale will provide both quantity and quality control to meet MOE and City of Ottawa requirements.
	• Quality control at the parking lots will be provided through 'end-of-pipe' solutions such as stormwater management ponds, oil/grit separators and stormceptors. The facilities will be designed to meet Ontario Ministry of the Environment and City of Ottawa requirements for quality control.
	• Mitigation of stormwater quantity impacts from the parking lot facilities will be carried out in accordance with the Master Drainage Plans or Servicing Studies for the areas in which they are located. Within developed urban areas, and where available, runoff will be directed to the existing stormsewer systems. For flows greater than the five-year peak storm, water will be held on-site and gradually discharged to the local system. Storage will be designed for the 100 year storm event. In rural and developing communities, it is recommended that stormwater be held on-site and gradually discharged into local stormwater facilities for controlled release.
	• At the Walkley Facility existing flow across the facility will be retained to avoid outletting into the existing Turtlehead Nature Area watershed. Any surplus flow will be treated and directed away from this area.
	• Impacts on the quantity and quality of runoff from the storage and maintenance facilities will be mitigated through the use of technologies such as oil/grit separators or stormcepters, diversion to existing or new stormwater management ponds (SWMP) and improved ditching. Oil/grit separators and stormceptor basins are installed as part of the storm sewer system. Through a series of baffles and filters they effectively remove both fine and coarse grit, as well as petroleum products. It is recommended that water passing through the separators and/or stormceptors be outlet into existing SWMPs. Improved ditches will provide additional treatment and attenuation for water not captured by the storm water sewer system (i.e. from permeable surfaces). In an effort to conserve water and reduce impacts on the environment, recycling of washwater should be investigated.
	• Establish a spills action plan:
	    o Undertake a detailed drainage investigation of the site;
	    o Employee "Best Practices" for drainage design;
	    o Construct stormwater management ponds to ensure the quality and control flows;
	    o Use oil and grit collectors;
	    o Control areas of refilling; and
	    o Monitor/record spill clean up.

Transportation	• The City of Ottawa will be developing a strategy for providing both LRT and bus service on Albert and Slater, part of that strategy will include taking advantage of the LRT capacity to reduce the buses on Albert and Slater. The City of Ottawa is committed to as much as 30% reduction in the number of buses on Albert and Slater. Even so the potential for conflicts at bus stops is possible; the EA has suggested a set back of parking/loading from the stop areas. The City of Ottawa will monitor the bus operations and if required increase the set back during the peak hours to accommodate transit operations. • Through alternative generation and selection of a recommended alternative, impacts to the downtown road network have been minimized. All current turning movements will be retained. Through approved City of Ottawa procedures turning movement will be reviewed and queuing and parking adjusted as per the City of Ottawa's normal review processes following the implementation of a change to a road. • LRT and BRT platform locations were recommended that least impact access to adjacent lands and have potential for integration into the development. As the City of Ottawa continues to talk to developers about the potential for integration and refines the operating strategy for the LRT BRT system it may be necessary to move stop locations

Table 5.6-3 Summary of Proposed Operation/Maintenance Mitigation	
Federal Information Requirement	**Proposed Operation/Maintenance Mitigation**
	to accommodate the outcome of those processes. This process can be carried out with the detailed design and take advantage of the public consultation during the implementation stage. • Safety protocols will be developed by the operating authority for typical urban rail transit operation. These protocols will discuss threats to the facility and to surrounding pedestrians and recreational network. • All of the City of Ottawa's Light Rail vehicles are expected to carry bicycles inside the vehicle, along with their riders and buses equipped with bike rakes. • The City of Ottawa will continue to work with the cycling community to ensure that Light Rail and cycling complement each other to promote environmentally friendly modes of travel. • The recommended plan identifies the relocation of the existing NRC-CSTT access siding track to the west of the twin-track Light Rail Transit line. Although the recommended plan identifies a third track as the preferred solution, the City of Ottawa will consider other options during the detailed design stage of the project implementation process that may provide a more cost-effective means of serving the NRC-CSTT facility. These options may include using a portion of the LRT track where technically feasible. • City of Ottawa and NRC-CSTT will coordinate or considered using the same maintenance firm to reduce conflict in operations. • At this time Ontario does not have legal signals, which apply to transit designation to permit bus to proceed ahead of the train at intersections. The City of Ottawa will investigate the options available, in the meantime an operating protocol will be included in the City of Ottawa's operating strategy to address this situation.
Vegetation and Wetlands	• Implement stormwater management and spills management measures for operation of maintenance facility. • The LRT system is operated by electricity, minimizing potential airborne contaminants. • Storm water management measures will be managed within the ROW using vegetated, flat bottom ditches that will collect and 'filter' runoff to provide informal 'cleansing'. In general, runoff volumes are not anticipated to be large, and will filter through the railway embankment, so formal stormwater management (SWM) facilities are not proposed, other than at Park and Ride lots and maintenance facilities. Where appropriate, for example at the road intersection areas, drainage from the LRT will also be designed to tie into existing SWM systems as well as those that are proposed as part of the surrounding development plans. Specific mitigation measures related to stormwater run-off include the commitment to not permit any new outflows into the Rideau Canal and to design deck drainages capture systems on all new bridges over the Rideau Canal. These mitigation measures will ensure that no salt laden runoff enters the Rideau Canal. Additional details on stormwater management are included in as described in the above Surface and Groundwater section will be implemented. Section 5.1.1.4. • Stormwater management and 'spills prevention and management' measures will also be implemented for the proposed maintenance facility and parking lots to avoid potential adverse effects to the adjacent natural area and associated small wetland community. Additional details on stormwater management are included above and in Section 5.1.1.4. • Noise levels will be mitigated to the extent possible through design and electric operation, and relative to other transportation facilities are of much reduced frequency and intensity generally. • Use of pesticides for right-of-way management will be avoided wherever possible. This is consistent with the City of Ottawa's policy for pesticide use, which limits its use to situations where there is a serious risk to human or animal health, or if the survival of trees or shrubs is threatened.

Table 5.6-3 Summary of Proposed Operation/Maintenance Mitigation

Federal Information Requirement	Proposed Operation/Maintenance Mitigation
	• During any future rehabilitation activities through natural areas all relevant construction-related measures, similar to those used during initial construction will be applied to address impacts specific to the proposed works and natural area. The details will be reviewed with relevant external agencies at the time of rehabilitation.
Wildlife and Migratory Birds	• During any future rehabilitation activities through natural areas all relevant construction-related measures, similar to those used during initial construction will be applied to address effects specific to the proposed works and natural area. The details will be reviewed with relevant external agencies at the time of rehabilitation. • Operation of the LRT is anticipated to have minimal effects on wildlife. There will likely be some direct mortality; however, it is not anticipated to be significant. Train frequency will be many times less than the frequency of vehicular traffic on roadways within the same vicinity therefore it is anticipated that direct mortality from trains will be only a small proportion of total transit-related mortality. In fact, the total transit-related wildlife mortality may decrease if the number of cars on the roads is reduced through LRT ridership.

Table 5.6-4 Summary of Commitments to Future Studies/ Work	
Federal Information Requirement	**Commitment to Future Studies/ Work**
The most significant commitment to future studies/work is to develop an implement specific Project Environmental Management Plans (PEMPs) for each construction project. The intent of the PEMPs is to ensure that all the commitments made during planning and design have been addressed. Each PEMP provides the continuity from planning into design and through to construction, operation and maintenance. It becomes a partnership between the City of Ottawa, the designer and the contractor. The PEMPs will track the commitments made and ensure that mitigation measures are incorporated in the design and ultimately implemented during construction. When preparing the design and construction packages, the design team will consult with the appropriate external agencies to ensure that the specific mitigation requirements adequately address the EA commitments. In addition, the design team will undertake the work required to obtain outstanding permits and approvals required to construct the project. Additional details regarding PEMP responsibilities, preparation, implementation, and quality control/monitoring are provided in Section 9.0 of this report	
Accidents and Malfunctions	• Develop documents to address spill situations for the LRT line. Included will be a spill response manual describing types of spills, procedures for containment and mandatory contacts with the City, Ontario Ministry of the Environment Spills Action Centre (1-800-268-6060) and the Federal Spills Response Centre (819-997-3742, if the incident is on or adjacent to Federal property). • Develop an emergency protocol to both manage a derailment accident investigation and restore the LRT system to service.
Air Quality	• Not Applicable
Archaeology and History	• Consult with Parks Canada regarding potential underwater archaeological resources within the Rideau Canal/Dows Lake • Undertake a Stage 2 Archaeological Assessment for works in the undisturbed area comprising Riverside South and Barrhaven and the link to the Airport. During this assessment, Parks Canada should be consulted regarding potential underwater resources in the vicinity of the new Rideau River crossing. If archaeological finds are discovered, Stage 3-4 mitigation will be undertaken as required in accordance with the guidelines and policies of the Ministry of Culture. Consultation will occur with the Ontario Ministry of Culture and relevant First Nations to discussion mitigation strategies if sites are found as part of the Stage 2 Assessments. Copies of the Archaeological Assessments will be provided to the RAs.Given that much of the alignment on the existing rail right-of-way and in the downtown has been previously disturbed, limited additional archaeological investigations are required. In areas where construction will occur outside the existing transit corridor or rail bed, including LeBreton Flats, the area between the LeBreton Station and Bronson Avenue, Dow's Lake, new maintenance facility or station facilities, or other construction adjacent to the rail bed, a Stage 2 Archaeological Assessment will be undertaken. Parks Canada will be consulted regarding potential underwater resources in the vicinity of the Dow's Lake. If archaeological finds are discovered, Stage 3-4 mitigation will be undertaken as required in accordance with the guidelines and policies of the Ministry of Culture. • Complete Stage 3-4 Archaeological Assessments if warranted by finding of Stage 2 Archaeological Assessment; submit to Ministry of Culture a minimum of 90 days prior to construction • Consult with Parks Canada and NCC during the design of the Rideau Canal/River crossings and obtain necessary permits during detail design. • Develop interpretive panels in consultation with the City of Ottawa Heritage Department to recognize the rich rail history of the former CPR corridor.
Central Experimental Farm	• Continue consultation with Dominion Arboretum staff as design progresses to discuss site access, establish a program to identify and transplant and to protect or replace others, and explore other mitigation measures to minimize adverse effects during construction.

