Environmental Project Report

BARRHAVEN LIGHT RAIL TRANSIT AND RAIL GRADE-SEPARATIONS PLANNING AND ENVIRONMENTAL ASSESSMENT STUDY

Draft

June 2024

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ENVIRONMENTAL PROJECT REPORT

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DATE: June 2024

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

APPENDICES

Appendix A: Consultation Record
Appendix B: Supporting Reports

Acronyms

AAQC	Ambient Air Quality Criteria
AAC	Accessibility Advisory Committee
ACG	Agency Consultation Group
ANSI	Area of Natural and Scientific Interest
BCG	Business Consultation Group
BHR	Built Heritage Resource
BIA	Business Improvement Area
BMP	Best Management Practices
BMRRGSS	Barrhaven and Merivale Road Rail-Grade Separation Study
BRC	Black Rapids Creek
BRT	Bus Rapid Transit
CCDP	Climate Change Data Portal
CHER	Cultural Heritage Evaluation Report
CHL	Cultural Heritage Landscape
CHR	Cultural Heritage Resource
CLI	Canada Land Inventory
CPTED	Crime Prevention Through Environmental Design
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
COSSARO	Committee on the Status of Species at Risk in Ontario
CWS	Canadian Wildlife Service
DFO	Department of Fisheries and Oceans
EA	Environmental Assessment
EB	East Bound
ECA	Environmental Compliance Approval
ECCC	Environment and Climate Change Canada
ELC	Ecological Land Classification
ENCG	Environmental Noise Control Guideline
END	Endangered
EPR	Environmental Project Report
ESA	Environmental Site Assessment
GHG	Greenhouse Gas
HFR	High Frequency Rail
IAA	Impact Assessment Act
IPZ	Intake Protection Zone
LID	Low Impact Development
LoS	Level of Service
LRT	Light Rail Transit
MCM	Ministry of Multiculturalism and Citizenship
MMAH	Ministry of Municipal Affairs and Housing
MNRF	Ministry of Natural Resources and Forestry
MECP	Ministry of the Environment, Conservation and Parks
MTO	Ontario Ministry of Transportation
MUP	Multi-Use Pathway
NCC	National Capital Commission
NHIC	Natural Heritage Information Centre
ESA	Ontario Endangered Species Act
OCS	Overhead Catenary System
OHA	Ontario Heritage Act
OP	Official Plan
OPA	Official Plan Amendment

OPH	Ottawa Public Health
OPP	Ontario Provincial Police
OWES	Ontario Wetland Evaluation System
OWRA	Ontario Water Resources Act
PCG	Public Consultation Group
pphpd	Person per hour per direction
PPS	Provincial Policy Statement
POH	Public Open House
PSPC	Public Service Procurement Canada
PSW	Provincially Significant Wetland
PTTW	Permit to take Water
REC	Royale Equestrian Centre
RMA	Roadway Modification Approval
RTTP	Rapid Transit and Transit Priority
RVCA	Rideau Valley Conservation Authority
SAR	Species at Risk
SARA	Species at Risk Act
SC	Special Concern
SWH	Significant Wildlife Habitat
SWM	Stormwater Management
TBM	Tunnel Boring Machine
TDM	Transportation Demand Management
THR	Threatened
TMP	Transportation Master Plan
TOD	Transit-Oriented Development
TPAP	Transit Project Assessment Process (renamed Transit and Rail Project Assessment Process February 2024)
TPSS	Traction power substation locations
TSB	Transportation Safety Board
TSSF	Train Storage and Servicing Facility
UNA	Urban Natural Area

Executive Summary

Introduction/Overview

Extending Light Rail Transit (LRT) to Barrhaven is contemplated in the City of Ottawa's current Transportation Master Plan (TMP, 2013) as part of the Ultimate Rapid Transit and Transit Priority Network, with implementation anticipated beyond the 2031 horizon year. In June 2018, City Council approved a motion directing staff to undertake the Barrhaven Light Rail Transit (LRT) Environmental Assessment (EA) Study for conversion of existing Southwest Transitway between Baseline Station and Barrhaven Town Centre from Bus Rapid Transit (BRT) to LRT facility. Completion of this study will bring the Barrhaven area to the same level as other suburban communities in Ottawa with regards to LRT planning, as part of the Stage 3 LRT program. This is the last LRT segment identified in the City's 2013 TMP requiring EA approval.

This study focused on implementing LRT within the rapid transit corridor previously identified and protected through the 1997 Southwest Transitway EA study (Baseline Station to Strandherd Drive) (McCormick Rankin) and the 2006 Southwest Transitway Extension EA study (Strandherd Drive to Cambrian Road) (TSH). This study also examined options for implementation of a Train Storage and Servicing Facility (TSSF), a new Park and Ride lot, and pedestrian and cycling facilities to support rapid transit service.

It should be noted that through the course of this study Baseline Station was renamed to Algonquin Station. To avoid confusion, Baseline Station remains the name used for the Station as it was shown on public consultation documents throughout the project lifecycle.

Environmental Assessment Process

The project planning phase for the Barrhaven LRT commenced in accordance with Ottawa City Council's direction of June 27, 2018 (Motion No. 72/8) and the EA Scope of Work subsequently approved by Ottawa Transportation Committee on October 3, 2018 (Motion No. 35/1).

This study was carried out in accordance with the Province of Ontario's Transit Project Assessment Process (TPAP) which has since been renamed to the Transit and Rail Project Assessment Process (February 2024) as prescribed in Ontario Regulation 231/08 of the Ontario *Environmental Assessment Act*. The regulation prescribes an EA process facilitating public consultation, documentation, and provincial approval. The process is documented in an Environmental Assessment Report (EPR) which is submitted to the Minister of the Environment, Conservation and Parks (MECP) for approval following a mandatory 30-day public review. The Minister has 35 days to render a decision whether the project can proceed. If the Minister does not render a decision by the end of the 35th day, the project is considered approved. Should there be requests to elevate the scale of the EA, the scope of those requests is limited to matters of provincial importance, related to the natural environment or cultural heritage values or interests, or the project may have negative impact on constitutionally protected Aboriginal and treaty rights.

In accordance with the regulation, this EPR will be placed on public record for comment and review prior to MECP approval. If there are concerns of provincial interest that cannot be resolved, a written objection may be made and sent to the Minister for consideration.

Study Process

The Study process reconfirmed the project needs and opportunities, documented existing conditions, evaluated of alternative solutions and alternative designs to arrive at a Preferred design, with public and stakeholder consultation undertaken throughout. On November 25, 2020, Ottawa City Council approved the Preferred Design for the Barrhaven Light Rail Transit (LRT) extension from Baseline Station to Barrhaven Town Centre that incorporated an elevated LRT guideway located immediately west of the Woodroffe Avenue Right-of-Way between Algonquin College and the Nepean Sportsplex. One of the impacts of this plan was the removal of 100 low-cost

residential housing units situated within a required 20 metre wide strip of land between Knoxdale and West Hunt Club Roads – a section of Right-of-Way referred to throughout the Study as the 'Pinch Point'.

An outcome to Committee and Council's approval of the Preferred Design included direction to establish a task force and working group on affordable housing to address the displacement of 100 privately owned rental units for the properties located with municipal mailing addresses of: 1, 3, 5, 19 and 23 Cheryl Road, 1668 Woodroffe Avenue and 5 Majestic Drive (Recommendation #5). The task force and working group on affordable housing was initiated prior to the issuing of the Notice of Commencement of the TPAP on October 23, 2021.

The task force explored numerous options to mitigate the housing loss, including modifying the LRT alignment to eliminate the loss of housing altogether. Accordingly, the Study Team prepared a functional design plan shifting the LRT alignment to the median of Woodroffe Avenue between north of Knoxdale Road and the Nepean Sportsplex Station (the "Pinch Point"). The new median LRT alignment requires reconstruction of Woodroffe Avenue through the Pinch Point to accommodate the elevated guideway and support piers. It is important to note that the functional design for the remainder of the corridor remains unchanged.

On June 8, 2022 the median LRT alignment and was subsequently approved by Transportation Committee and Council and directed staff to finalize the functional design for the revised alignment and conduct public consultation on the design change and report back to Committee and Council with the outcome prior to re-initiating the TPAP.

Following consultation and refinement of the median elevated LRT alignment the Recommended Plan was presented and approved by the City of Ottawa Transportation Committee on April 27, 2023 and full Council on May 10, 2023. The modification to the design has been captured and described beginning in **Section 6.7** of this EPR. Sections preceding **Section 6.7** have not been edited so as to maintain the transparency and accuracy of the process followed over a number of years to finalize the EA study's Recommended Plan. As part of the revised design, the existing conditions have been revisited and are documented in **Annex 18, Appendix B**. The remainder of the EPR remains unchanged, consistent with the majority of the Recommended Plan remaining unchanged from what was presented and approved by Committee and Council in 2021.

New City of Ottawa Official Plan

During the process of revising the design, the City adopted a new Official Plan (2022). Subsequently, the Infrastructure Master Plan and Transportation Master Plan have also undergone process of updating and have significantly completed drafts since the documentation of the existing conditions written at the outset of the EA study in 2018. The Recommended Plan has been reviewed to ensure consistency with these new planning documents and is described in **Section 6.8**.

Existing Conditions

The Study Area extends from Baseline Station in the north to Barrhaven Town Centre in the south.

The Official Plan designations from both the 2013 and new 2022 versions were considered through the EA study. Areas around Baseline Station (renamed to Algonquin) and Barrhaven Town Centre are recognized as areas for high density developments, a range of mixed use functions within easy access to transit. Station locations are identified as areas for future focused development and intensification. The Study Area north of Hunt Club Road recognizes Woodroffe Avenue as a Mainstreet Corridor. The Study Area south of West Hunt Club Road to Fallowfield Road recognizes the Greenbelt area and support for Agricultural Resource Area, and Greenbelt Facility. Greenspaces cross the Study Area throughout.

The VIA Rail Smiths Falls Subdivision also crosses the Greenbelt whereby the Southwest Transitway, Woodroffe Avenue and Fallowfield Road all cross at-grade.

Existing environmental conditions for the Study Area were established through a combination of document review and field investigation. Major issues identified which guided planning and design of the project included:

- Geotechnical conditions –a large part of the Study Area includes sensitive soils and groundwater conditions which influence alternative designs, constructability, and project cost.
- Land use and development constraints –part of the Study Area includes established residential communities. New infrastructure must be compatible and address potential impacts such as noise, vibration, the visual environment, community access and property requirements.
- National Capital Commission Greenbelt –new infrastructure needs to address the visual environment, property (including farm infrastructure) and access impacts and enable pathway/eco-passage connectivity.
- Transportation conditions –The Southwest Transitway and Woodroffe Avenue carry large volumes of transit and automobile traffic and there are key pedestrian/cycling linkages in the Study area. New infrastructure will need to support future travel demand for all modes and address safety, capacity and accessibility requirements.

Pre-planning Activities

The following activities were undertaken during the pre-planning phase:

- Data collection to establish the existing conditions for the Study Area and inform subsequent evaluations;
- Re-confirm the project need and opportunity;
- Re-confirm the Preferred Solution identifying the transit project;
- Develop and complete a comprehensive evaluation of alternative designs and Train Storage and Servicing Facility (TSSF) locations;
- Consultation and engagement including three (3) public open houses, 16 consultation group meetings and several individual stakeholder meetings;
- Presentation and approval of the Recommended Plan at City of Ottawa Transportation Committee and Council; and
- Preparation of the draft Environmental Project Report.

Recommended Plan (Project Description)

The Recommended Plan incorporates:

- 10 kilometres of twin-track, fully segregated electric LRT including;
  - 2.4 kilometres on an elevated structure west of Woodroffe Avenue between Baseline Station and the Nepean Sportsplex.
  - 7.6 kilometres converted form bus to rail within the existing Southwest Transitway corridor between Nepean Sportsplex and Barrhaven Town Centre, including 1.7 kilometres of an open-cut trench at the southern end of LRT line.
- 7 LRT stations;
  - Three new LRT stations: Tallwood, Knoxdale and Nepean Sportsplex.
  - Converting four existing Bus Rapid Transit (BRT) stations to LRT stations: Fallowfield, Longfields, Strandherd and Barrhaven Centre.
- Improved and new facilities for pedestrian and cyclists along the corridor, including a pedestrian bridge connecting to the Nepean Sportsplex over Woodroffe Avenue;
- Reconstruction of Woodroffe Avenue from north of Knoxdale to the southern Nepean Sportsplex intersection including modification to five intersections (Knoxdale, Majestic, West Hunt Club, Sportsplex North, Sportsplex South) conforming to the City's Protected Intersections Design Guidelines;
  - Inclusion of uni-directional cycle tracks on both sides of Woodroffe Avenue between Knoxdale Avenue and West Hunt Club Road; and
  - Corridor Landscaping.
- Three new bridges over the VIA Rail line at Woodroffe Avenue, the Southwest Transitway (LRT) and Fallowfield Road;

- Three new below-grade separating structures at Berrigan Drive, Marketplace Avenue and Chapman Mills Drive;
- A light rail TSSF near the VIA Rail overpass at Greenbank Road (1005 and 1045 Greenbank Road);
- A bus-to-rail transfer terminal and 250 space park-and-ride facility at the Barrhaven Town Centre; and
- Signalization at Woodroffe Avenue and the entrance to Baseline Station, and the relocation of a northbound bus stop to far-side at Norice Street as interim transit priority measures.

From approximately 200m north of the Knoxdale/Medhurst intersection to the Nepean Sportsplex south entrance, Woodroffe Avenue will require reconstruction to accommodate the elevated LRT alignment within the median. The functional design for roadway reconstruction reflects a reduction in total traffic lanes (from six to four) through this segment by reallocating the existing transit-only lanes to a wider median needed to support the elevated LRT. The roadway functional design also reflects current best practices and City design standards for Complete Streets, with wider sidewalks and separated cycling facilities (cycle tracks). It also includes five protected signalized intersections (Knoxdale, Majestic, West Hunt Club, Sportsplex North, Sportsplex South) with Smart-channels for right-turns at some locations to meet traffic operations requirements and a wide median to provide road safety barriers around piers.

South of Nepean Sportsplex to Barrhaven Town Centre, the LRT would follow the existing Southwest Transitway corridor, with grade separations over the VIA Rail line. A new signalized intersection at Woodroffe Avenue will provide access to the integrated Fallowfield Station. The Park and Ride at the Barrhaven Centre Station could be integrated with the future development plans for the Barrhaven Town Centre area.

The TSSF will be located on City-owned land in the north-east corner of the Greenbank-Highbury Park intersection. The location is near the end of the LRT line, which will reduce deadhead train mileage, operating cost and non-revenue service time.

Impact Assessment Mitigation and Monitoring

A comprehensive analysis/assessment was undertaken to identify the impacts on the social, natural and physical environments based on implementation of the Recommended Plan. Where potential effects were predicted, mitigation measures are recommended including monitoring, where applicable.

Environmental implications and mitigation measures include:

Noise and Vibration

A noise and vibration assessment and subsequent addendum to capture any changes resulting from the modification to the preferred design were completed to evaluate the potential impacts of the project on the surrounding noise sensitive land uses. Operational noise impacts due to the LRT project are not expected to be significant as noise levels along the alignment are dominated by area road traffic. At-source noise control measures in the form of a noise screen along elevated portions of the guideway is not warranted based on current guidelines. Should there be changes to the guidelines and best management practices in the future or changes in LRT design, it is recommended that noise control measures be reviewed at detailed design. The proposed Fallowfield Road re-alignment to the north will move the road away from nearby receptors, thus reducing road noise levels for residents on the southside. The activity and traffic patterns around existing bus stations and proposed LRT stations are expected to remain similar to the current stations, with the exception of Barrhaven Centre Station which will be reconstructed to include a new bus terminal and Park and Ride lot.

The TSSF is located 100 metres from the nearest sensitive receiver. Inspections and servicing activities will be undertaken indoors, thereby reducing the impact of noise on the adjacent community. Nevertheless, it is recommended that a detailed stationary noise analysis be undertaken during detailed design to confirm mitigation needs. Measures could include equipment silencers, noise walls or berms around the perimeter of the property. Walls and/or landscaped berms could also be built as needed to reduce visual and noise impacts.

Vibration impacts due to the project are not expected to be significant although, if required, appropriate mitigation such as ballast mats/track isolation and resilient track fasteners can be implemented. This can be confirmed during design and continued discussion with the LRT office of lessons learned through Stage 1 and 2 implementation.

The expected impacts from construction of the project will be limited to isolated and local surface construction generating an increase in occasional minor ground vibrations, emissions and dust, as well as intermittent noise. In all cases, air quality, noise and ground vibrations are not expected to be overly disruptive to commonly occurring regular activities and can be mitigated through standard best practices during construction.

Visual Impacts and Privacy

The project will change the existing views within the corridor and offer new views and vistas across the NCC Greenbelt from the facility and rail grade-separations. The rail grade-separations have been designed to minimize embankment heights and use long open spans to allow for light penetration and views underneath the structures.

The elevated section from Baseline Station to the Nepean Sportsplex will become a new view from the surrounding land uses. Detailed landscape plans will be required throughout the corridor and will include preserving, to the extent possible, existing vegetation and provide new opportunities to mitigate views of the elevated facility to the surrounding community. Where the project includes elevated sections, opportunities to program the space under the guideway for community benefiting uses including parks and recreational pathways or greening will be explored.

The elevated facility is located 40 metres to 60 metres from existing residences along Beechcliffe Street. Opportunities to include landscape buffering, public space and/or more transit-oriented land uses will be explored to minimize impacts to privacy.

Natural Environment

The LRT alignment, while largely within an urban context, does cross the NCC Greenbelt between West Hunt Club Road and Fallowfield Road.

The project includes three existing water crossings: one at the north end of the Greenbelt that provides drainage from the agricultural fields to storm systems under and along Woodroffe Avenue and West Hunt Club Road; and two crossings of Black Rapids Creek closer to Fallowfield Station. Impacts to fisheries and aquatic habitat, as well as water quality, can be avoided using standard design and construction practices such as adhering to in-water timing restrictions and by implementing erosion and sediment control measures.

The project will require the removal of some vegetation along the edge of the Tallwood Woods, an urban woodlot. A detailed tree conservation report and landscape plan will be required prior to project implementation to minimize the impact to trees and identify areas where new trees could be provided.

There is potential for the project to interact with urban and rural species, as well as Species at Risk. The need for more targeted species/inventories is documented in future requirements and with the application of mitigation measures, potential impacts can be reduced or eliminated following all federal and provincial permitting requirements. In addition, the project will need to adhere to the City of Ottawa Protocol for Wildlife Protection during construction. Stations will be designed following the City of Ottawa's guidelines for bird-safe design.

Climate Change

Electric LRT will have a positive effect on climate change when compared to the effects of the current diesel bus service that operates in the corridor today. The reliability and convenience of LRT will also encourage residents to switch from single-occupancy vehicle trips to transit. In addition to electric propulsion, which reduces greenhouse gases, particularly sulphur and nitrogen oxides and other contaminants, LRT also reduces the

number of vehicles required to carry large volumes of passengers. The rail grade separations will also eliminate vehicle idling and congestion associated with the existing at-grade crossings while waiting for trains to pass, thus contributing to a cleaner local environment in the community.

There are also activities that can be done during construction to minimize the project's negative impacts on the environment such as: waste reduction/re-use/diversion measures; sourcing local materials where possible; minimizing tree removals; and other best management practices to reduce temporary noise and air quality impacts. The LRT design includes measures to increase its resiliency to the effects of climate change: stormwater management strategies that consider extreme weather events; landscaping plans that include additional shelter and rest elements to shield facility users from extreme heat; and developing maintenance plans throughout the lifecycle of the facility, including snow and ice management strategies.

Approvals, Monitoring and Commitments to Future Work

The following future commitments will be undertaken as part of the next phases of the project:

- Additional consultation with the Royale Equestrian Centre and NCC regarding the new entrance to the centre at 2191 Woodroffe Avenue resulting from the grade-separation of Woodroffe Avenue and LRT.
- Section 82 determination under the *Impact Assessment Act* based on requirement for federal lands.
- Federal Land Use, Design and Transaction Approval (FLUDTA) from NCC due to the requirement for federal lands.
- Other Federal Approvals to be confirmed including those required under the *Species at Risk Act* and *Fisheries Act* and O.Reg. 406/19 On-site and excess soil management.
- Provincial Approvals to be confirmed including: Environmental Compliance Approval, Permit to take Water, those under the *Endangered Species Act*, *Heritage Act*, *Public Lands Act*, *Conservation Authorities Act*,
- Possible EA under Hydro One Class EA process
- Municipal Approvals to be confirmed including: Road modification Approval, Road Cut Permit, Temporary Encroachment Permit, Noise By-Law Exemption and Tree Protection By-Law.

Monitoring plans from **Section 7** will be developed and reviewed by the appropriate agencies prior to implementation. Construction and post construction monitoring will be required (**Section 9.6**).

In addition, monitoring may be required as part of the permit and approval process detailed above.

Under the Environmental Assessment Act, the proponent is required to monitor compliance of the implementation of mitigation measures as identified in the EPR. The City of Ottawa will prepare a monitoring plan in accordance with subsection 9.2.8 of Ontario Regulation 231/08 to verify the effectiveness of the mitigation measures. The monitoring plan will be designed prior to the start of construction and will outline roles and responsibilities related to agency reviews and implementation of the monitoring report.

Financial Implications

The Class C estimate (2023 dollars) to design and implement the Barrhaven LRT and three rail grade-separations is $4.019 billion.

The project can be constructed in phases:

- Phase 1: Baseline Station to Fallowfield Station ($2.717 billion). It includes rail grade-separations (at Woodroffe Avenue, Southwest Transitway and Fallowfield Drive) and the expansion of the maintenance facility at Moodie Drive to initially support Phase 1 extension.
- Phase 2: Fallowfield Station to Barrhaven Town Centre ($1.302 billion). It includes the new TSSF.

Rail grade-separations of Woodroffe Avenue, Southwest Transitway and Fallowfield Drive may be undertaken in advance of the LRT extension at an estimated cost of $535 million. This cost is included in the estimate for Phase 1.

The Class C estimate (2020 dollars) to design and implement a new signalized protected intersection at the entrance to the Baseline Station, and the relocation of an existing bus stop at Norice Street, is $2 million.

This near-term improvement measure can be funded through the City's transit priority program.

Public Consultation / Input

Consultation with stakeholders occurred through the Agency Consultation Group (ACG), Business Consultation Group (BCG), and Public Consultation Group (PCG). Stakeholders include Indigenous Communities, government agencies, Ottawa Housing, National Capital Commission (NCC), VIA Rail, CN Rail, Rideau Valley Conservation Authority (RVCA), City's Accessibility Advisory Committee (AAC), Barrhaven Business Improvement Area (BIA), developers, landowners, business groups, school boards, community associations and special interest groups. Consultation with the general public occurred primarily through three open houses and through the project website, e-mail, and additional meetings as required, such as with affected property owners. A project website (www.ottawa.ca/barrhavenlrt) was established to share information on the study's progress.

Major feedback included: support for advancing the project; concerns about the impact on rental housing units, noise and visual impacts from the elevated facility, and avoiding traffic impacts to Woodroffe Avenue during and post construction; support for pedestrian and cycling facilities, making use of the space under the guideway, providing more parking, and the grade separations at the VIA rail crossings; and a desire to limit impacts on the NCC Greenbelt and green spaces; and, impact on water quality.

These issues were assessed during the development of Recommended Plan and are described as part of the description of the Recommended Plan.

Sommaire

Dans l'actuel Plan directeur des transports (PDT), le prolongement du train léger sur rail (TLR) jusqu'à Barrhaven est envisagé dans le cadre du réseau de transport en commun rapide et de transport en commun ultime d'Ottawa et son déploiement est projeté au-delà de l'horizon de 2031. En juin 2018, le Conseil municipal a approuvé une motion mandatant le personnel d'entreprendre une étude d'évaluation environnementale pour le TLR à Barrhaven. Une fois d'étude achevée, le secteur de Barrhaven sera au même niveau que d'autres collectivités suburbaines d'Ottawa en ce qui concerne la planification du TLR dans le cadre de l'Étape 3 du programme municipal de transport en commun par train léger sur rail. Il s'agit du dernier segment du réseau de TLR défini dans le PDT de la Ville qui est nécessaire à l'approbation de l'évaluation environnementale.

L'étude a été axée sur le couloir de transport en commun rapide protégé dans le cadre des études d'évaluation environnementale de 1997 (de la station Baseline à la promenade Strandherd) et de 2006 (de la promenade Strandherd au chemin Cambrian) réalisées pour le Transitway Sud-Ouest. Différentes options de mise en œuvre ont également été examinées, de même que l'aménagement d'une installation d'entreposage et d'entretien des trains (IEET), d'un nouveau parc-o-bus et d'installations piétonnières et cyclables pour soutenir le service de transport en commun rapide.

L'étude a été réalisée en vertu du Règlement de l'Ontario 231/08 sur le processus d'évaluation des projets de transport en commun (PEPTC) aux termes de la Loi sur les évaluations environnementales de l'Ontario.

Plan recommandé

Le plan recommandé comprend :

- Une ligne de 10 km de TLR électrique à deux voies entièrement séparée :
  - 2,4 km de voies sur une structure surélevée à l'ouest de l'avenue Woodroffe, entre la station Baseline et le Sportsplex de Nepean
  - La conversion en couloir de TLR de 7,6 km du couloir du Transitway Sud-Ouest, entre le Sportsplex de Nepean et le centre-ville de Barrhaven, y compris une tranchée à ciel ouvert de 1,7 km à l'extrémité sud de la ligne du TLR
- Sept stations de TLR :
  - Trois nouvelles stations de TLR : Tallwood, Knoxdale et Sportsplex de Nepean
  - La conversion de quatre stations de transport en commun rapide par autobus (TCRA) en stations de TLR : Fallowfield, Longfields, Strandherd et Barrhaven Centre
- Des installations améliorées et nouvelles pour les piétons et les cyclistes le long du couloir, y compris une passerelle piétonnière reliant ces installations au Sportsplex de Nepean au-dessus de l'avenue Woodroffe;
- Trois nouveaux ponts enjambant la ligne ferroviaire de VIA Rail à la hauteur de l'avenue Woodroffe, du Transitway Sud-Ouest (TLR) et du chemin Fallowfield;
- Trois nouvelles structures souterraines à la hauteur de la promenade Berrigan, de l'avenue Marketplace et de la promenade Chapman Mills;
- Une installation d'entreposage et d'entretien des trains (IEET) près du passage supérieur de VIA Rail à la hauteur du chemin Greenbank (1005 et 1045, chemin Greenbank);
- Un terminus pour les correspondances autobus/train et un parc-o-bus de 250 places au centre-ville de Barrhaven;
- L'installation de feux de signalisation à l'avenue Woodroffe et l'entrée de la station Baseline et le déplacement de l'arrêt d'autobus – direction nord – de l'autre côté du couloir, à la hauteur de la rue Norice, à titre de mesures provisoires de priorité au transport en commun.