Table 5.6-4 Summary of Commitments to Future Studies/ Work	
Federal Information Requirement	**Commitment to Future Studies/ Work**
	• Additional compensation for removal of mature trees and additional mitigation measures for transplanted trees and shrubs will be negotiated through discussions with Dominion Arboretum staff.
Construction Staging and Access	• It should be noted that potential construction staging areas and construction accesses are currently being identified. It is recognized that detailed impact assessment has not occurred on the construction staging and access purposes. However the City is committed to providing the necessary details on the potential effects and proposed mitigation measures as design progresses. The contractor shall be responsible for meeting any and all conditions set out in the occupancy permit or easement agreement for the individual properties. The City of Ottawa has been and will continue to be actively involved in the application for occupancy of federal lands by the contractor. The details of the occupancy permits cannot be established until the selected contractor is carrying out detail design and is developing a detailed project schedule. During the application and review stage any environmental constraints shall be identified and a management plan developed.
Contaminated Sites and Waste Management	• A Phase II Environmental Site Assessment (ESA) will be completed on the north portion of the former Gloucester Landfill that will be required for a commuter parking lot. The Phase II ESA will include intrusive environmental sampling for soil and groundwater quality. Representative soil and groundwater samples will be submitted for laboratory analysis by a Canadian Association for Environmental Analytical Laboratories (CAEAL) approved laboratory. The results of the analyses will be compared against applicable MOE Standards and Canadian Council of Ministers of the Environment (CCME) Guidelines, as stipulated in the CCME Contaminated Sites Policy. All sampling will be completed by a Qualified Person under CCME Guidelines. If remediation of this property is required, the appropriate remedial option will be selected on the basis of the extent of contamination, type of contamination, and the cost to remediate; in accordance with CCME Guidelines and O. Reg 347. The selection of the proper method for remediation and/or disposal will be performed by a Qualified Person under O.Reg. 153/04 of the OEPA, and in accordance with O.Reg. 153/04. CEPA (Part 5, Part7, Part 9, Schedule 5, and Schedule 6) will be followed in conjunction with OEPA statutes and regulations. CCME publications regarding contaminated sites will be used for guidance during the selection of proper methods for remediation and/or disposal. In addition, the investigation will determine any potential impacts on the federal groundwater treatment plan and develop appropriate measures to mitigate potential impacts. Procedures for the disposal of any material generated are outlined in Section 5.1.2.10 of this report. Transport Canada will be consulted prior to the commencement of any Phase II ESA work at the former Gloucester Landfill, in order to ensure that any Phase II ESA work appropriately considers existing background data. Phase II ESA requirements will be determined by a Qualified Person, and in accordance with O.Reg. 153/04 under the OEPA. CEPA (Part 5, Part7, Part 9, Schedule 5, and Schedule 6) will be followed in conjunction with OEPA statutes and regulations. In addition, CCME contaminated sites publications and the Canadian Standards Association (CSA) Standard Z769-00 will be used for guidance during the selection and evaluation of Phase II ESA requirements. • A Phase I ESA will be completed for the south portion of LeBreton Flats, north of Wellington Street. The Phase I ESA will include a review of all historical background information for the site, including: historical insurance plans, MOE inventories, maps and plans, and aerial photographs. The Phase I ESA will be completed in accordance with the Contaminated Sites Policy under the CCME Guidelines. The Phase I ESA will make recommendations for further environmental investigation, at the discretion of the Qualified Person. If cleanup is required, procedures for the disposal of any material generated are outlined in Section 5.1.2.10 of this report. • A Phase I ESA will be completed for any property, or portion of a property, to be acquired or leased by the City of Ottawa for the purposes of accommodating the North-South corridor LRT. Where a property has been recommended for further environmental

Table 5.6-4 Summary of Commitments to Future Studies/ Work	
Federal Information Requirement	**Commitment to Future Studies/ Work**
	investigation, as per the Phase I ESA completed by AMEC Earth and Environmental for the CPR Ellwood/Prescott Subdivision lands (O-Train Corridor), the City of Ottawa will complete a Phase II ESA on a site-by-site basis. • Continue negotiations with the property owner of the former fuel service station located on the north side of the Queensway near Gladstone Ave. (west side of the existing right-of-way), with regard to the presence of contamination observed to be migrating within the existing O-Train Corridor. Any contaminated material that is encountered during construction will be managed and disposed of in accordance with the mitigation measures outlined in Section 5.1.2.10 of this report. Additional measures will be taken to prevent the further spreading of contamination within the preferred LRT corridor. • Identify waste management procedures for storage, transporting, handling and disposal of water materials; compare requirements of the Ontario Water Resources Act (OWRA). • A Spill Prevention, Control and Countermeasures (SPCC) Plan will be prepared for all construction activities within the boundaries of the LRT corridor, by the Contractor. The Contractor will develop, implement, and maintain the SPCC Plan to ensure that construction activities do not increase the risk of a release of fuel, oils, or other hazardous materials and chemicals to the environment. The SPCC Plan will describe the procedures and equipment in-place to minimize spills, leaks, or releases of hazardous materials. In addition, the plan will address the reporting and response procedures in the event of an incident. The plan should incorporate the following: an inventory of all on-site hazardous chemicals; clearly identified hazardous materials storage areas with secondary containment features; install and maintain spill kits in areas that are readily accessible to workers. The kits should contain absorbent pads, booms, drain covers, etc.; and all wastes generated as a result of spill clean-up will be managed according to O.Reg. 347 (amended to O.Reg. 558).
Fish and Fish Habitat	• Finalize HADD determinations during detail design and develop compensation plan in consultation with DFO and RVCA (and MNR and Parks Canada as appropriate), and obtain *Fisheries Act* Authorizations from DFO. • Undertake any additional field investigations as required to refine existing conditions, impact assessment, mitigation/compensation, prepare *Letter of Intent*, and provide as supporting documentation to RVCA and DFO, to obtain the Authorizations • Provide a copy of the documentation of the existing bed profile and substrate conditions of the Rideau Canal (above the tunnel) will be provided to Parks Canada. • Confirmatory field testing of rock elevations at Dows Lake the will occur during the detail design phase. The contract will contain blasting specifications which the City of Ottawa will provide to the Parks Canada Agency.
Health and Wellbeing	• In advance of opening the LRT lanes a public awareness campaign as part of the over all project communications plan will be activated, to inform the public of the changes and procedures. In addition an enforcement blitz will be initiated as part of the communications effort. • The City of Ottawa will monitor traffic and parking activities to identify any conflicts with the transit operations, parking restrictions and turning lane lengths will be adjusted to minimize interruption to transit movement, and ensure the safety of the public.
Land Use	• Obtain all required land use approvals for maintenance facility, parking lots and stations if required.
Noise and Vibration	• Undertake a detailed vibration assessment in the vicinity of the NAC once the train selection has been finalized to provide more specific recommendations accounting for specific frequency characteristics of the proposed LRT. The City of Ottawa will consult with the NAC to select an appropriate consultant to undertake that review. • Consult with the NAC to develop an appropriate construction schedule to minimize impacts to NAC operations. • Establish dialogue with NAC during design and into construction to coordinate construction efforts and minimize impacts.