La construction d'une voie de guidage surélevée à l'ouest de l'avenue Woodroffe est recommandée, car une telle structure est moins complexe à réaliser techniquement et n'érige pas de barrière entre les collectivités. Le tronçon surélevé se trouve de 40 m à 60 m de distance des maisons longeant la rue Beechcliffe.

Au sud du chemin Knoxdale, une bande de terrain d'une largeur de 20 m est requise pour y aménager la voie de guidage surélevée, ce qui touchera 120 logements locatifs, propriétés de deux entreprises privées. Afin de réduire le déplacement, la Ville s'est engagée à mettre sur pied un groupe de travail dont le mandat consiste à les installer ailleurs les résidents longtemps avant les travaux. Il est prévu qu'avant les travaux, il y ait un délai suffisant pour installer ailleurs les résidents. La Ville travaillera également en collaboration avec ses partenaires du secteur du logement abordable et avec les promoteurs du secteur privé afin de les inciter à offrir des options de logement similaires sur les terrains adjacents au couloir ou dans les collectivités à proximité.

Au sud du Sportsplex de Nepean jusqu'au centre-ville de Barrhaven, il est prévu que le tracé du TLR emprunte le couloir actuel du Transitway Sud-Ouest et que des sauts-de-mouton soient construits aux passages ferroviaires de VIA Rail. Une nouvelle intersection avec signalisation à la hauteur de l'avenue Woodroffe permettra d'accéder à la station intégrée de Fallowfield. Il sera possible d'intégrer le parc-o-bus de la station de Barrhaven-Centre aux plans d'aménagement futur du centre-ville de Barrhaven.

L'installation d'entreposage et d'entretien des trains sera située sur un terrain appartenant à la Ville à l'angle nord-est de l'intersection du chemin Greenbank et de la promenade Highbury-Park. Cet emplacement est situé près de la fin de la ligne du TLR, réduisant ainsi le nombre de kilomètres parcourus à vide par les trains, les frais d'exploitation et le temps de service non commercial.

Répercussions financières

Selon l'estimation de catégorie C (en dollars de 2020), la conception et la mise en œuvre du TLR de Barrhaven et des trois sauts-de-mouton coûteront 3 milliards de dollars.

Le projet peut se réaliser en trois phases :

- Phase 1 : de la station Baseline à la station Fallowfield (2 milliards de dollars). Cette phase comprend les sauts-de-mouton ferroviaires (à l'avenue Woodroffe, au Transitway Sud-Ouest et à la promenade Fallowfield) et l'agrandissement de l'installation d'entretien de la promenade Moodie pour soutenir initialement la phase 1 du prolongement.
- Phase 2 : de la station Fallowfield à la station Barrhaven Centre (1 milliard de dollars). Cette phase comprend la nouvelle installation d'entreposage et d'entretien des trains.

Les travaux de construction des sauts-de-mouton ferroviaires de l'avenue Woodroffe, du Transitway Sud-Ouest et de la promenade Fallowfield peuvent commencer avant le début des travaux de prolongement du TLR, à un coût estimé de 400 millions de dollars. Ce montant est compris dans l'estimation des coûts de la phase 1.

Selon l'estimation de catégorie C (en dollars de 2020), la conception et la construction de la nouvelle intersection protégée avec feux de signalisation à l'entrée de la station Baseline et le déplacement de l'arrêt-bus à la hauteur de la rue Norice coûteront 2 millions de dollars.

Cette mesure d'amélioration à moyen terme peut être financée à même le budget du programme de priorité au transport en commun de la Ville.

Consultations publiques/commentaires

Les consultations se sont déroulées par l'entremise du Groupe de consultation des organismes (GCO), du Groupe de consultation des entreprises (GCE) et du Groupe de consultation publique (GCP). Les intervenants consultés incluent des communautés autochtones, des ministères, Logement Ottawa, la Commission de la capitale nationale (CCN), VIA Rail, le Canadien National (CN), l'Office de protection de la nature de la vallée Rideau (OPNVR), le Comité consultatif sur l'accessibilité (CCA) de la Ville, la Zone d'amélioration commerciale de Barrhaven (ZAC), des promoteurs, des propriétaires, des groupes de gens d'affaires, des conseils scolaires, des

associations communautaires et des groupes d'intérêts spéciaux. La consultation du grand public a surtout pris la forme de deux séances portes ouvertes, de commentaires recueillis sur la page Web du projet, de courriels et de rencontres additionnelles au besoin, notamment avec les propriétaires touchés. Un site Web (www.ottawa.ca/barrhaventlr) a été créé pour le projet afin de partager de l'information sur le déroulement de l'étude.

Les principaux commentaires ont porté sur les aspects suivants : soutien pour l'avancement du projet; impact sur les logements locatifs; bruit et effets visuels de la structure surélevée; éviter de perturber la circulation sur l'avenue Woodroffe durant et après la construction; soutien pour les installations piétonnières et cyclables; utilisation de l'espace sous la voie de guidage; fournir plus de places de stationnement; soutien pour les sauts-de-mouton aux passages à niveau de VIA Rail; limiter les répercussions sur la Ceinture de verdure et les espaces verts de la CCN ; et impact sur la qualité de l'eau.

Ces questions ont été examinées au cours de l'élaboration du plan recommandé et sont présentées dans le présent rapport.

1 Introduction

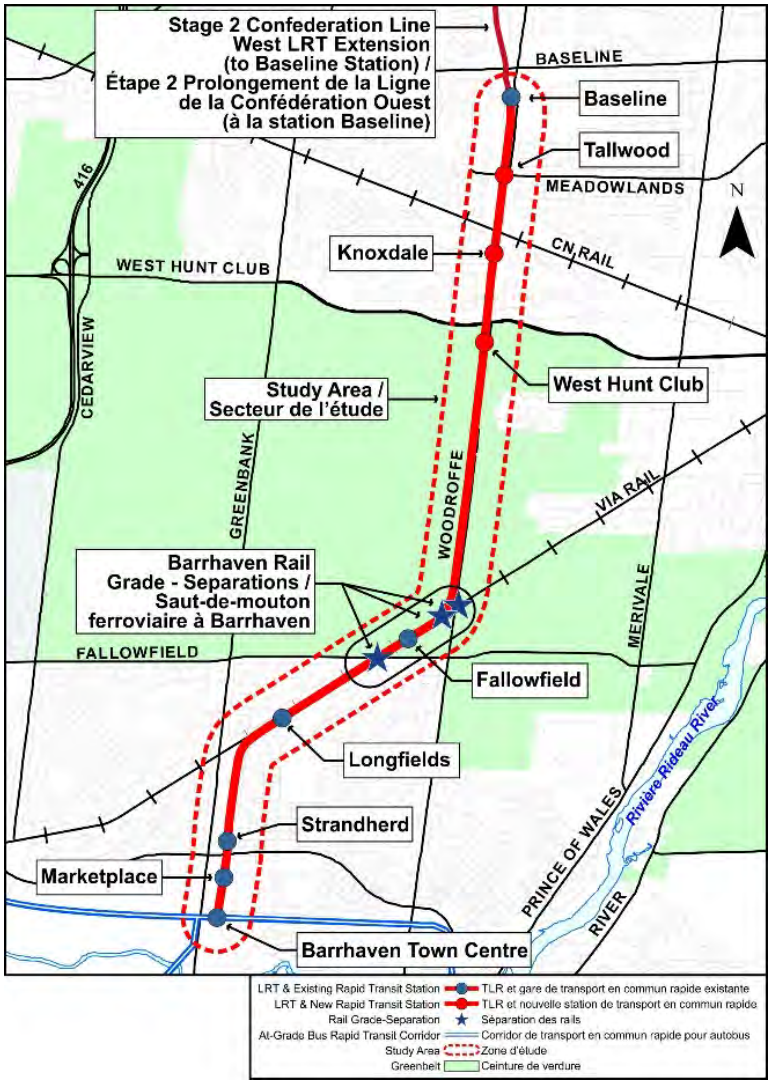
The City of Ottawa is the proponent of the Barrhaven Light Rail Transit (Baseline Station to Barrhaven Town Centre) and Rail Grade-Separations Planning and Environmental Assessment (EA) Study. The Study was completed in accordance with the Transit Project Assessment Process (TPAP) (since renamed to the Transit and Rail Project Assessment Process) Ontario Regulation 231/08 under Ontario's *Environmental Assessment Act*. This EA study has developed a Recommended Plan for a 10 kilometre (km) long twin-track electrically powered Light Rail Transit (LRT) facility extending from Baseline Station to Barrhaven Town Centre, as well as the grade-separations of Woodroffe Avenue, the Southwest Transitway and Fallowfield Road where these corridors currently cross the VIA Rail Smiths Falls Subdivision rail line at-grade in Barrhaven. The Study Area for this EA is illustrated on **Figure 1-1**. The City of Ottawa will have charge of this project, following the responsibilities and obligations identified in Regulation 231/08 during the planning stages, Transit and Rail Project Assessment Process, implementation and operation of the preferred undertaking described herein.

The need and opportunity for extending LRT to Barrhaven Town Centre and implementing the associated rail grade-separations is well established in a number of the City's key strategic directions and objectives as well as within the previously completed EA studies dating from 1997. There are numerous benefits associated with extending LRT to Barrhaven Town Centre, including providing opportunities for modal shift from private vehicles to public transit and via enhanced pedestrian and cycling facilities with improved connections to and from rapid transit stations as well as along the LRT corridor.

The proposed rail grade-separations will address Transportation Safety Board of Canada (TSB) Recommendation R15-05 provided by the TSB in its Railway Investigation Report R13T0192 on the September 2013 VIA Rail/OC Transpo train and bus collision at the VIA Rail line/Southwest Transitway level crossing. The need for the rail grade-separations is further established and confirmed by the recently completed study: Barrhaven and Merivale Road Rail-Grade Separation Study ((BMRRGSS,) 2017).

As part of the study process, this Environmental Project Report (EPR) has been prepared to document activities and findings during the planning and functional design phase and to present the Recommended Plan for the project. The EPR provides the background and an overview of the study including the location and rationale for the proposed project; EA requirements; the public consultation process; the existing and future social, transportation, infrastructure and utilities, economic, natural and physical conditions; development and evaluation of alternative designs; the selection of a preferred alternative; the Recommended Plan; and an assessment of the effects of the project.

Figure 1-1 Study Area



1.1 Project Background

The Barrhaven LRT project is a component of the City's planned rapid transit network. It is identified in the City's 2013 Transportation Master Plan (TMP) as part of the Ultimate Rapid Transit Network, with implementation currently anticipated beyond the TMP's 2031 horizon year (**Figure 1-2**).

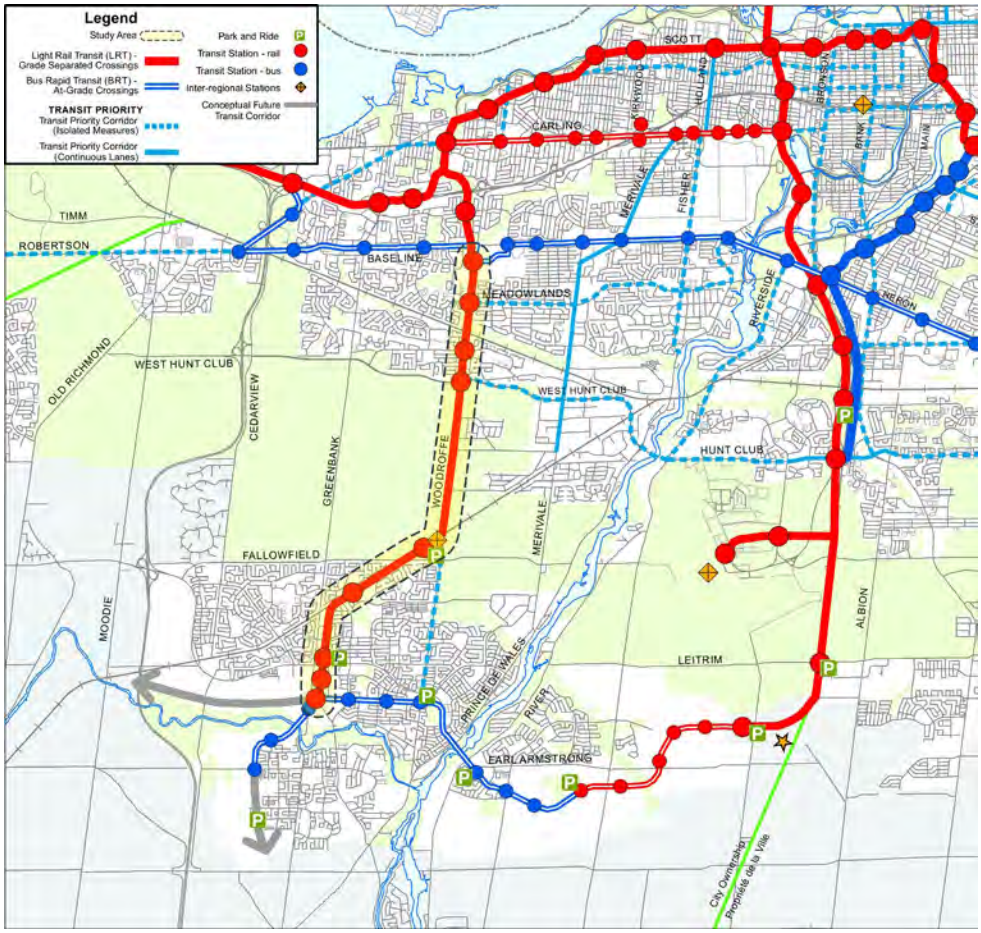
In May 2018, the City initiated the Barrhaven Rail Grade-Separation Environmental Assessment study to complete the EA requirements for rail grade-separation of the Southwest Transitway, Woodroffe Ave and Fallowfield Road at VIA Rail crossing.