Table 5.6-4 Summary of Commitments to Future Studies/ Work	
Federal Information Requirement	**Commitment to Future Studies/ Work**
	• Undertake necessary noise studies to support land use approvals for maintenance facility, parking lots and stations if required.
Rail Rolling Stock Accessibility	• Specific accessibility requirements will be addressed during the detail design and construction stage of the project to ensure that the LRT facility will be fully accessible following all of the City of Ottawa's 2006 City of Ottawa Municipal Accessibility Plan and in accordance with the CTA's " Code of Practice: Removing Communications Barriers for Travellers with Disabilities" and "Guide to Removing Communication Barriers for Travelers with Disabilities".
Rideau Canal	• Consult with Parks Canada during the design of the twin bridge at the north Rideau River crossing and the new bridge at the south Rideau River crossing. All required permits and approvals will be obtained. • Consult with Parks Canada regarding potential underwater archaeological resources within the Rideau Canal/Dow's Lake. • Stage 2 Archaeological Assessment at Dow's Lake; submit to Ministry of Culture a minimum of 90 days prior to construction. • Obtain *Navigable Waters Protection Act* authorizations for Dow's Lake Tunnel and the Rideau River Crossings (per Section 5.1.2.11).
Species of Special Concern	• Provide Environment Canada details on methodology, mapping and the results of future investigations related to species at risk. • Visually survey the existing railway bed (timed during the nesting season- May to September), to confirm that Blanding's Turtle (although no recent records of in study area) is not using the railway bed for nesting. If any nests are located, consult with MNR and Environment Canada to assist in the relocation of nestlings and/or eggs. • Consult with MNR during the detail design stage to finalize mitigation measures for the regionally rare Foxtail Sedge. Also consult with PWGSC as it is likely their lands to be used under license of occupation.
Surface and Groundwater	• Establish a spills action plan: – Undertake a detailed drainage investigation of the site; – Employee "Best Practices" for drainage design; – Construct stormwater management ponds to ensure the quality and control flows; – Use oil and grit collectors; – Control areas of refilling; and – Monitor/record spill clean up. • Develop a groundwater monitoring program (GMP) to be implemented prior to construction to collect information on groundwater levels and conditions in the vicinity of cuts and excavations, particularly south of the Macdonald-Cartier International Airport. The GMP will involve installing monitoring wells in proximity to construction activities to monitor any adverse impacts on groundwater resources, which may influence groundwater flow to surface watercourses, or private and municipal wells. Piezometers will be installed near surface watercourses to measure water levels and baseflow conditions. In addition, a well monitoring strategy will be developed and implement from private wells in the vicinity of construction. This will include preparing an inventory of wells in the vicinity of construction and monitoring effects during construction. If any of the wells are impacted such that there is insufficient water to meet the local residential water demand and/or the quality is impaired such that it is unsuitable for human consumption then a suitable alternative water supply will be provided. A map of potable water wells will be created as part of the GMP.
Transportation	• The City of Ottawa will continue to work with the cycling community to ensure that Light Rail and cycling complement each other to promote environmentally friendly modes of travel. • Obtain all necessary Navigable Waters Protection Act authorizations. • During construction traffic detours will be required to construct the utilities and rail

Table 5.6-4 Summary of Commitments to Future Studies/ Work	
Federal Information Requirement	**Commitment to Future Studies/ Work**
	network. The City of Ottawa through the procurement team is preparing plans for traffic and bus routing during construction. • The O-Train Service is to be kept operational as long as possible. However, closure of the system is required for construction and testing. This closure will be mitigated as much as possible by temporarily operating a parallel bus service. This type of alternative service has been proven to be effective in the past • Consultation with the Stakeholders and media will be required to mitigate confusion as the project proceeds. The City of Ottawa will establish a consultation strategy for the design and construction periods. • The City of Ottawa will be developing a strategy for providing both LRT and bus service on Albert and Slater, part of that strategy will include taking advantage of the LRT capacity to reduce the buses on Albert and Slater. The City of Ottawa is committed to as much as 30% reduction in the number of buses on Albert and Slater. Even so the potential for conflicts at bus stops is possible; the EA has suggested a set back of parking/loading from the stop areas. The City of Ottawa will monitor the bus operations and if required increase the set back during the peak hours to accommodate transit operations. • Through alternative generation and selection of a recommended alternative, impacts to the downtown road network have been minimized. All current turning movements will be retained. Through approved City of Ottawa procedures turning movement will be reviewed and queuing and parking adjusted as per the City of Ottawa's normal review processes following the implementation of a change to a road. • At this time Ontario does not have legal signals, which apply to transit designation to permit bus to proceed ahead of the train at intersections. The City of Ottawa will investigate the options available, in the meantime an operating protocol will be included in the City of Ottawa's operating strategy to address this situation. • LRT and BRT platform locations were recommended that least impact access to adjacent lands and have potential for integration into the development. As the City of Ottawa continues to talk to developers about the potential for integration and refines the operating strategy for the LRT BRT system it may be necessary to move stop locations to accommodate the outcome of those processes. This process can be carried out with the detailed design and take advantage of the public consultation during the implementation stage.
Vegetation and Wetlands	• Unit 16 - Consult with Parks Canada during the detail design process to examine opportunities to further reduce or eliminate vegetation displacement (Strandherd Crossing). • Continue consultation with Dominion Arboretum staff as design progresses to discuss site access, establish a program to identify and transplant and to protect or replace others, and explore other mitigation measures to minimize adverse effects during construction. • Additional compensation for removal of mature trees and additional mitigation measures for transplanted trees and shrubs will be negotiated through discussions with Dominion Arboretum staff. • Conduct a field review of the 'South of Leitrim, North of Quinn' UNA at the detail design stage to confirm site characteristics and determine site-specific impacts and mitigation measures, as appropriate. • Potentially unstable slopes along Sawmill Creek will be analyzed using geotechnical studies and mitigation measures will be developed in consultation with PWGSC.
Wildlife and Migratory Birds	• If clearing can not be accommodated outside the breading bird season, provide the mitigation plan addressing any potential impacts on migratory birds or their active nests to Environment Canada for review prior to implementation.

6.0 Consultation

Consultation with affected parties was an essential and productive component of the study process and provided a mechanism for the City of Ottawa to define and respond to issues before limiting decisions were made prior to the EA document submission. The study was organized so that affected parties were:

- involved throughout the study;
- provided access to information;
- provided responses to questions and data requests; and
- encouraged to participate in an issue identification/resolution process.

A "Consultation Plan" was developed that identified key consultation objectives, target groups and activities to address consultation.

Conducting Public Open Houses was one of the most useful and beneficial techniques for exchanging information with the public. Four sets of Public Open Houses were held at locations accessible to all residents in the study area and were staged to seek input at the following key decision points:

- Development of Terms of Reference (Study Process/Problems and Opportunities);
- Evaluation of Alternatives to the Undertaking and Generation of Alternative Methods;
- Route Evaluation/Recommended Alternative; and
- Functional Design.

In addition, the Consultation Plan identified four groups (Public, Business, and two Agency groups) to advise and comment on issues that directly affected each group. The Consultation Groups met prior to each of the four Open House sessions.

The first round of Public Open Houses/Consultation Group Meetings was held in May/June 2004. A total of 76 people signed the registry for this round and 27 comments were received. The purpose of these meetings was to discuss:

- Project Initiation;
- Roles of the Consultation Groups;
- Provincial and Federal EA Process;
- Draft Terms of Reference; and
- Project Schedule.

Table 6.0-1 summarizes the major comments received from the general public during the first round of Public Open Houses.

Table 6.0-1 Summary of Primary Comments and Responses from Open House 1		
Comment	**No. of Responses**	**Response Provided**
ToR restricts the use of the CN track to Fallowfield.	6	Previous City of Ottawa Study RTES ruled out that option, because it bypasses the Riverside South Community, which this Undertaking is intended to service.
LRT on existing Prince of Wales rail bridge as an interprovincial link is not considered in the ToR.	6	The Undertaking is to provide transit service between downtown and the growing southern communities. A study to consider interprovincial transit connections is being planned by the City of Ottawa, City of Gatineau/STO, and the NCC. This project does not preclude the findings of the Interprovincial Transit Study.
The Strandherd Bridge should be built for transit only.	6	The Official Plan includes the Strandherd Crossing for cars. An ESR has been completed for that crossing. This study looked at the opportunities that a single crossing may offer for transit and cars.
EA should consider staging of the Undertaking and costing the stages.	3	The EA will be seeking approval for the ultimate project. The EA is not seeking approval of Stages. Staging analysis was intended for the City of Ottawa to consider maximum benefit from limited funds.
The Schedule is too short to undertake the amount of work required.	3	The schedule is tight but sufficient to complete a thorough EA.
The O-Train operations must be retained during a change to electric trains.	3	The recommended plan allows the current O-Train to operate during construction. However, the system will be impacted due to blasting north of Dow's Lake and during the testing phase.
ToR should not consider any alternatives other than transit.	2	The EA process requires all reasonable alternatives to be considered.
Electric trains will be powerless in a black out.	2	A report was produced that discussed the advantages and disadvantages of potential technologies and is summarized in this report.
The EA should consider the impact on cyclists and pedestrians and recreational pathway.	2	The EA considers the impacts on the recreational network. The City of Ottawa is conducting additional studies to see what opportunities the Undertaking will provide for recreational network improvements.

The second round of Public Open Houses/Consultation Group Meetings was held in October 2004. A total of 261 people signed the registry for this round and 97 comments were received. The purpose of these meetings was to discuss:

- The Approved Terms of Reference;
- Technology Choices and Ridership;
- Needs and Justification;

- Alternative Solutions;
- Alternative Corridors; and,
- Evaluation Process and Technologies.

Table 6.0-2 summarizes the major comments received from the general public during the second round of Public Open Houses.