In June 2018, Council directed staff to undertake the EA study for conversion of the BRT corridor to LRT facility to serve Barrhaven, such that interim results can be part of the upcoming TMP review to be assessed for consideration with respect to the City's next phase of transit investments.

The Barrhaven LRT EA study area partially overlaps with the then ongoing Barrhaven Rail Grade-Separation EA study. Due to the overlapping study areas and design issues, EA process requirements, study durations and consultation activities, the two EA studies were integrated and restructured into one study. The integrated EA study was titled as the Barrhaven Light Rail Transit (Baseline Station to Barrhaven Town Centre) and Rail Grade-Separations EA study. Combining the two studies was deemed appropriate to bring efficiencies to the EA processes, streamline consultation and project management activities and cost savings to the City.

On October 3, 2018, as per Committee approval, the scope of the ongoing Barrhaven Rail Grade-Separation EA Study was expanded to include extending the Confederation Line LRT to Barrhaven by converting the Southwest Transitway from bus to rail technology due to overlapping study areas, cost saving and efficiency in the EA process (Motion No. 35/1).

Figure 1-2 The Project as Identified in the 2013 TMP



1.2 Environmental Assessment Process

The purpose of the *Ontario Environmental Assessment Act RSO 1990* (EA Act) is to help protect and conserve Ontario's environment by ensuring that projects subject to the Act follow a planning process leading to environmentally sound decision-making. An EA involves identifying and planning for environmental issues and effects prior to implementing a project. The process allows for opportunities for the involvement of public and other stakeholders in the decision-making process of the project.

In June of 2008, the Transit Projects Regulation (*Ontario Regulation 231/08*) was created under the EA Act to guide public transit projects through approval. The process requires public sector proponents to assess the impacts of their project, identify mitigation measures, undertake consultation, and make available information or documentation completed for the pre-planning work which led to the selection of the Recommended Plan for the transit project.

The process outlined in Ontario Regulation 231/08 provides a framework for an accelerated consultation and review process regarding the assessment of the potential environmental effects of a transit project, to enable decision-making within six months from the time an EA Study is launched. As per Section 6 (1) of the regulation prior to the project commencement date, the proponent shall complete the following steps:

1. *Prepare and distribute a notice of commencement of the transit project assessment process under section 7.*
2. *Conduct consultations under section 8.*
3. *Prepare an environmental project report under section 9.*

4. *Prepare and distribute a notice of completion of the environmental project report under section 11.*
5. *Submit statements of completion of the transit project assessment process to the Director of the Environmental Assessment Branch and the appropriate regional director of the Ministry under section 14. O. Reg. 231/08, s. 6 (1); O. Reg. 354/12, s. 3 (1); O. Reg. 342/20, s. 4 (1).*

The project planning phase for the Barrhaven LRT commenced as per the Ottawa City Council direction of June 27, 2018 (Motion No. 72/8) and the Scope of Work subsequently developed and approved by Ottawa Transportation Committee on October 3, 2018 (Motion No. 35/1).

The planning and assessment phase of the project was designed to meet the Province of Ontario's Transit and Rail Project Assessment Process requirements as prescribed in Ontario Regulation 231/08 (**Figure 1-3**). The six-month EA process is primarily for public consultation, documentation, and provincial approval of the EPR. Once the EPR is submitted to the Minister of the Environment, Conservation and Parks (MECP), the approval period is 35 days (this is within the six-month timeline). If the Minister does not render a decision by the end of the 35th day, the project is considered approved. Should there be requests to elevate the scale of the EA, the scope of those requests is limited to matters of provincial importance, related to the natural environment or cultural heritage values or interests or the project may have negative impacts on constitutionally protected Aboriginal and treaty rights.

In accordance with Ontario Regulation 231/08 this EPR has been completed and made publicly available. As part of the assessment process, the EPR will be placed on public record for comment and review prior to MECP approval. If there are outstanding concerns regarding potential impact to constitutionally protected Aboriginal and treaty rights or provincial importance that cannot be resolved, a written objection may be made and sent to the Minister for consideration.

Figure 1-3 Illustration of the Transit and Rail Project Assessment Process as per the Environmental Assessment Act

1.3 Impact Assessment Act

The purpose of the *Impact Assessment Act (IAA) (2019)* is to protect the components of the environment that are within the legislative authority of the federal government from significant adverse environmental effects caused by a designated project. Additionally, the Act serves to promote cooperation and coordinated action between federal and provincial governments with respect to EAs.

Under Section 82 of the IAA: "*An authority must not carry out a project on federal lands, exercise any power or perform any duty or function conferred on it under any Act of Parliament other than this Act that could permit a project to be carried out, in whole or in part, on federal lands or provide financial assistance to any person for the purpose of enabling that project to be carried out, in whole or in part, on federal lands, unless (a) the authority determines that carrying out of the project is not likely to cause significant adverse environmental effects; or (b) the authority determines that the carrying out of the project is likely to cause significant adverse environmental effects and the Governor in Council decides, under subsection 90(3), that those effects are justified in the circumstances*".

As federal lands are required for various phases of project completion, an Environmental Effects Analysis of all the physical activities proposed on federal lands is required, under Section 82 of the IAA. No approvals from the National Capital Commission under the *National Capital Act* can be issued before these obligations are fulfilled. An Environmental Effects Analysis of a proposed project will determine the need to eliminate or mitigate adverse effects, or to recommend monitoring based on detailed design. **Section 7.8.2** details the impact assessment based on the Recommended Plan described herein. Many of the potential impacts that will also be analyzed through the federal Environmental Effects Analysis are included.

The proposed project will also require approval through the Federal Land Use, Design and Transaction Approvals (FLUDTA) process under the *National Capital Act*. Other federal authorities that may have an interest in the project include Public Services and Procurement Canada, Fisheries and Oceans Canada, the Canadian Transportation Agency, and Transport Canada. This Report was prepared in consultation with the NCC and is intended to form the basis for evaluation of environmental effects when the Federal EA requirements are met.

1.4 Consultation

1.4.1 CONSULTATION GROUPS

The study proceeded under the direction of the City of Ottawa and benefitted from the direct involvement and guidance of three invited Study Consultation Groups. These included an Agency Consultation Group (ACG) consisting of City staff, consultants in a variety of disciplines and representatives from government agencies and approval bodies that may have an interest in the project; a Business Consultation Group (BCG) including business associations, institutions and large commercial establishments/developers; and a Public Consultation Group (PCG) consisting of representatives from Community Associations and interested community groups relevant to the Study Area.

1.4.1.1 Agency Consultation Group

The ACG was formed to address the full range of technical issues and to comment on special studies as well as applicable procedures, legislation, and policies. ACG members included agencies and government department representatives from Municipal, Provincial and Federal levels, as well as Indigenous communities. The following were invited to participate either by attending ACG meetings or providing comments during the EA process:

Internal ACG (City of Ottawa) Representation

- Transportation Services Department
- Transportation Planning
  - Transportation Environmental Assessments
  - Transportation Policy and Networks
- Traffic Services
  - Traffic Operations
  - Road Safety and Traffic Investigations
- Rail Construction Program Services
- Transit Customer Systems and Planning
- Planning, Infrastructure and Economic Development Department
  - Planning Services
    - Development Review
  - Infrastructure Services
    - Asset management
  - Economic Development Services
  - Resiliency, Planning and Policy
    - Natural Systems and Rural Affairs
  - Right of Way, Heritage and Urban Design Services
- Corporate Real Estate Office
  - Realty Initiatives and Development
    - Environmental Remediation Unit
  - Realty Services
- Emergency and Protective Services Department
- Public Works and Environmental Services Department
- Recreation, Cultural and Facility Services Department
- Ottawa Public Health (OPH)

External ACG Representation

Federal

- National Capital Commission (NCC)
- VIA Rail
- CN Rail
- Public Services and Procurement Canada (PCPC)
- Transport Canada
- Environment and Climate Change Canada (ECCC)

Provincial

- Ministry of the Environment, Conservation and Parks (MECP)
- Ministry of Agriculture, Food and Rural Affairs
- Ministry of Natural Resources and Forestry (MNRF)
- Ministry of Heritage, Sport, Tourism and Culture Industries (MHSTCI) now, Ministry of Multiculturalism and Citizenship (MCM)

Regional

- Rideau Valley Conservation Authority (RVCA)
- Hydro Ottawa Limited
- Transport Action Canada
- Rogers
- Hydro One Networks Inc. "Hydro One"
- Bell Canada
- Enbridge

Indigenous Groups

- Algonquins of Ontario
- Algonquins of Pikwàkanagàn
- Kitigan Zibi Anishinabeg
- Ottawa Métis Council
- Metis Nation of Ontario

Meeting agendas and notes are contained in **Appendix A**. **Table 1-1** outlines the meeting dates and main agenda topics.

Table 1-1 Agency Consultation Group Meetings

Meeting #	Date	Main Agenda Topics
1	November 27, 2018	Study Overview, Study Background, Needs and Opportunities, Existing Conditions, Alternative Solutions, Alternative Design Considerations
2	June 12, 2019	Preferred Solutions, Evaluation of Alternative Designs Methodology and Criteria, Results of Technical Studies, Alternative Alignments and Designs, Alternative Train Storage Facility Locations
3	October 16, 2019	Alternative Alignments and Designs (Baseline-West Hunt Club), Preliminary Plan to Convert Southwest Transitway to LRT, Preliminary Plan for Rail Grade-Separations, Alternative Train Storage Facility Locations
4	August 20, 2020	Evaluation and Confirmation of Alternative Alignments and Designs (Baseline-West Hunt Club), Evaluation and Confirmation of Alternative Train Storage and Servicing Facility Locations, Preliminary Recommended Plan, Impact Assessment
5	August 16, 2022	Introduction, purpose of meeting, background, what has evolved since last meeting, Woodroffe new median LRT plan overview, current study scope, next steps and timelines and roundtable discussion.
6	January 24, 2023	Background, what we've heard so far, detailed description of the Recommended Plan, constructability review, impact assessment, next steps and timelines and roundtable discussion. Narration of the plan and profile of the Pinch Point.

1.4.1.2 Business Consultation Group

The BCG was formed to review work completed to-date and to provide comments on study activities, issues and concerns that reflect each group's interests and values. Throughout the study, BCG membership was revisited to capture changes to those with business interest in the Study Area. The BCG consisted of representatives from:

- Aera Investments Ltd.
- Algonquin College
- Barrhaven Business Improvement Association
- Barrhaven Town Centre

- Campanale Homes
- Caivan Communities
- Chapman Mills Marketplace
- College Square
- Conseil des écoles publiques de l'Est de l'Ontario
- Community, Recreation, Cultural Programs Service
- Minto Properties Inc.
- Minto Communities - Canada
- N.A. Development Group (Barrhaven Town Centre)
- Novatech (representing an undisclosed property north of West Hunt Club)
- Ottawa Catholic School Board
- Ottawa-Carleton District School Board
- Ottawa Catholic School Board
- Ottawa Transportation Student Authority
- Richcraft
- Royale Equestrian Centre
- Smart Living Properties, (Forum SLP)

Meeting agendas and notes are contained in **Appendix A**. **Table 1-2** outlines the meeting dates and main agenda topics.

Table 1-2 Business Consultation Group Meetings

Meeting #	Date	Main Agenda Topics
1	November 28, 2018	Study Overview, Study Background, Needs and Opportunities, Existing Conditions, Alternative Solutions, Alternative Design Considerations
2	October 17, 2019	Preferred Solutions, Evaluation of Alternative Designs Methodology and Criteria, Results of Technical Studies, Alternative Alignments and Designs (Baseline-West Hunt Club), Preliminary Plan to Convert Southwest Transitway to LRT, Preliminary Plan for Rail Grade-Separations, Alternative Train Storage Facility Locations
3	September 3, 2020	Evaluation and Confirmation of Alternative Alignments and Designs (Baseline-West Hunt Club), Evaluation and Confirmation of Alternative Train Storage and Servicing Facility Locations, Preliminary Recommended Plan and Impact Assessment
4	August 18, 2022	Introduction, purpose of meeting, background, what has evolved since last meeting, Woodroffe new median LRT plan overview, current study scope, next steps and timelines and roundtable discussion.
5	January 26, 2023	Background, what we've heard so far, detailed description of the Recommended Plan, constructability review, impact assessment, next steps and timelines and roundtable discussion. Narration of the plan and profile of the Pinch Point.

1.4.1.3 Public Consultation Group

The PCG was formed to enable community and interest groups to provide direct input to the study and to comment on technical and local issues and concerns. PCG members included representatives from City wards adjacent to the corridor, interest groups and City of Ottawa advisory committees. Representation included, but was not limited to:

- Ward 8 – College
- Ward 9 – Knoxdale-Merivale
- Ward 3 – Barrhaven
- Ward 22 – Gloucester-South Nepean
- City of Ottawa Accessibility Advisory Committee (AAC)
- Arts, Culture, Heritage and Recreation Advisory Committee
- Barrhaven Seniors' Council
- East Barrhaven Community Association
- West Barrhaven Community Association
- Bel-Air Community Association
- Bike Ottawa
- Big Brothers Big Sisters Ottawa
- Centrepointe Community Association
- Confederation Education Centre
- Country Place Community Association
- Ecology Ottawa
- Environmental Stewardship Advisory Committee
- Fisher Heights & Area Community Association
- General Burns Community Association
- Glens Community Association
- Greenspace Alliance of Canada's Capital
- Grenfell Glen Community Association
- Half Moon Bay Community Association
- Healthy Transportation Coalition
- Little Scholars Montessori Academy
- Merivale Gardens Community Association
- Manordale-Woodvale Community Association
- Peter D. Clark Long Term Care
- QTSR Community Association
- Tanglewood/Hillsdale Community Association
- Stonebridge Community Association

Meeting agendas and notes are contained in **Appendix A**. **Table 1-3** outlines the meeting dates and main agenda topics.

Table 1-3 Public Consultation Group Meetings

Meeting #	Date	Main Agenda Topics
1	November 28, 2018	Study Overview, Study Background, Needs and Opportunities, Existing Conditions, Alternative Solutions, Alternative Design Considerations
2	October 17, 2019	Preferred Solutions, Evaluation of Alternative Designs Methodology and Criteria, Results of Technical Studies, Alternative Alignments and Designs (Baseline-West Hunt Club), Preliminary Plan to Convert Southwest Transitway to LRT, Preliminary Plan for Rail Grade-Separations, Alternative Train Storage Facility Locations
3	September 8, 2020	Evaluation and Confirmation of Alternative Alignments and Designs (Baseline-West Hunt Club), Evaluation and Confirmation of Alternative Train Storage and Servicing Facility Locations, Preliminary Recommended Plan, and Impact Assessment
4	August 18, 2022	Introduction, purpose of meeting, background, what has evolved since last meeting, Woodroffe new median LRT plan overview, current study scope, next steps and timelines and roundtable discussion.
5	January 26, 2023	Background, what we've heard so far, detailed description of the Recommended Plan, constructability review, impact assessment, next steps and timelines and roundtable discussion. Narration of the plan and profile of the Pinch Point.

1.4.2 PUBLIC OPEN HOUSES

Three public open houses (POH) were held at key stages during the study to obtain feedback from the general public on the project information being provided. These events presented work on confirming the problem or opportunity (needs assessment) and evaluation of alternative solutions, evaluation of alternative designs (and alignments), and presenting the Preliminary Recommended Plan for the corridor. The first POH was organized to allow informal viewing of display panels about the project, examination of resource material related to the various stages of the EA and included a presentation and question and answer period. All presentations, displays and maps were available in both official languages. Study Team members were present to answer questions and explain various aspects of the study as well as work completed to-date. The second public consultation event was organized online for a period of two weeks due to the public health guidelines for COVID-19. Presentation boards, and three videos presented materials for the public and a comment/questionnaire was provided to obtain feedback on the City of Ottawa's study's website. The third event was also online, a live presentation followed by question and answer period was provided. A two week comment period was provided for review of materials presented and to provide feedback. POH content and summaries are contained in **Appendix A**. **Table 1-4** outlines POH dates and main presentation topics.

Table 1-4 Public Open Houses

Meeting #	Date	Main Agenda Topics
1	October 30, 2019	Study Overview, Study Background, Needs and Opportunities, Existing Conditions, Alternative Solutions, Alternative Design Considerations, Alternative Alignments and Designs (Baseline-West Hunt Club), Preliminary Plan to Convert Southwest Transitway to LRT, Preliminary Plan for Rail Grade-Separations, Alternative Train Storage Facility Locations
2	September 9-23, 2020	Study Overview, Study Background, Feedback Received to date, Evaluation and Confirmation of Alternative Alignments and Designs (Baseline-West Hunt Club), Evaluation and Confirmation of Alternative Train Storage and Servicing Facility Locations, Preliminary Recommended Plan, and Impact Assessment
3	February 8-22, 2023	Background, what we've heard so far, detailed description of the Recommended Plan, constructability review, impact assessment, next steps and timelines and roundtable discussion. Narration of the plan and profile of the Pinch Point.

1.4.3 INDIVIDUAL STAKEHOLDER MEETINGS

During the study, the Study Team met with individual stakeholders and landowners to discuss specific elements of the study and proposed design. Comments provided are included in Consultation Summary Reports provided in **Appendix A**.

These individual stakeholder meetings focused on topics such as the impact on adjacent properties, how the project relates to specific policies or mandates of agencies, connections to employment and residential land uses and future development

opportunities. To obtain direction and feedback regarding LRT and Transit service, the Study Team also met with the City's Rail Office and OC Transpo.

Table 1-5 outlines the individual stakeholder meeting dates and main agenda topics. More details regarding the meetings can be found in Annex 4 of Appendix A.

Table 1-5 Individual Stakeholder Meetings

Meeting #	Date	Stakeholder	Main Agenda Topics
1	June 27, 2018	VIA Rail	Study Introduction
2	September 27, 2018	NCC	Study Introduction and background
3	April 3, 2019	Hydro One	Study Introduction and background
4	August 15, 2019	Aera Investments	Study Introduction and background potential project impacts
5	August 27, 2019	Minto Investments	Study Introduction and background potential project impacts
6	November 14, 2019	Hydro One	Study Introduction and background potential project impacts
7	March 26, 2020	Hydro Ottawa	Study Introduction and background potential project impacts
8	July 7, 2020	VIA Rail	Study Recommendations
9	July 14, 2020	NCC	Study Recommendations
10	September 2, 2020	Aera Investments	Study Recommendations
11	September 2, 2020	Smart Living Properties	Study Recommendations
12	September 23, 2020	Richcraft and Minto	Study Recommendations
13	October 7, 2020	NCC	Impacts to Greenbelt lands
14	October 13, 2020	Royale Equestrian Centre	Study Recommendations
15	October 14, 2020	NCC	Impacts to Greenbelt lands
16	October 20, 2020	Royale Equestrian Centre	Study Recommendations follow-up
17	October 26, 2020	ACORN	Study Recommendations
18	November 24, 2020	Hydro One	Study Recommendations
19	January 7, 2021	MECP	TPAP process meeting; Notice of Commencement and next steps.
20	November 30, 2021	Royale Equestrian Centre and NCC	On-site visit to discuss REC's concerns with the Recommended Plan.
21	February 8, 2022	MECP	TPAP process meeting; Notice of Issue discussions
22	August 4, 2022	C. Harder & Barrhaven BIA	Discussions on the new median LRT Functional Design
23	August 19, 2022	Accessibility Advisory Committee	Discussions on the new median LRT Functional Design
24	August 30, 2022	Hydro One	Discussions on the new median LRT Functional Design
25	October 18, 2022	Hydro Ottawa	Discussions on the new median LRT Functional Design
26	March 14, 2023	Royale Equestrian Centre	On-site visit to discuss REC's concerns with the Recommended Plan.
27	April 25, 2023	MECP	Consultation outcomes; TPAP process meeting; Notice of Commencement and next steps.
28	October 24, 2023	MECP	Consultation outcomes; TPAP process meeting; Agency Pre-Review comments received, Notice of Commencement and next steps.
29	December 12, 2023	MECP	Consultation updates; TPAP process discussion; next steps.
30	April 10, 2024	MECP	Consultation updates; Transit and Rail Project Assessment Process discussion; next steps.

1.4.4 INDIGENOUS CONSULTATION

Consultation with Indigenous Communities was undertaken as per the guidelines described in the regulation. The Communities consulted as part of the study were determined in coordination between the City of Ottawa, the Ontario Ministry of Aboriginal Affairs, Aboriginal Affairs and Northern Development Canada and the MECP. Communities consulted include:

Ottawa Region Métis Council, Algonquins of Ontario Consultation Office (AOO), Algonquins of Pikwàkanagàn, Kitigan Zibi Anishinabeg, and the Métis Nation of Ontario.

Initial contact was made to inform each group of the project and identify opportunities for involvement. Official notices were also sent throughout the study process. The EPR was made available for review by all the identified Communities. Consultation was achieved through email with representatives of the Communities identified for this study.

In January 2021, prior to issuing the Notice of Commencement, during the Agency and Indigenous Pre-Review period of the EPR, the Algonquins of Pikwàkanagàn and the AOO expressed interest in further consultation. The Algonquins of Pikwàkanagàn expressed interest in reviewing and providing comment on the EPR. In December 2022 the City entered into a Capacity Agreement to facilitate the Algonquins of Pikwàkanagàn to make formal comments on the EPR. **Table 1-6** outlines meetings held for Indigenous consultation dates and main agenda topics.

Table 1-6 Indigenous Consultation Meetings

Meeting #	Date	Community/Representatives	Main Agenda Topics
1	March 1, 2021	Don Bilodeau (on behalf of the Algonquins of Pikwàkanagàn First Nation)	Scope of the project, highlighting environmental, archaeological and cultural heritage resources within the corridor and history of outreach to Indigenous Groups for the project, and next steps.
2	April 19, 2021	Algonquins of Ontario Consultation Office (AOO) Representatives	Meeting to discuss the project scope and approach to consultation. Links to the Stage 1 Archaeological Assessment resent in advance.
3	May 10, 2021	AOO's Planning and Environment Working Group (PEWG)	Scope of the project, highlighting environmental, archaeological and cultural heritage resources within the corridor and history of outreach to Indigenous Groups for the project, and next steps.
4	May 18, 2021	Algonquins of Ontario Consultation Office (AOO) Representatives	Meeting to discuss outcome of the PEWG meeting, consultation efforts and next steps.
5	November 10, 2021	Algonquins of Pikwàkanagàn First Nation	Discussed capacity support need, critical dates, archaeological studies, an overview of environmental assessment.
6	December 13, 2021	Algonquins of Pikwàkanagàn First Nation	Reviewed Schedule B of Capacity Agreement Consultation.
7	March 24, 2022	Algonquins of Pikwàkanagàn First Nation	Discussed Capacity Agreement and invoicing.
8	October 13, 2022	Algonquins of Pikwàkanagàn First Nation	Discussed AOPFN comments on Capacity Agreement.
9	November 16, 2022	Algonquins of Pikwàkanagàn First Nation	Discussed legal comments on Capacity Agreement.
10	March 28, 2023	Algonquins of Pikwàkanagàn First Nation	Presentation of the design re-alignment through the pinch point.
11	April 20, 2023	Algonquins of Pikwàkanagàn First Nation	Provided details of the change in design to the median LRT alignment, archaeological and cultural heritage resources within the corridor, species at risk and next steps.
12	July 27. 2023	Algonquins of Pikwàkanagàn First Nation	Shared information on the discussion had with AOPFN community members.
13	September 20, 2023	Algonquins of Pikwàkanagàn First Nation	Discussed functional and detail design, detail that can be included in the draft EPR, Table 1-6 and Annex 1, site visit and next steps.
14	November 1, 2023	Algonquins of Pikwàkanagàn First Nation	Reviewed potential locations of interest for site visit based on draft EPR findings, next steps.
15	April 10, 2023	Algonquins of Pikwàkanagàn First Nation	Planning for the site visit. Confirmation receipt of preliminary comments on the draft EPR.
16	April 10, 2024	Algonquins of Pikwàkanagàn First Nation	Site visit discussion and preparations.
17	May 15, 2024	Algonquins of Pikwàkanagàn First Nation	Site visit of selected points of interest in the Study Area.

Correspondence and additional details related to Indigenous Consultation is contained in **Appendix A**.

1.4.5 CITY OF OTTAWA WEBSITE

The City of Ottawa developed and maintained a project website with consultation materials for the study, key milestones, and the overall EA process.

English: www.Ottawa.ca/BarrhavenLrt

French: www.Ottawa.ca/BarrhaventLr

The information posted on the website was also formatted in a manner compatible with the City's accessibility guidelines for on-line graphics, videos, and printed materials.

1.5 Report Organization

The purpose of this EPR is to document the study rationale, the planning, design, and consultation processes of the project, and make that documentation available for review by the public and review agencies. The report consists of the following sections:

- Executive Summary
- Introduction
- Project Need and Opportunities
- Existing Environmental Conditions
- Evaluation of Alternative Solutions
- Update to Existing Environmental Conditions
- Evaluation of Alternative Designs
- Recommended Plan and Assessment
- Recommended Plan - Functional Design Drawings
- Implementation and Approvals
- Conclusion Regarding the Project
- References

The Appendices contain the technical reports and technical documentation prepared throughout the course of the study. These reports and documentation contributed to the decision-making process and the development of recommendations that led to the selection of the preferred design (Recommended Plan).

2 Project Need and Opportunities

This section outlines the need and opportunities for the project, which is based on the City's planning policies and studies, current and future transit demand, transit network requirements and land use objectives. As the Barrhaven LRT extension is the last section of the Confederation Line without EA approval status, there is a need to complete this Study to enable decision-making on future transportation investment and choices. Further, there is also a need derived from the Transportation Safety Board of Canada (TSB) Recommendation R15-05, in its Railway Investigation Report R13T0192 on the September 2013 VIA Rail and OC Transpo crossing collision in Barrhaven. The EA requirement of the TSB recommendation that "*the City of Ottawa reconsider the need for grade separations at the Woodroffe Avenue, [Southwest] Transitway, and Fallowfield Road level crossings*" will be addressed through this study's findings.