Table 6.0-2 Summary of Primary Comments and Responses from Open House 2

Comment	No. of Responses	Response Provided
Why is it taking so long to get an LRT system up and running?	8	This project is being fast tracked to make sure that the system could be operational by 2009.
The EA should include a rail connection to Gatineau.	7	The Undertaking is to provide transit service between downtown and the growing southern communities. A study to consider interprovincial transit connections is being planned by the City of Ottawa, City of Gatineau/STO, and NCC. This project does not preclude the findings of the Interprovincial Transit Study.
Why not consider a tunnel or elevated rail system through downtown?	6	Both the elevated and tunnel options were considered to have additional costs and require long-term structural maintenance. At grade solutions are not uncommon in North America.
Since PCG confirmed LRT was the appropriate technology, any mention of road widening as part of the solution is a disservice to PCG.	5	This EA does not address or preclude future road widenings that are recommended in the Council-approved TMP. Those will be subject to separate EA studies.
The Study has not considered danger of LRT to cyclists nor enhancements to cycling facilities.	5	The impact on existing cycling facilities is considered in the study.
The recommended solution includes the selection of roadway construction, without any environmental assessment being carried out. Transit should be the priority.	4	The recommended solution is consistent with the goals of the City of Ottawa's TMP and Official Plan, which included a complementary transportation network of roads and transit. The road component of the solution will be subject to separate EA's. This EA is focused on the expansion of transit.
Will hydrogen or other clean fuel technologies be considered for powering the LRT vehicles?	4	Alternative fuel systems are still in the test stage and not proven for our climatic conditions. Electric systems are proven in North America. Alternative systems may be considered in time.
How will the City fund its share of the project?	4	The City of Ottawa is assessing its options such as the use of gas taxes and rebates.
The design should be accessible to all which means sidewalks must be	3	Accessibility in technology and design is considered in the development of the preferred concept. Winter maintenance will be carried out

Table 6.0-2 Summary of Primary Comments and Responses from Open House 2

Comment	No. of Responses	Response Provided
cleared in the winter months.		in accordance with City of Ottawa standards and practices.
Corridor should use the existing VIA track to Barrhaven.	3	The existing VIA track alignment will not service the Riverside South and Leitrim sites.
LRT and buses should have a dedicated street for operations.	2	The study considers the benefits of all possible configurations for mixed LRT and Bus operation.
The number of buses going through downtown must be reduced.	2	The City of Ottawa has committed to considering route changes to take advantage of opportunities that the LRT will provide.
Surface LRT is a short-term solution; ultimately a tunnel through downtown will be required.	2	A tunnel option is being considered as a separate study[1]. The anticipated cost of a tunnel is beyond the budget envelope for this project.
Consider LRT looping through downtown with bus feeder service.	2	This option would require transfer of all bus passengers to the LRT outside of downtown. The additional transfers are undesirable and add complexities at the transfer stations.
Options look very costly, what is the value to the taxpayer?	2	The value to the taxpayer is found within the reduction of the roadway costs, reduced congestion and improved travel times.
Consideration should be given to complementary land use and residual lands purchased as part of the project.	2	The City of Ottawa has undertaken a planning study of Riverside South and Nepean South to optimize development around station locations.

[1] In the late 1980s, the former Region of Ottawa-Carleton examined grade-separated options for rapid transit services through the central area. One of these options included deep tunneling. The twin bus tunnels would start from the escarpment near Bronson Avenue in the west, continue under Albert and Slater Streets, and emerge on the east side of the Canal in the vicinity of the University of Ottawa. Four underground stations at Lyon, Bank, Metcalfe and Nicholas were proposed.

Recently, there has been interest expressed by some members of the public that the tunnel option should be re-examined. This is primarily due to concerns with the bus volumes on Albert and Slater. The EA study team has updated the estimated cost of this bus tunnel to be approximately $720 M. This tunnel option would move buses from the streets to a tunnel, with Light Rail Transit on the surface.

If the tunnels were to include both Light Rail Transit and buses, there would be additional costs for tracks, power and signals on top of the $720 M estimate. Albert and Slater Streets would still experience major construction and utility relocations since excavations for stations, elevators and escalators are still needed for these access points at the surface.

Due to the current budget envelope allocated to the North-South Light Rail Transit project, a tunnel option is not being recommended.

The third round of Public Open Houses/Consultation Group Meetings was held in March 2005. A total of 277 people signed the registry for this round and 135 comments were received. The purpose of these meetings was to discuss:

- Preliminary Routes, Station and Park and Ride Locations:
- Facility locations;
- Grade Separation locations;
- Downtown Screening of Corridors; and,
- Preliminary Downtown Concept plan.

Table 6.0-3 summarizes the major comments received from the general public during the third round of Public Open Houses.

Table 6.0-3 Summary of Primary Concerns and Responses from Open House #3

Area of Concern	No. of Responses	Response Provided
Albert/Slater are the correct streets for the LRT.	53	Comment noted.
LRT is good idea and looks like its properly planned. Get on with it.	30	Comment noted.
A tunnel through the downtown core would relieve the current and future congestion.	23	A tunnel is not needed for the projected LRT passenger levels. A separate study is being undertaken to consider a tunnel in the future; therefore the current solution will not preclude it.
The EA must include a LRT stop at the airport.	18	The EA includes a link to the Airport. The City of Ottawa will determine if it is built as part of the initial construction based on ridership and budget considerations.
Too many forms of transportation modes on the same street, (LRT, BRT, cyclist pedestrians and autos) will make congestion worse.	14	Placing LRT and BRT on same roadway improves transfer service. Disadvantages to autos are undesirable but might be acceptable if it advantages the transit service. Transit lanes will be defined to reduce confusion. The introduction of LRT will provide an opportunity to reduce the supply of buses.
A single track on Sparks would be a better solution.	9	A single track will not accommodate the anticipated LRT service level. NCC plans for Sparks Street do not accommodate LRT. Sparks Street has geometric problems at Elgin Street.
Removal of cyclist from Mackenzie King bridge is a concern; it is a major cycle link to Ottawa University.	9	Impacts on the cycle network have been considered. Both the Laurier and Somerset Structures provide access for cyclists to Ottawa University.
Concerns regarding cyclists' operations on narrow lanes in a mix of buses cars and rail vehicles on Albert and Slater Streets.	8	The recommended plan has been revised since this Open House to limit all transit to a single curb, separating transit from regular traffic and cyclists as it is today.
Need safe loading areas for delivery trucks.	7	The recommended plan has readdressed the available space for parking and loading areas.

Table 6.0-3 Summary of Primary Concerns and Responses from Open House #3		
Area of Concern	**No. of Responses**	**Response Provided**
Service to Gatineau is required; the EA should consider it.	6	This EA will not preclude a link to Gatineau. Interprovincial transit integration is the subject of separate study.
Mackenzie King stop is disruptive and extension east has not been addressed.	5	The Rideau Centre is a major destination for transit riders. Stopping on the Mackenzie King Bridge leaves options open for future easterly extension (subject of separate study).
Concern about reduction of curbside parking, loading areas and increased conflicts with turning vehicles.	5	The concept has been reviewed in order to preserve as much of the existing parking and loading areas as possible.
Pedestrian “jaywalking” may occur because of bus and rail off-set platforms.	5	Pedestrian crosswalks are to be well defined with appropriate signage. The City of Ottawa will enforce good pedestrian movements through education and fines.
Use transit hubs outside downtown to reduce buses in core.	5	Option of facilities and transfers at Bayview and Hurdman was considered. The option was not carried forward because of the size of the land requirements, which impacted on the development potential of the site. In addition the transfer of all passengers at these locations was considered to be a disbenefit to transit services.
Elimination of the left turn at Bay and Metcalfe will result in traffic congestion.	4	The turn restrictions have been removed in the recommended plan.
Wellington may be a better location for the LRT.	4	Wellington is too far north of the business area to be an effective transit corridor. In addition, security issues are concerns for the Parliamentary Precinct.
PWGSC needs to be consulted with respect to impacts on Dows Lake Arboretum and Cliff Street Parking access.	4	PWGSC have been involved since the start of the study and this issue has been addressed.
LRT and BRT should not be on same road, bus service should be relocated to Sparks or Queen Street.	3	The same transit reasons that make Albert and Slater best for LRT, also apply to BRT.
Preference for LRT and BRT both directions on one street.	3	Placing all transit on one street will result in loss of public access to adjacent developments.
Why not elevate the LRT above the road network.	3	An elevated system was considered to have a high construction and maintenance cost. In addition, it would have a great visual impact and the foundations for the structure would have a significant impact on the street use below.

Table 6.0-3 Summary of Primary Concerns and Responses from Open House #3		
Area of Concern	**No. of Responses**	**Response Provided**
Should eliminate cars from downtown area.	3	The City of Ottawa has yet to develop to a size where it requires a car-free downtown. A mix of transit and autos is still workable.
Consider additional Park and Ride lot at River Road.	3	A Park and Ride lot has been proposed south-east of the river road and earl Armstrong intersection.
Abutting land use to stations must be high density.	3	The stations in Riverside South and Barrhaven were located to accommodate densification of development.
Bayview transit station should integrate LRT and BRT services.	3	The EA has considered the development potential of the lands in relation to transit integration.

The fourth round of Public Open Houses/Consultation Group Meetings was held in June 2005. A total of 256 people signed the registry for this round and 107 comments were received by the project manager. The purpose of these meetings was to discuss:

- Revised Downtown Concept;
- Changes to Station locations and Park and Ride lots;
- Facility locations; and.
- LeBreton Flats.

Table 6.0-4 summarizes the major comments received from the general public during the fourth round of Public Open Houses.

Table 6.0-4 Summary of Primary Concerns and Responses from Open House #4		
Comment	**No of Responses**	**Response Provided**
Project is exciting; it's what the City needs.	34	Comment noted.
Concerned about cycle access on Mackenzie King Bridge. Bridge requires a bike priority lane.	14	The bridge section cannot accommodate a continuous cycling priority lane and both LRT and BRT vehicles. Safety of cyclists is a concern. Alternative routes include cycle lanes on Laurier Bridge and the Somerset pedestrian bridge.
Staging strategy must include early extension to Gatineau and the Airport.	12	Staging strategy will consider the merits of an early link to the Airport. Currently the projected ridership is low thus not a priority. The link to Gatineau has not been precluded and will be the subject of a separate study.
Exclusion of a LRT link to Gatineau is not acceptable or in accordance with the EA's Terms of Reference (ToR).	10	The ToR does not include a link to Gatineau, nor does the EA preclude any future link. The ToR mentions coordination with the Interprovincial Transit Study, but unfortunately that study has not yet begun.

Table 6.0-4 Summary of Primary Concerns and Responses from Open House #4

Comment	No of Responses	Response Provided
The concept has too many stations, this will reduce the trains speed and increase the travel time.	10	Station locations have been identified in conjunction with the development plans to ensure reasonable walking distances for most transit users. Stations will be constructed as required to meet the pace of development.
Underground is the only sensible alternative.	8	A tunnel is not needed for the projected LRT passenger levels. The City of Ottawa is considering a tunnel for the future; therefore the current solution will not preclude it.
Concerned about rerouting of traffic due to closure of Mackenzie King Bridge, especially when Laurier is closed for events. Traffic diversion will impact Sandy Hill and cause traffic tie-ups.	8	Options are being considered for limited use of Mackenzie King Bridge for traffic. A Traffic Impact Assessment indicated that the low volume traffic could be diverted in the downtown. Traffic analysis indicates that impacts to congestion and Sandy Hill will be minimal.
All Park and Ride lots must have bicycle racks/storage, plug in for block heaters, handicap parking, and separate exits for bus and car.	7	These components will be considered in the detail design.
This is a bad idea that will not improve the transit network, but will cost a lot more than it is worth. It should not be done for another 10 years.	6	The addition of LRT will provide an opportunity to reduce the number of buses downtown. BRT and LRT on the same street provides for maximum integration of transit services. Postponing the LRT project will impact on the development of the southern communities and add more cars to the current traffic problems.
Must reduce bus traffic downtown, should consider stopping buses at Hurdman and Bayview.	6	The City of Ottawa has committed to revisit bus routing and reduce bus traffic in the downtown. The City of Ottawa will review the “hub and spoke” approach to transit service.
Staging must include protecting the existing O-Train service as long as possible.	6	The recommended plan allows the current O-Train to operate during construction. However, the system will be impacted due to blasting north of Dow’s Lake and during the testing phase.
The Albert and Slater plans do not show a cycle lane.	4	The right-of-way limitations do not allow for a separate cycle lane. The plan proposes that cyclists continue to travel in the traffic lane (today’s situation).
Concerned about security at Quinn Park and Ride Lot and neighborhood, including accessibility.	4	Pedestrian access from Quinn will be provided, but vehicle access will be provided from a new service road. The recommended plan includes provision for security cameras and security through design to be incorporated. Landscaping has been included to minimize visual intrusion.

Table 6.0-4 Summary of Primary Concerns and Responses from Open House #4

Comment	No of Responses	Response Provided
Please provide a traffic light at the intersection of Quinn and Albion roads.	3	The intersection currently does not meet the warrants for signalization. The City of Ottawa's program for monitoring and assessing the need for traffic control measures will determine the need and timing for traffic signals.
Concerned about noise and vibration of the train in downtown and on the Mackenzie King Bridge.	3	Noise and Vibration analysis have been conducted for the entire alignment including downtown and have been included in the report.

Table 6.0-5 summarizes the major consultation activities and notification procedures undertaken throughout the study process. In addition to these formal activities, numerous individual meetings were held with individual stakeholders, such as Government Agencies, property owners and individual businesses to discuss specific issues as required. The following sections summarize the specific input received from the various Consultation Groups and the General Public.

Table 6.0-5 Public Consultation Program							
Stage	**Activity**			**Review Round**			
				1 Summer 2004	**2 Fall 2004**	**3 Spring 2005**	**4 Summer 2005**
Prior to public Meetings/ Open House	Municipal and Consultation Committees		City PCG ACG BCG	Council Meeting Meeting Meeting	Council Meeting Meeting Meeting	Council Meeting Meeting Meeting	Council Meeting Meeting Meeting
	Publicity	Flyers/ Brochures	Distribution: - study area - registered - libraries	 - - -	 - Yes -	 - Yes -	 - Yes -
		Notification	MPP, MP Councillors External Team Property Owners	- - - -	- - Yes -	- Yes Yes Yes	- Yes Yes Yes
		Advertisement	- Citizen - Le Droit - City Web Page	May 7, 14 May 7, 14 May	Oct 8, 15 Oct 8, 14 Oct	Mar 11, 18 Mar 11, 18 March	May 27, Jun 3 May 27, Jun 3 June
		Media Release		-	Oct 18	March 17	May 27
Public Open House Meetings			City Hall Jim Durrell Walter Baker Rideauview CC	May 19 May 20 - -	Oct 19 Oct 21 Oct 20 -	March 22 March 23 March 21 -	June 6 June 9 June 8 June 7
			Total Registration Total Comment Sheets	76 101	261 97	277 216	267 107
Follow Up Activities	Downtown Stakeholder Meetings		Sheraton Hotel Crown Plaza Hotel Various Businesses	- - -	- - -	March 7 March 7 April 16-19	- May 17 -
			Total Registration Comment Sheets			74 122	50 12
	Summary Report			Yes	Yes	Yes	Yes

6.1 Consultation with the Public Consultation Group

Membership in the group was developed through dialogue with City of Ottawa staff and supplemented with requests for various groups as the project advanced.

Table 6.1-1 provides the invited membership list of the Public Consultation Groups.

Table 6.1-1 List of Invitees - Public Consultation Group
Alta Vista Community Association
City Centre Coalition
Carleton University Students Association
City of Ottawa Forests and Greenspace Advisory Committee
City of Ottawa Pedestrian and Public Transit Advisory Committee
City of Ottawa Roads and Cycling Advisory Committee
City of Ottawa Accessibility Advisory Committee
City of Ottawa Environmental Advisory Committee
City of Ottawa Local Architectural Conservation Advisory Committee
City of Ottawa Arts, Heritage and Culture Advisory Committee
Dalhousie Community Association
Disabled and Proud
Emerald Woods Community Association
Federation of Citizens Association
Greely Community Association
Heart's Desire Community Association
Heron Park Community Association
Hintonburg Community Association
Hunt Club Community Organization
Hunt Club Park Community Association
Manotick Community Association
Ontario Disability Directorate
Ottawa Youth Cabinet
Quinterra-Riverwood Community Association
Ridgemont Community Association
Riverside Park Community and Recreation Association
Riverside South Community Association
Sawmill Creek/Blossom Park Community Association
South Keys/Greenboro Community Association
Southpointe Community Association
Transport 2000
Upper Hunt Club Community Association
Uplands on the Rideau Community Association

In general this Group was supportive of the overall project and need for improved transit services in the area. However, there were comments regarding the accelerated schedule and limited time for review of study materials.

The Project Team explained that the EA was being conducted in accordance with the requirements of the Ontario *Environmental Assessment Act* and the *Canadian Environmental Assessment Act* and that their participation was essential to the study outcome. The Consultation Group was advised that they were not being requested to approve the report; but that their review was to assist in ensuring that all aspects relating to their interest in the study were being addressed. With this in mind, the Group reviewed the presented plans, providing valuable insight into the concerns and benefits of the project.

Public review of the concept plan resulted in the bringing forward of several specific concerns. These, along with responses to the concerns are summarized in Table 6.1-2.

Table 6.1-2 Summary of Primary Concerns with the Concept Plan, and Associated Responses

Specific Concerns with the Concept Plan	Response to Concerns
Elimination of traffic and the through cycle lane on Mackenzie King bridge.	A traffic impact assessment indicated that the low volume traffic could be diverted in the downtown. Cyclists could use alternative crossings such as Laurier Bridge or the Somerset pedestrian bridge.
Location of Maintenance Facility near Blossom Park Community. Concerned about: • loss of park land; • impacts on the natural environment; • property value; and • potential for noise and visual impacts.	Mitigation through landscaping buffers was proposed to shield the community from the facility location.
Desire to consider use of the Diesel Multiple Unit (DMU) in staging.	DMU's were considered in the staging of the LRT, however, it was determined that a DMU stage was not practical.
LRT service should continue across the Prince of Wales Bridge to Gatineau.	The extension is the subject of the joint NCC, City of Ottawa and City of Gatineau Interprovincial Transit Integration Study. This EA does not preclude the extension to Quebec, as alternatives were developed to protect for this future link.
Consider extensions of LRT to the project Exhibition site and Rideau Carleton Raceway grounds.	The alignments were set to protect for future extensions to the Rideau Carleton Raceway and Exhibition area, if needed.
Integration with the East West LRT project and the Interprovincial Transit Study.	N-S EA schedule is ahead of E-W EA. Wherever possible, coordination has taken place. The E-W study will resolve integration issues once it has been completed.
Service to the Airport should be included in the initial construction.	The EA is not seeking approval of staging. Staging analysis was intended for the City of Ottawa to consider maximum benefit from limited funds. Low ridership projections for the Macdonald-Cartier International Airport connection and limited budget

Table 6.1-2 Summary of Primary Concerns with the Concept Plan, and Associated Responses	
Specific Concerns with the Concept Plan	**Response to Concerns**
	were key considerations for not including the link for initial construction.
Number of stations within Barrhaven and Riverside South Communities would result in increased travel time.	Number of stations reflects the development concept for the community, which includes maximum walk-in potential to attract ridership. Stations will be built as required and monitored by Operating Authority to determine the need.
Pedestrian access to stations.	Pedestrian access to the stations is included in the development plans for Barrhaven and Riverside South. Access to other stations will be refined in detail design. The City of Ottawa is undertaking a pathway study that will consider additional access to stations.
The ability to add trains to the bus mix on Albert Street and Slater Street.	Computer simulation modeling indicates that (under a controlled system) rail and bus can operate on the same roadway. Taking advantage of LRT service, the number of buses can be reduced thus minimizing the impact on street traffic.