2.1 Need for the Project

2.1.1 MEETING PLANNING POLICY

2.1.1.1 Official Plan

During the course of finalizing this study the City of Ottawa adopted a new OP which was approved by the Ministry of Municipal Affairs and Housing in 2022. The information provided in this section remains the basis for subsequent evaluation and development of the Recommended Plan therefore, it remains unchanged. Discussion of the new OP and its influence on the project or process, is documented in Section 6.8.

The City of Ottawa Official Plan, 2013 (OP) provides a vision of future growth for the City and sets the policy framework to guide its physical development over the planning horizon to the year 2031. The plan is updated every five years to meet statutory requirements, the last review having been completed in 2013. This EA study aims to address the OP's Strategic Directions, as follows:

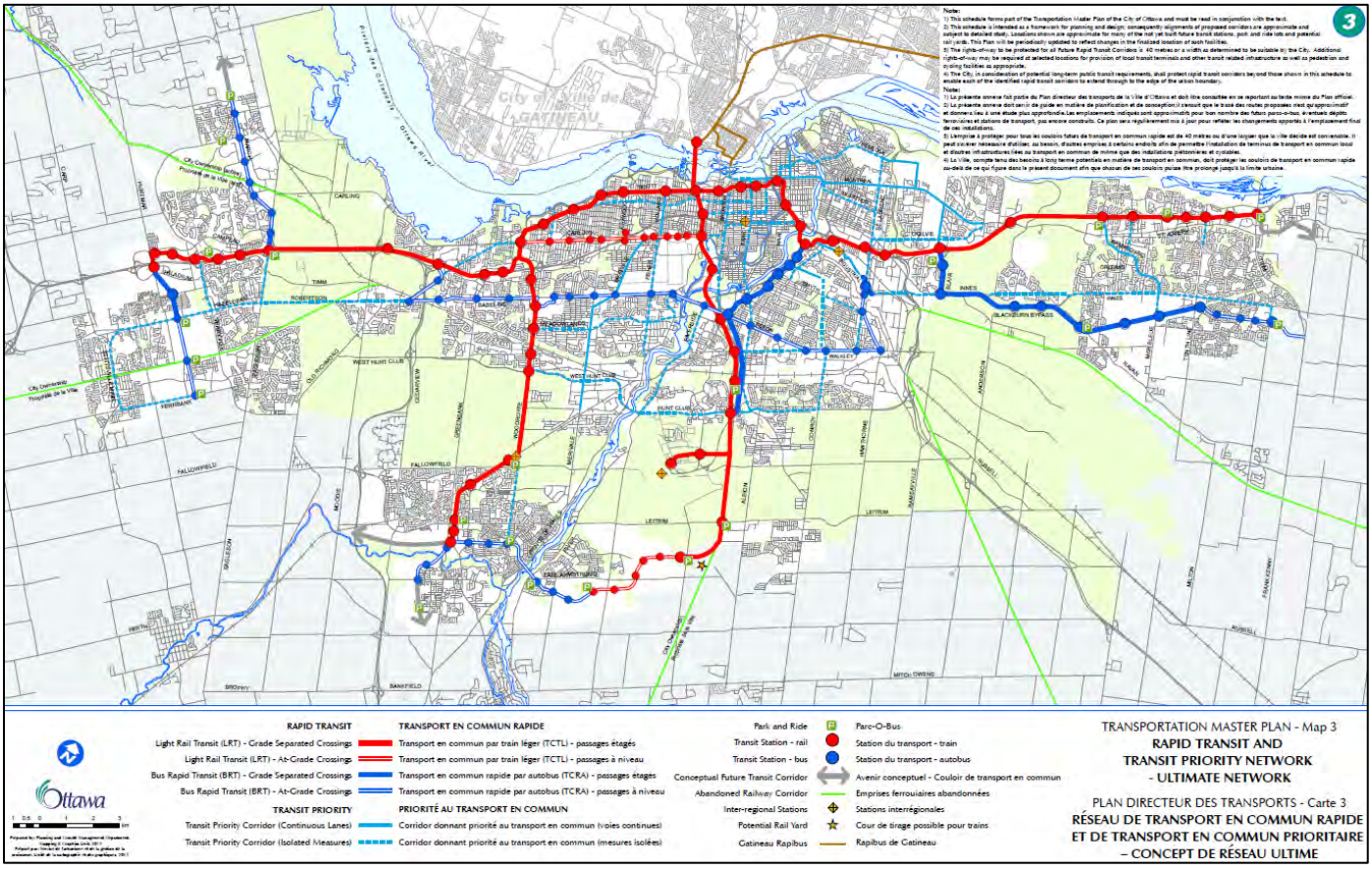
- The Barrhaven LRT and Rail Grade-Separations project will support sustainable growth in the Barrhaven community which is located within the City's urban boundary. It will foster mixed-use growth around transportation nodes, which can provide affordable housing, community services, employment and leisure opportunities to the Barrhaven community (OP Section 2 – Strategic Directions, 2.1 Patterns of Growth, Managing Growth).
- It will connect Barrhaven Town Centre with the City's LRT network and will also supply increased and safer transportation network capacity necessary to support increased development densities (OP Section 2 – Strategic Directions, 2.1 Patterns of Growth, Building Liveable Communities).
- The Barrhaven LRT will connect to the walking and cycling networks, fostering an active and multi-modal transportation network. Implementation of this and other rapid transit projects in the Barrhaven community will encourage automobile users to switch to transit, necessary to achieve the significant transit ridership increases contemplated in the OP (OP Section 2 – Strategic Directions, 2.1 Patterns of Growth, Providing Infrastructure).
- The project will contribute to improved local air quality by providing an alternative to automobile use, by removing cars idling at intersections and by replacing the diesel Bus Rapid Transit (BRT) vehicles with electric LRT. The project supports a compact urban form, which will contribute to reduced energy use, carbon and pollution emissions (OP Section 2 – Strategic Directions, 2.1 Patterns of Growth, Maintaining Environmental Integrity).
- As the project will generally follow the existing transitway corridor, it will require minimal alteration to existing green spaces and environmental areas (OP Section 2 – Strategic Directions, 2.1 Patterns of Growth, Providing Infrastructure).

2.1.1.2 Transportation Master Plan

During the course of finalizing this study the City of Ottawa has begun developing a new TMP. The information provided in this section remains the basis for subsequent evaluation and development of the Recommended Plan therefore, it remains unchanged. Discussion of the new TMP and its influence on the project or process is documented in Section 6.8.

The City's 2013 TMP identifies extension of the Confederation Line LRT to Barrhaven Town Centre as part of the Ultimate Rapid Transit and Transit Priority (RTTP) Network as shown in **Figure 2-1**, with an implementation timeline currently envisaged beyond the TMP's 2031 planning horizon. As part of the RTTP 2031 Network Concept, the TMP identifies completion of the Southwest Transitway as an exclusive Bus Rapid Transit (BRT) facility prior to extension and conversion to LRT technology south of Baseline Station. This staging will be re-evaluated as part of the evaluation of alternative solutions (**Section 4**) for this study and any updates brought forward for consideration as part of the next TMP update.

Figure 2-1 TMP Ultimate Rapid Transit Network



The Barrhaven LRT (Baseline Station to Barrhaven Town Centre) extension is the last remaining segment of the Confederation Line for which EA approval is not yet in place. Therefore, there is a need to complete this EA Study so that planning and decision-making for the City's LRT network can be advanced. This EA Study will help inform the next TMP update, which will consider future rapid transit investment priorities as part of the City's Affordable RTTP Network.

2.2 Rapid Transit Network Overview

The City's current TMP, updated in 2013, identifies the following RTTP network serving the Barrhaven LRT and Rail Grade-Separation EA Study Area:

1. A grade-separated rapid transit corridor running in the existing Southwest Transitway corridor from Baseline Station to Barrhaven Centre Station, with BRT technology implemented as part of the 2031 network concept and conversion to LRT implemented as part of the ultimate network concept.
2. An at-grade BRT corridor is identified for Chapman Mills Drive/Strandherd Drive between Greenbank Road and the future Limebank O-Train Line 2 Station. This facility currently exists between Longfields Drive and Nepean Woods Park and Ride. Future extension of the Chapman Mills BRT corridor to west of Cedarview Road is proposed (Chapman Mills Extension and Bus Rapid Transit EA Study, IBI, 2016).

3. An at-grade BRT corridor is identified (future Southwest Transitway Extension) in the re-aligned Greenbank Road corridor running from Chapman Mills Drive to Cambrian Road, with a future extension to Barnsdale Road and a Park and Ride facility in the vicinity of Kilbirnie Drive.
4. Transit priority corridors (isolated measures) are identified for:

    a. Meadowlands between the Southwest Transitway and Heron Road;
    b. West Hunt Club Road between Woodroffe Avenue and Riverside Drive; and
    c. Woodroffe Avenue between Fallowfield Station and Nepean Woods Park and Ride.

2.2.1 PREVIOUS PLANNING STUDIES

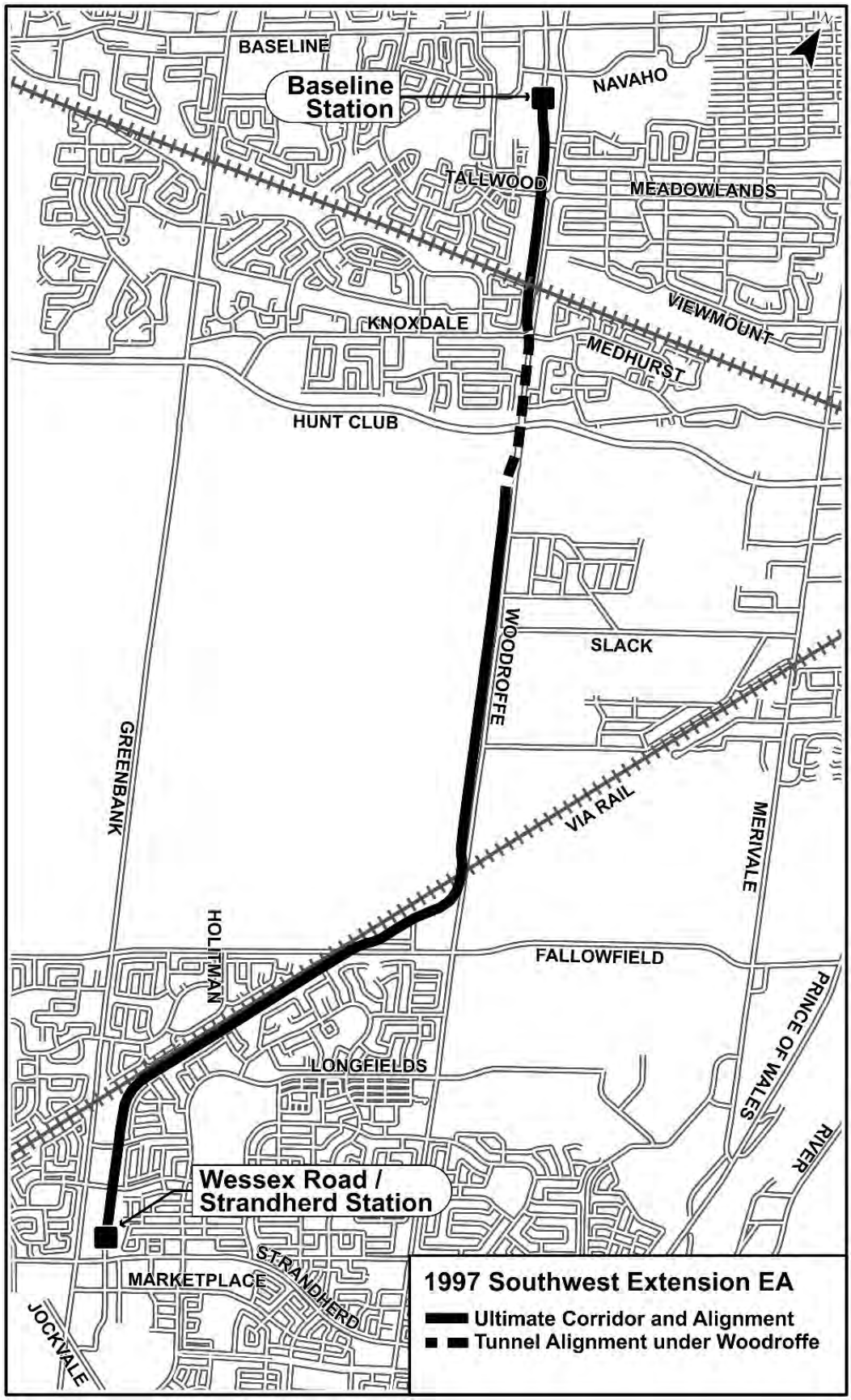
2.2.1.1 Southwest Transitway Extension Environmental Assessment (1997)

To enable construction of the existing Southwest Transitway corridor, the Southwest Transitway Extension EA was completed in 1997 by McCormick Rankin (hereafter, "the 1997 Southwest Transitway EA"). The goal of the EA was to identify a fully segregated Bus Rapid Transit (BRT) facility to extend transit service from Baseline Station to the growing southern urban community of Barrhaven.