In addition, approval of the City of Ottawa North-South Corridor LRT was obtained from the City of Ottawa Transportation Committee (July 6, 2005) and the City of Ottawa Council (July 13/15, 2005). A copy of the depositions, a report to the Transportation Committee (June 25, 2005) and Transportation Committee minutes (July 6, 2006) are provide in Appendix J.

Business Consultation Group (BCG)

Table 6.1-3 includes the invited membership list of the Business Consultation Groups.

Table 6.1-3 List of Invitees - Business Consultation Group
Barrhaven Business Group
Building Owners and Managers Association
ByWard Market Business Improvement Area (BIA)
Carleton University
Capital Hill Hotels and Suites
Downtown Rideau BIA
Downtown Business Group*
Equity management International Limited
Greater Ottawa Chamber of Commerce
Ottawa-Gatineau Hotel Association
Ottawa Macdonald-Cartier International Airport Authority
Ottawa Tourism and Convention Authority
Preston Street BIA
Sparks Street Mall Management Board
Sparks Street BIA
University of Ottawa

*Formed in March 2005

In general this Group was supportive of the overall project and the need for improved transit services in the area. As with the PCG, this Group also commented on the relatively short study timelines.

After the 3rd Open House, several businesses in the downtown identified concerns with the concept of both curb lanes being allocated for transit use. The concerns included: impacts on curb parking, loading areas, and general street safety/operations. Two additional meeting sessions were held on March 7, 2005 and May 17, 2005 to discuss the downtown Stakeholders' specific concerns. A separate meeting was held for BOMA (Building Owners and Managers Association) on April 7, 2005 to update the representatives on the project and provide another opportunity for feedback.

On March 7, 2005 the concept presented showed Bus and Rail operating on both Albert Street and Slater Street with each transit mode using its own curbside lane. The majority of concerns pertained to: loss of a lane of regular traffic, the poor environment created with transit on either side of regular traffic, and the reduced space for pedestrian activity, parking, emergency services and loading.

At the April 7, 2005 BOMA meeting, questions arose regarding the consideration of a tunnel; the elimination of surface parking and loading; the impact of removing a lane of traffic; the validity of the traffic modeling and the budget and timing of the project.

Plans reflecting a response to consultation input (March 7th and April 7th with the BOMA) were presented for comment at the May 17, 2005 meeting. The major change in the concept was that the buses and the rail would operate in a single shared lane on both Albert Street and Slater Street, thus reinstating the traffic and parking lanes. The general feedback that was received suggested this was a better option with fewer impacts to the existing environment.

The major concerns voiced by the Business Consultation Group through Open Houses, comment forms, meetings and other methods are summarized in Table 6.1-4.

Table 6.1-4 Summary of Business and Stakeholder Concerns and Associated Project Team Responses

Business and Downtown Stakeholders Specific issues	Response to Concerns
The existing number of buses on Albert Street and Slater Street is impacting on the traffic flow and the environment of the streets.	The City of Ottawa has committed to reducing the number of buses when the LRT is operational.
Any reduction in parking or loading area would impact on business operations.	Concept was revised to reduce the impact on parking and loading areas.
Reduction in traffic lanes would effect emergency vehicle operations and access.	Concept was revised to retain existing traffic lanes where possible.
Addition of LRT to the bus fleet would exacerbate current traffic and access problems.	The City of Ottawa has committed to readdressing bus operations to take advantage of LRT capacity.
Addition of LRT vehicle to the bus fleet and vehicle traffic would result in a congested and dangerous situation for traffic, cyclists and pedestrians.	Public and private modes of transit currently exist on the streets, the revised concept will not significantly change that mix.

Table 6.1-4 Summary of Business and Stakeholder Concerns and Associated Project Team Responses	
Business and Downtown Stakeholders Specific issues	**Response to Concerns**
The project was not considering a tunnel as a serious option.	An update of the 1988 RMOC Central Area Transitway Grade Separation Feasibility Study was undertaken and a LRT tunnel option was examined. The excessive cost and disruption for the tunnel option in downtown renders it totally unacceptable for addressing the limited impact of the LRT in the downtown area. The major issue was the impact of the diesel busses and this is being addressed by reducing the number of buses.
The tunnel option was not as expensive as indicated and was the best solution to adding LRT to the Downtown area.	The tunnel is estimated to be $720M, Current available funding for the project (Rideau Centre to Woodroffe) is $725M.
Removal of traffic from Mackenzie King Bridge would effect emergency services and result in traffic congestion during special events when Laurier Bridge is closed to Traffic.	The City of Ottawa's Emergency Services confirmed that they use Laurier, and would use the bus lanes on the Mackenzie King Bridge if necessary.
How would impacts to businesses during construction be mitigated?	The design phase will consider the mitigation measures required. The City of Ottawa has committed to continuing consultation during the design and construction.
How would businesses be compensated for losses during the construction period?	The City of Ottawa may consider individual cases as they occur.
LRT should extend beyond the Mackenzie King Bridge.	The extension beyond Mackenzie King is the subject of another EA. Refer to the RTES and ORTEP studies for the full planned LRT network.
Noise, vibration and traffic studies need to be made available.	Noise, vibration and traffic studies were distributed to BCG members and are included in the final report.

6.2 Consultation with External Departments and Agencies

Table 6.2-1 provides the invited membership list of the External Agency Consultation Groups.

Table 6.2-1 List of Invitees - External Agency Group
Canadian Environmental Assessment Agency – Ontario Regional Office
Canadian Transportation Agency – Rail Infrastructure Directorate
Environment Canada – Environmental Policy and Assessment Division
Fisheries and Oceans Canada

Table 6.2-1 List of Invitees - External Agency Group
Health Canada Environmental Health Assessment Services Safe Environments Program, Healthy Environments and Consumer Safety Branch
Infrastructure Canada-Policy & Priorities
National Capital Commission - Design and Land Use Division
National Capital Commission - Planning Division
National Capital Commission – Environmental Management and Protection Division
National Research Council - Centre for Surface Transportation Research
Ontario Ministry of Culture
Ontario Ministry of the Environment - Environmental Assessment and Approvals Branch
Ontario Ministry of Natural Resources
Ontario Ministry of Public Infrastructure Renewal
Ontario Ministry of Transportation - Transit & Policy Programs Office
Ontario Ministry of Transportation - Planning & Design – Eastern Region
Parks Canada Agency
PWGSC – Environment & Sustainable Development Services
PWGSC – Real Property Service Branch
Rideau Valley Conservation Authority
Société de Transport de l'Outaouais (STO)
Transport Canada – Project Management
Transport Canada - Rail Safety
Transport Canada - Railway Equipment

The major concerns brought forward by this Group, along with the associated Project Team responses, are provided in Table 6.2-2.

Table 6.2-2 Summary of External Agency Concerns and Project Team Responses	
External Agency Consultation Groups Concerns	**Response to Concerns**
Justification for the project and use of LRT as the vehicle.	A justification document and report on vehicle options were produced and are summarized in this CEAA Screening Report.
Impact on the Greenbelt and Transport Canada Lands.	NCC and Macdonald-Cartier International Airport were contacted to evaluate impacts on their lands.
Access to the PWGSC Cliff Street steam plant and parking lot.	Access to PWGSC Cliff Street facility was reassessed.
Coordination with NCC's revised approach to the development of LeBreton Flats.	The City of Ottawa had extensive discussions with NCC to identify a preferred alignment through LeBreton Flats.
Coordination with the CEAA process.	The Federal EA process is being coordinated through CEAA.
Operation of the LRT under Transport Canada jurisdiction.	The future LRT line will be used exclusively for urban transit and will operate in compliance with normal urban transit safety protocols practiced by the American Public Transit members operating urban LRT systems. There will be no railway freight operations on the line and the line will be grade separated from the 2 crossing rail lines.
Removal of traffic and through cycle lanes from Mackenzie King Bridge.	A Traffic Impact Assessment indicated that the low volume traffic could be diverted in the downtown. Cyclists could use alternative crossings such as Laurier Bridge or the Somerset pedestrian bridge.
Impact on traffic and current bus operations.	The City of Ottawa has committed to reducing the bus fleet in order to take advantage of LRT capacity, and to develop an operational strategy.
Impact on the Greenbelt.	NCC and Macdonald-Cartier International Airport were consulted to evaluate impacts on their lands. No significant impacts identified.
Impact on the operations of the NAC.	NAC has been consulted. Impact assessment and mitigation measures have been developed. Noise and Vibration Impact reports have been developed and are included in the final report.
Concern regarding construction of a tunnel (Crossing #2) and new bridge (Crossing #17)	Parks Canada will continue to be consulted. The new bridge will be designed in accordance with the Strandher-Armstrong Bridge Aesthetic Guidelines (du Toit Allsopp Hillier, November, 2005).