Among the alternatives considered, the EA assessed bus versus heavy-rail technology, widened roadways featuring bus-only lanes and travel demand measures. It concluded that all non-transitway alternatives would not provide a robust solution to address future transit capacity and need for the south urban community, and that the Woodroffe Avenue corridor offered the best potential for development of a transit facility to improve transit services. A phased approach was identified, which included initial widening of Woodroffe Avenue to accommodate dedicated bus-only lanes as a first stage of project implementation.

The EA identified that the ultimate Southwest Transitway corridor would be grade-separated, in an open-cut, urban style section west of Woodroffe Avenue between Baseline Station and Knoxdale Road. It would then be tunneled under Woodroffe Avenue between Knoxdale and West Hunt Club roads. Through the Greenbelt, the transitway would be placed west of Woodroffe Avenue at-grade, crossing under the VIA Rail line (then CN Rail line) to a new Park and Ride facility and station (Fallowfield Station) located north and west of the Woodroffe/Fallowfield intersection. The transitway would then continue at-grade and parallel to the VIA Rail line to Wessex Road where it would terminate at-grade. Full grade-separation was proposed at all transitway crossings, including roads, railways, and walkways. This alignment is illustrated on Figure 2-2.

Figure 2-2 The 1997 Southwest Transitway EA alignment



The EA also noted that construction of the transitway facility could be staged over a number of years as funding demand and increased revenues permitted. The EA recommended construction of interim measures, such as bus only lanes from Norice Drive to Hunt Club along Woodroffe Avenue and widening of Woodroffe Avenue as a four-lane divided roadway through the Greenbelt. Since approval of the 1997 Southwest Transitway EA, bus only lanes have been implemented between Baseline Station and the Nepean Sportsplex and widening of Woodroffe Avenue through the Greenbelt has taken place. The new Fallowfield Station and Park and Ride have also been constructed. Widening of Fallowfield Road (west and east of Woodroffe Avenue at the Park and Ride site) and widening of Woodroffe Avenue (south of Fallowfield Road) were also completed.

Both the Southwest Transitway's ultimate alignment as well as Bus Only Lane alternatives would provide grade-separations at all rail crossings, roadways, walkways, and trails. As per **Figure 2-3**, the VIA Rail line (then CN Rail line) would be at-grade with underpasses for both Woodroffe Avenue and transitway, and as per **Figure 2-4** the transitway would run parallel to the rail, with Fallowfield Road as an underpass. Therefore, grade-separations between the transitway/Woodroffe Avenue and rail line as well as Fallowfield Road and the rail line were an intrinsic part of the 1997 Southwest Transitway EA study.

Figure 2-3 1997 Southwest Transitway EA, exhibit 6-22, grade-separations of CN Rail, Woodroffe Ave and proposed Transitway

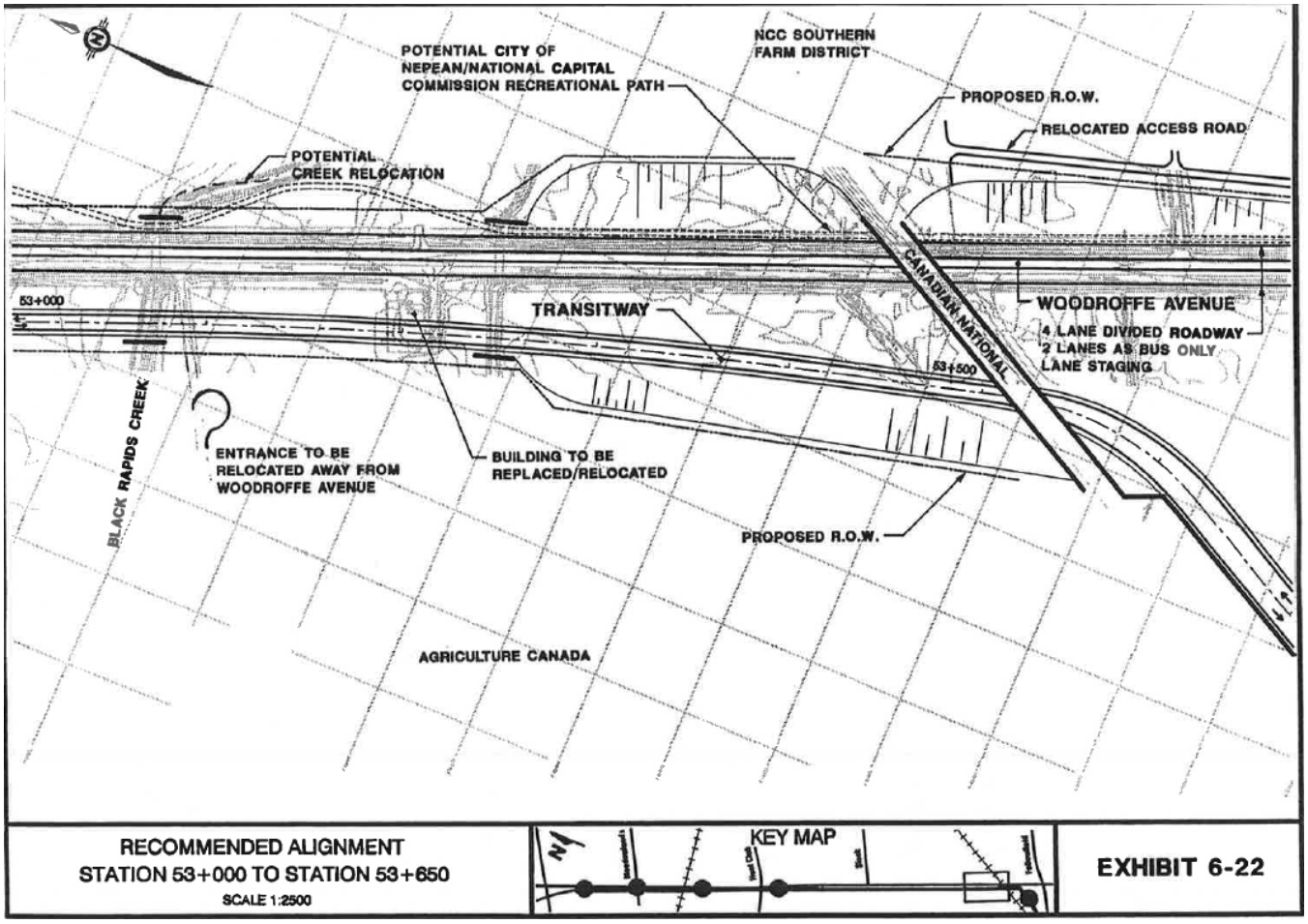
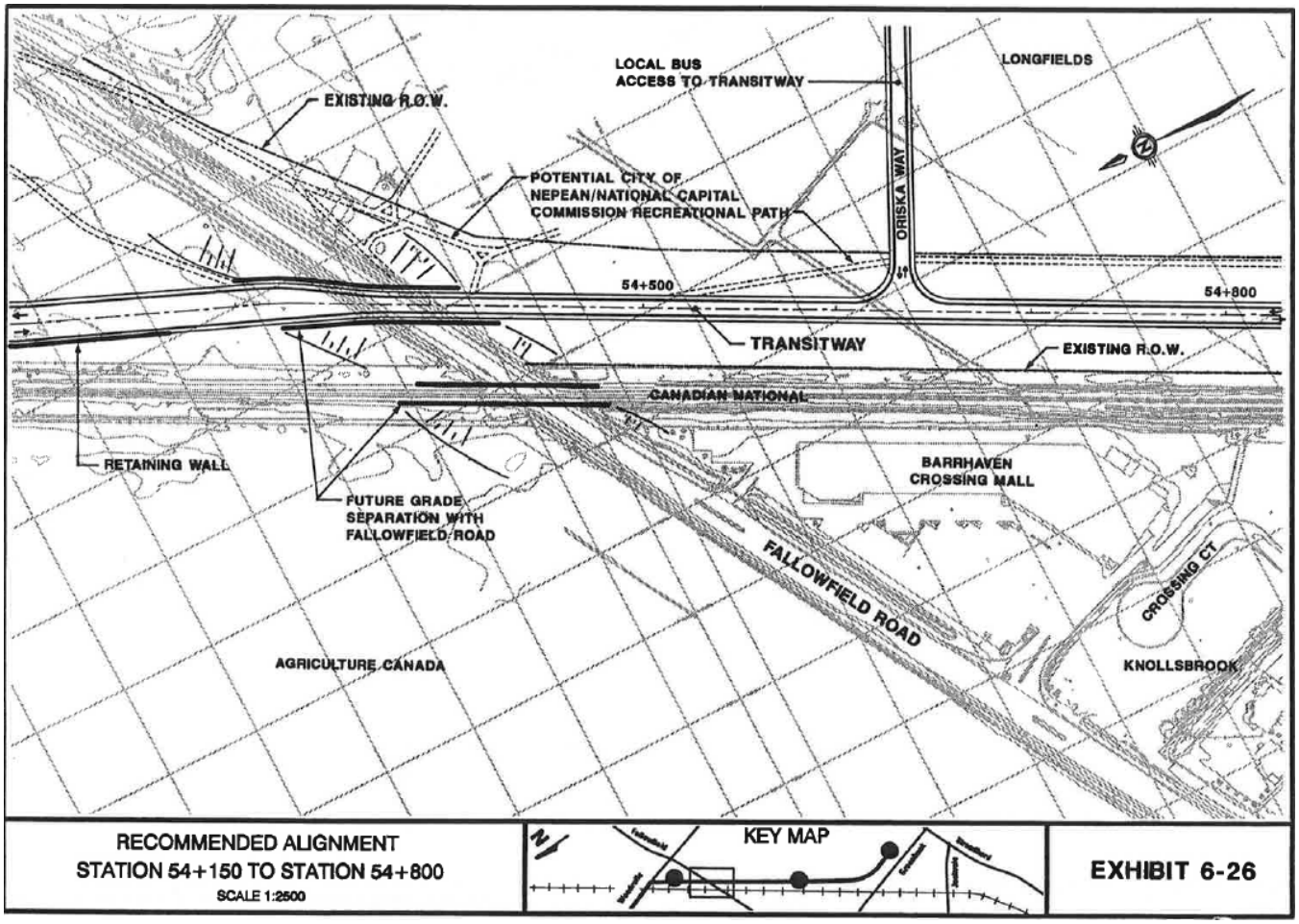


Figure 2-4 Southwest Transitway EA, exhibit 6-22, grade-separations of CN Rail, proposed Transitway and Fallowfield Road



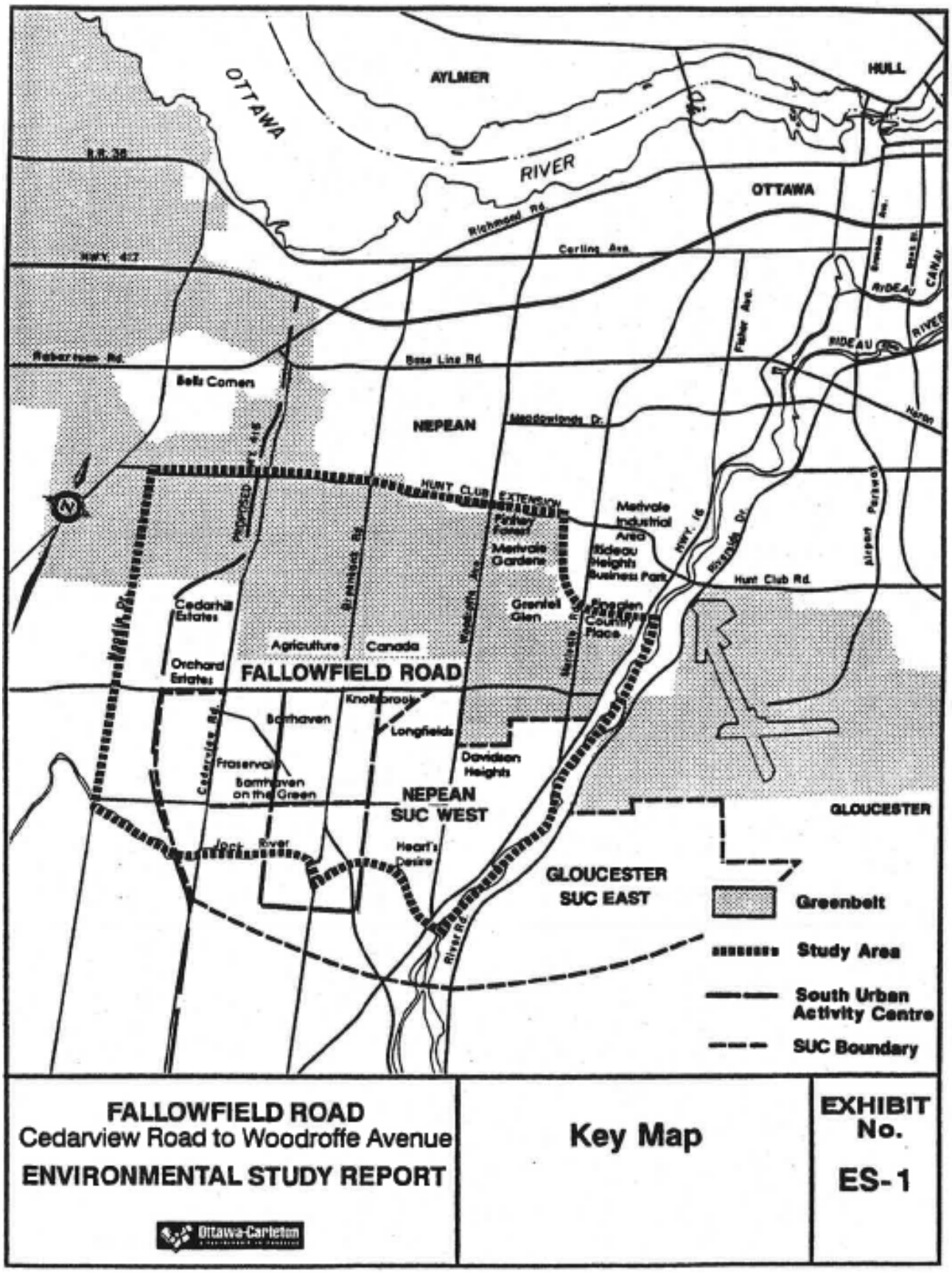
The 1997 Southwest Transitway EA study also had as a key requirement to "be a facility which can be flexible enough that a range of future demand levels and technologies can be accommodated" (**Section 2.4**). The geometric design and structural elements of the Southwest Transitway were planned so that the possibility of eventually operating a rail technology on it would not be precluded.