In addition to the formal consultation group meetings several meetings and discussions were held with the Federal Team to discuss the project and develop a scoping document to guide the preparation of this CEAA Screening Report.

A technical fisheries meeting was held on August 26, 2005 with the Department of Fisheries and Oceans and the Rideau Valley Conservation Authority RVCA to review the potential impacts to fisheries, the proposed mitigation measures and make preliminary HADD (Harmful Alteration, Disruption or Destruction) determinations. The results of this meeting are documented in Section 5.1.1.2.

6.3 Consultation with First Nations

No aboriginal groups are located directly in the study area. However, the proposed project is located within the boundaries of a comprehensive land claim filed in 1991 by the Algonquins of Pikwàkanagàn First Nation (formerly known as the Algonquins of Golden Lake); this land claim is currently under negotiation with federal and provincial agencies and is considered outside the scope of this environmental assessment (EA).

In May 2004 the City of Ottawa notified the Algonquins of Pikwàkanagàn of the commencement of the provincial EA study for this project. Notification was in the form of a letter along with copies of the provincial Notice of Study Commencement and Draft provincial EA Terms of Reference for review and comment. The project was also listed on the Canadian Environmental Assessment Registry in February, 2005. No comments were received from the First Nation during the course of either the provincial or federal EAs.

On March 6, 2006, the City of Ottawa extended an offer to meet with the Algonquins of Pikwàkanagàn Band Council to introduce and discuss this project and address any issues their community may have. The Band Council's initial response by letter dated March 7, 2006 was to decline the offer and refer any discussion of this project to the Land Claim Negotiation table. Subsequent to this written response, a representative from the Band Council accepted the City of Ottawa's request to consult on this project. As of this writing, a date for the presentation to the Band Council has yet to be determined.

Potential effects on lands and resources used for traditional purposes by aboriginal persons have been examined by taking into account the City's knowledge of the study area, reviewing existing information from other sources including the Algonquins of Pikwàkanagàn website[1], and identifying potential effects on specific resources. The City of Ottawa is not aware of any current use of lands and resources for traditional purposes by aboriginal persons within the study boundaries. The urban and suburban nature of the study area limits many traditional land uses, including hunting, fishing and the gathering or harvesting of plants for traditional use. In addition, the sections specified below provide the information from which it has been concluded that this project will not likely result in significant adverse environmental effects to fish or fish habitat, wildlife habitat, vegetation, or archaeological resources:

- Fish and fish habitat: sections 5.1.1.2, 5.1.1.3 and 5.1.1.4;
- Vegetation, wetlands, wildlife, migratory birds, species of conservation concern and species at risk: sections 5.1.1.5 and 5.1.1.6; and
- Archaeological resources: section 5.1.2.8.

The City of Ottawa will continue to try to meet with the Algonquins of Pikwàkanagàn First Nation and to work with them to address any issues they may raise about the proposed project. The City will inform the federal authorities of any matters raised during these discussions.

[1] www.algonquinsofpikwakanagan.com

7.0 References

North-South Corridor Light Rail Transit (LRT) Project (Rideau Centre to Barrhaven Town Centre) Environmental Assessment Natural Environment Report

North-South Corridor Project Stormwater Management and Drainage

Existing Land Use Conditions North-South Corridor LRT Project – Environmental Assessment

Environmental Noise Impact Assessment Ottawa North/South Corridor LRT Priority Project Ottawa, Ontario

Environmental Vibration Impact Assessment Ottawa North/South Corridor LRT Priority Project Ottawa, Ontario

Vibration Impact Assessment – National Arts Centre (NAC) Ottawa North/South Corridor LRT Priority Project Ottawa, Ontario

Site Contamination Study Rapid Transit Expansion Program North- South Corridor Light Rail Transit Rideau Centre to Barrhaven Town Centre City of Ottawa

North-South Corridor Light Rail Transit (LRT) Project (Rideau Centre to Barrhaven Town Centre) Environmental Assessment North-South Corridor LRT Project (Rideau Centre to Barrhaven Town Centre) Environmental Assessment Terms of Reference

Scoping Document for the Federal Screening of the City of Ottawa's North-South Corridor Light Rail Transit Project (Ottawa N-S LRT Project)

8.0 EA Determination

On the basis of this CEAA Screening Report, the Proponent has determined, in accordance with subsection 20 (1) of the Act, that the impact of this project on the environment is as follows (***check one only***):

[__] The project is not likely to cause significant adverse environmental effects: the project can proceed with application of the mitigation measures specified in this report

[__] The project is likely to cause significant adverse environmental effects that cannot be justified. The project does not proceed.

[__] Refer the project to the Minister of the Environment for referral to a mediator or a review panel because:

- [__] of uncertainty as to whether the project is likely to cause significant adverse environmental effects;
- [__] the project is likely to cause significant adverse environmental effects; and
- [__] of public concern.

9.0 Environmental Management Plan/ Monitoring

As part of this Study, environmental sensitivities, environmental effects, environmental protection and mitigation measures, and requirements for future approvals have been identified. In addition, specific commitments relating to monitoring impacts during construction (i.e. noise, groundwater, sedimentation and erosion control, etc.) have been identified. These commitments are fully outlined in Section 5.0 of this report.

The success of environmental protection during project implementation depends on having a systematic process with periodic checks to ensure that the commitments made during the EA process are carried through to the end of the project.

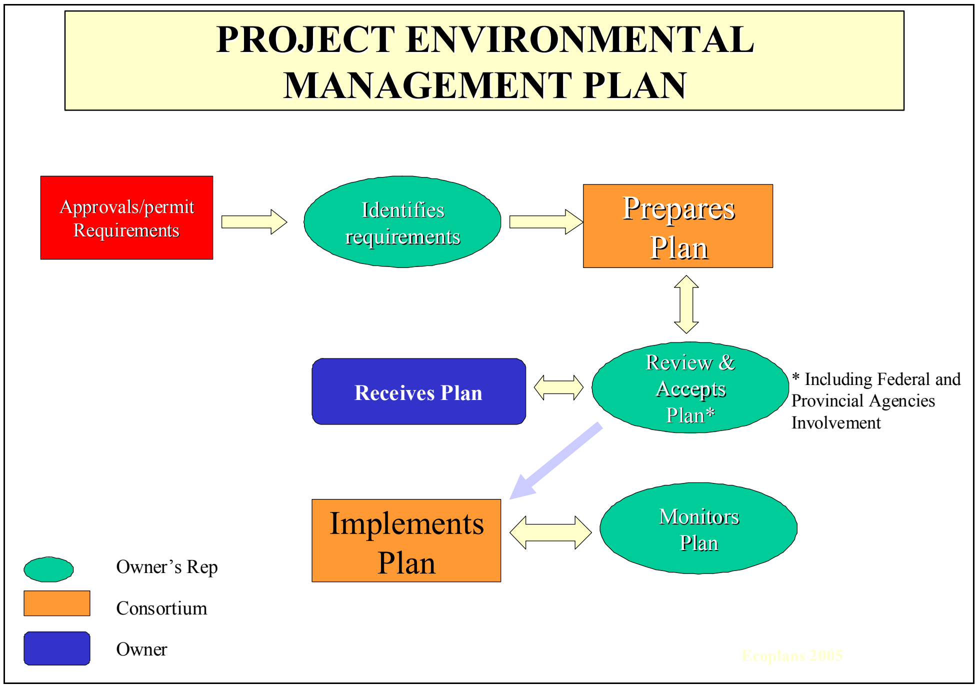
The Project Environmental Management Plan (PEMP) provides the continuity from planning into design and through to construction, operation, maintenance, inspection, monitoring and reporting. It becomes a partnership between the City of Ottawa, the designer and the contractor.

The Design Build Contractor (Siemens PCL Dufferin) will prepare the PEMP and submit it to the City of Ottawa for acceptance. The City of Ottawa will circulate the PEMP to provincial and federal authorities (including the Responsible Authorities (RAs)) to ensure that it meets all necessary requirements. The PEMP and any revisions made to it will require RA acceptance. The City of Ottawa is responsible for the implementation of all environmental protection measures. The approved PEMP will be a living document, to be updated and improved as project-specific lessons are learned and as new issues arise and are addressed. The approved PEMP will be a binding management plan for the project and will set the environmental protection requirements.

The following summarizes the process that will be followed to prepare and implement the PEMP.

9.1.1 Preparation of the PEMP

Figure 9.1.1-1 Environmental Management Plan



Identify the Environmental Protection Requirements

During the EA process a number of environmental issues have been identified and environmental protection commitments have been made. These commitments are documented in Chapter 5 of this report. These have been identified by experts on the project team, by government review agencies, by the public or special interest groups through the consultation process, or as permit requirements. These requirements will be addressed during the design phase, either as specific elements in the design or as controls placed on the construction, operations and maintenance phases of the project. A summary Table of Commitments will be prepared that documents the commitments along with how they will be met during design, construction, operations and maintenance of the project. This Table will build on the tables included in Section 5.7 to include the specific issues affecting the specific design assignment and will form the foundation for the PEMP. The Table of Commitments will be filed with the assessment team prior to construction

Preparing the PEMP

The PEMP will be prepared in three phases. The first is the design phase. The design team will prepare designs that address the environmental protection commitments set out in the Table of Commitments. When preparing the design and construction packages, the design team will consult with the appropriate external agencies to ensure that the specific mitigation requirements adequately address the EA commitments. In addition, the design team will undertake the work required to obtain outstanding permits and approvals required to construct the project.

A Regulatory Liaison Committee will be established as an oversight committee during the construction of the facility and will be made up of members from the RAs assessment team, representatives of the City of Ottawa and the consortium. The Regulatory Liaison Committee will review those aspects of the design and ultimately, of the construction, operations and maintenance, that respond to the environmental protection measures set out in the Table of Commitments.

The Table of Commitments will be used for quality control to ensure that each commitment has been adequately addressed. During the design phase the construction package will be prepared. The construction design and specification package will include a number of environmental special provisions that require the contractor to meet specific environmental protection standards. Again the Table of Commitments will be used to review the contract package prior to its finalization to ensure that the commitments have been made.

The second phase is construction. Prior to start of construction, the Consortium will be required to prepare the PEMP showing how they intend to comply with the environmental protection requirements. The third phase is operations and maintenance. The PEMP will address the environmental protection requirements associated with this phase of the project.

The Consortium's document will need to address the following:

- Provide a commitment to meeting the environmental protection requirements.
- Provide specific plans for addressing the environmental protection requirements during construction (e.g. erosion and sediment control plan).
- Provide a site monitoring and control plan showing how activities will be monitored to identify problems and how corrections will be made. The Consortium will be required to assign a qualified environmental inspector to ensure compliance with the environmental protection requirements.
- Provide training programs for construction, operation and maintenance staff on the environmental protection requirements and site staff responsibilities.
- Provide a contingency and emergency response plan to address unexpected events that could have environmental implications.

The detailed requirements are set out below under PEMP Contents.

Through this process the Consortium takes ownership of the environmental protection requirements.

The City of Ottawa's Representative will review the Consortium's plan and deficiencies will be reviewed with the Consortium. An acceptable Plan will be negotiated.

PEMP Contents

1. Identify project activities that could affect the environment and the nature of the effects.
2. Document the environmental protection requirements set out in all permits and approvals governing the project.
3. Identify specific measures to address the potential environmental effects and comply with permit/approval requirements.

4. Specify all timing windows for protection of environmental resources and provide a project schedule that demonstrates compliance with these timing windows.
5. Provide detailed approaches to the following:
   a) Erosion and sediment control throughout the project;
   soil handling (excavated soils must be monitored for contamination and disposed accordingly)
   b) Winter shutdown;
   c) Access;
   d) Sequencing for work in and near water;
   e) Tree clearing; (vegetation management/wildlife encounters)
   f) Product storage and handling;
   g) Waste/Contaminant management (including a Hazardous materials inventory);
   Waste reduction workplan
   h) Site restoration;
   i) Dust, vehicle emissions and noise control;
   j) Equipment maintenance and fuelling;
   k) Contingency and Emergency response plans (i.e. Spill Contingency Plan);
   l) Works facilities;
   m) Environmental protection zones;
   n) Other site-specific issues.
   - housekeeping (i.e. keeping the site clean and free from unnecessary debris, and the use of designated areas for materials/waste storage).
   - Water protection management
6. Provide the training and awareness programs.
7. Describe the inspection and monitoring programs.
8. Describe the process for identifying and resolving environmental issues.
9. Describe the documentation that will be maintained for the project.
10. Describe the communication that will occur on the project including communications with staff, managers, Contractors and subcontractors, consultant, regulatory agencies and the City of Ottawa's Representative.
11. Describe the process for reviewing and revising the PEMP.

Product Stewardship

- All materials (hazardous and non-hazardous) will be handled so as to preserve their value and to protect human health and the environment

Atmospheric Protection

- Activities will be planned and implemented, and equipment will be managed and maintained in a manner that minimizes air emissions.

Surface and Groundwater Protection

- Discharges of contaminants to surface waster and groundwater will be avoided.

Land Protection

- The amount of land affected by construction activities will be minimized. Lands that are inadvertently contaminated will be cleaned up to provincial and federal requirements.

Waste Management

- Discharges of waste to the environment will be avoided. Waste produced will be managed in accordance with applicable laws and in a manner that protects health and the environment.

Special Spaces and Species

- Given the importance of natural habitats for sustaining plant, animal and aquatic life, the design, construction, operation and maintenance of this project will protect natural habitats wherever possible.

Noise Reduction

- Noise sensitive areas will be avoided to minimize impacts.

9.1.2 Implementing the Plan

The Consortium will be responsible for implementing the plan. The City of Ottawa's Representative will be responsible for ensuring that the Consortium is fulfilling their obligations with respect to the plan and will initiate corrective action should non-conformances arise.

Benefits of the PEMP

- Ensures that the environment is protected during design, construction operation and maintenance.
- Encourages better planning and awareness of environmental protection requirements, measures, procedures and costs by the Consortium.
- Allows for innovation.
- Sets out practical environmental protection measures that the Consortium is committed to delivering on the project.
- Provides a mechanism to integrate the commitments made during the planning and design stages with the construction, operation and maintenance of the project.
- Promotes a higher environmental ethic by the Consortium.
- Demonstrates to stakeholders a commitment through actions to environmental protection throughout the project.
- Increases buy-in to environmental protection measures by the Consortium because they develop it.
- Provides a context for training and inspection.

Who Does What?

Consortium

- Prepares the PEMP.
- Submits the PEMP to the City of Ottawa's Representative prior to the start of work.
- Commits to effective implementation of the plan.
- Implements the environmental protection measures.
- Ensures that all project personnel including sub-contractors are trained and empowered to effectively implement the plan and respond to potential environmental problems.
- Monitors implementation and takes timely corrective action to address any deficiencies.
- Maintains all environmental control/protection devices to ensure their effectiveness.
- Ensures that project personnel including sub-contractors comply with the plan.

- Provides a knowledgeable and empowered individual at the worksite to ensure effective implementation of the plan, monitor and maintain environmental control devices and address environmental protection issues in a timely manner.
- Maintaining documentation and preparing and filing reports.

Responsible Authorities / FAs (Federal Authorities)

- Reviews changes to design, mitigative measures and the PEMP.

City of Ottawa's Representative

- Prepares the initial part of the PEMP.
- Identify all generic and specific situations that will require environmental protection measures.
- Reviews the PEMP and determine its adequacy for the site conditions.
- Ensures that the PEMP addresses all environmental protection issues.
- Liaises with the Federal Environmental Assessment Team to resolve any issues with the Plan.
- Liaises with the Consortium to resolve any issues with the Plan.
- Monitors the work zone to determine if the PEMP is being implemented and the environmental protection objectives are being achieved.
- Takes actions to address with the Consortium any concerns regarding implementation of the plan and ensures that the Consortium takes timely and effective corrective actions.
- Keeps the owner informed of the filing of the plan, review of the plan, effective implementation of the plan, non-conformances and corrective actions.

PEMP Review Process

- City of Ottawa's Representative reviews the plan.
- City of Ottawa's Representative and Consortium will resolve any issues such that an acceptable plan is prepared.
- RA's assessment team through the Regulatory Liaison Committee reviews the plan.
- The accepted plan will be forwarded to the owner.
- The owner has the right to review the plan and raise any concerns with the City of Ottawa's Representative and in turn with the Consortium. City of Ottawa's Representative and the Consortium will work to create an acceptable plan.

The Consortium will forward the plan to agencies for review and comment.

9.1.3 Revisions to the PEMP

The PEMP will be managed as a controlled document. The Consortium will make any and all changes to the PEMP and replacement pages documenting the change(s) will be sent out to all copyholders. The Consortium will forward any significant revisions to the PEMP to the Regulatory Liaison Committee and the RAs for review prior to adoption. The test of significance will be identified by the Consortium and reviewed by the Regulatory Liaison Committee and the RAs prior to adoption. Questions on the significance of revisions can be brought to the Regulatory Liaison Committee for discussion. Revisions will be approved by the RAs.

9.1.4 Quality Control/Monitoring

Quality control and monitoring occurs at several points in the process. The first key component is the Table of Commitments that is developed at the end of the planning stage. This table sets out the commitments and how they are to be addressed during project implementation. This table forms a checklist against which design packages, contract packages, construction, operations and maintenance activities can be reviewed as part of the quality assurance program.

The Consortium's PEMP is reviewed by the City of Ottawa's Representative and the RAs to ensure that it completes and addresses the environmental protection requirements. The PEMP is accepted rather than approved, as it is the Consortium's responsibility to ensure that its operations are compliant.

The Consortium shall be required to carry out the inspection and monitoring programs established in the PEMP, to ensure that the environmental protection measures are being implemented and that those measures are effective in managing environmental impacts. The consortium shall document the results of the environmental inspections and monitoring programs. The City of Ottawa and/or its representative will audit the inspection and monitoring documentation and carry out spot inspections to ensure compliance with the inspection and monitoring program.

Annual reporting will include the progress of the work accomplished and the mitigation measures applied. Details regarding the success of the mitigation measures should also be explained, including how the issue was resolved and whether the objective to reduce the impact had been met. These reports will be presented to the RAs on a yearly basis.