At the time of this study, the ultimate transitway corridor and alignment as approved via the 1997 Southwest Transitway EA has not yet been fully implemented, with the fully exclusive transitway facility existing south of West Hunt Club Road. In the segment north of West Hunt Club Road to Baseline Station, buses currently operate in dedicated curb lanes along Woodroffe Avenue.

2.2.1.2 Fallowfield Road Environmental Assessment (1997)

An EA was completed in 1997 (McCormick Rankin) for the widening of Fallowfield Road, from Cedarview Road to Woodroffe Avenue, from a two-lane rural undivided roadway to a four-lane divided urban arterial road to address future peak-hour traffic volumes. The EA's Study Area map is shown in **Figure 2-5**.

Figure 2-5 1997 Fallowfield Road (Cedarview Road to Woodroffe Avenue) EA, Study Area



As part of this EA, the proposed planning and design criteria for reconstruction of Fallowfield Road included: providing a four-lane divided roadway geometry, including commuter bicycle lanes, greening strips, and noise attenuation measures. During consultation with the Public Advisory Committee, it was agreed that an underpass solution for Fallowfield Road was preferred to grade-separate the then proposed Southwest Transitway and the then VIA Rail line (then CN Rail). An underpass was proposed primarily as it was considered that the visual impact of an overpass (Fallowfield Road over Southwest Transitway and the VIA Rail line) was deemed significantly adverse and the limited geotechnical investigations undertaken at that time considered an underpass a feasible option.

Approval for the need and construction of the rail grade-separation of Fallowfield Road, the Southwest Transitway and VIA (CN) Rail was established and granted via approval of this EA as a Schedule C project under the Ontario's Class EA for Municipal Road Projects.

Subsequent to approval of the 1997 Southwest Transitway EA and Fallowfield Road EA studies, the City undertook preliminary engineering in support of constructing rail grade-separations at the Woodroffe, Southwest Transitway and Fallowfield crossings. Additional geotechnical assessments done as part of this work identified significant cost and risk implications with the proposed underpasses, with a recommendation that the open-cut option should not be pursued, and that it was necessary to consider other alternatives.

2.2.1.3 Southwest Transitway Extension and Woodroffe Widening Federal Environmental Assessment (2004)

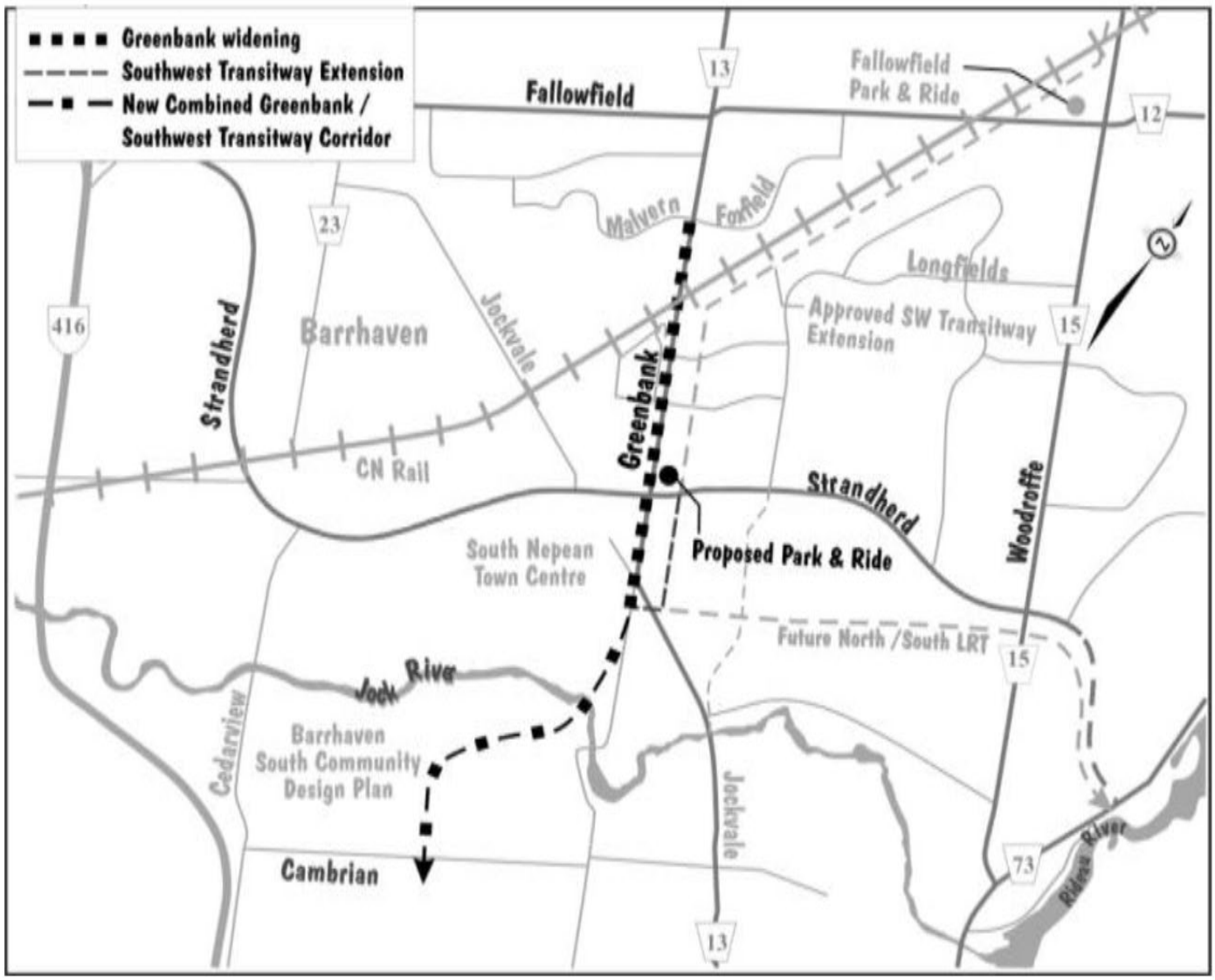
A federal EA was completed in 2004 (TSH) under the Canadian Environmental Assessment Act (CEAA). The CEAA was triggered due to funding provided by the Federal Government (under the Millennium Fund program) and due to the need for land acquisition from the NCC. The 2004 EA assessed construction of a two-lane Transitway placed adjacent and to the west of Woodroffe Avenue from the Nepean Sportsplex to Fallowfield Station and Park and Ride site, as well as reconstruction of Woodroffe Avenue as a four-lane arterial roadway from north of Slack Road to Fallowfield Road.

2.2.1.4 Southwest Transitway Extension EA Study (2006)

On 7 April 2004, the City's Transportation Committee approved the Statement of Work setting out the methodology, public consultation, and deliverables for an EA study for the Southwest Transitway Extension Project and the Greenbank Road Widening Project (Malvern to Cambrian) (TSH, 2006). Both facilities were evaluated together under one analysis but followed separate EA processes due to the physical proximity to each other and similar study areas. The Southwest Transitway Extension study was carried out as an Individual Environmental Assessment, with a separate Terms of Reference developed and approved by the Minister of the Environment. The Greenbank Road study followed the Municipal Class EA process. The recommended alignment of each new facility resulting from EA is presented on **Figure 2-6**.

The Southwest Transitway Extension EA study from Strandherd Drive to Cambrian Road was completed in 2006. It represents a continuation of the transitway established from the 1997 Southwest Transitway EA which terminated at Strandherd Drive. It includes 3.2 km of exclusive and shared Right-of-Way, extending from Strandherd Drive southerly, through the South Nepean Town Centre, across the Jock River to Cambrian Road reaching the planned Barrhaven South community. It consists of exclusive transit lanes throughout its length, five stations (including provision for an integrated BRT/LRT station in the heart of the South Nepean Town Centre). Trip projections (2021) estimated that up to 4,075 riders per hour could be served by the project (representing a 25% modal split as proposed by the Barrhaven South Community Design Plan).

Figure 2-6 Recommended Alignments for the Southwest Transitway Extension and the Greenbank Road Widening Studies

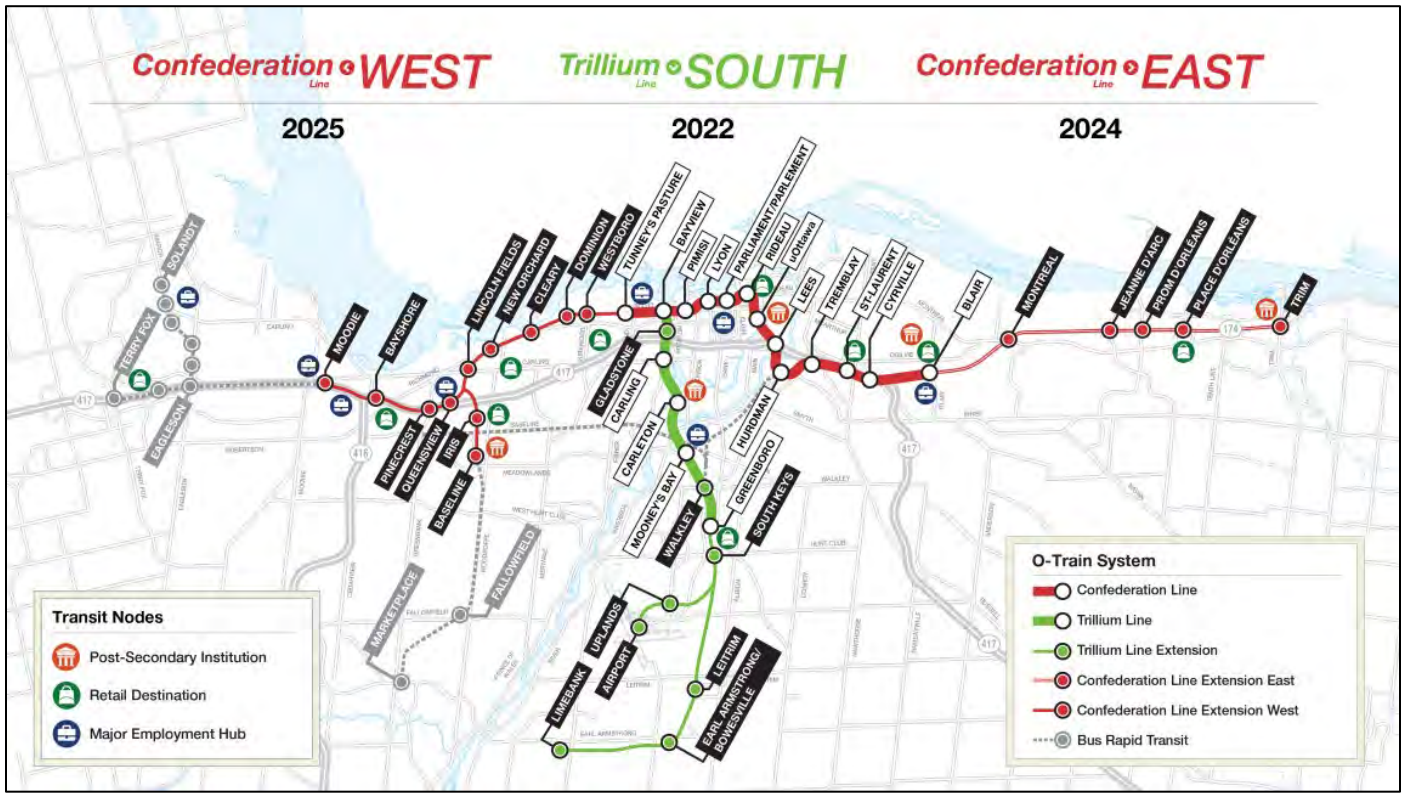


2.2.1.5 Confederation Line West LRT Extension (2016)

A planning and EA study was completed in June 2016 (Parsons Inc.) for the Confederation Line West LRT Extension to extend light rail service further west from Tunney's Pasture Station to Baseline and Bayshore stations as part of the City's proposed Stage 2 LRT network.

The study also gained approval for a new Light Maintenance and Storage Facility, to be located at the western portion of the vacant lands immediately north of the CN Rail line running north of Knoxdale Road (CN Beachburg Subdivision) between Woodroffe Avenue and Merivale Road. Subsequent to completion of the study, this Light Maintenance and Storage Facility was superseded by a facility proposed to the west of Moodie Drive, which was identified as part of the Stage 2 LRT project, and which also includes a further extension of the West LRT from Bayshore Station to Moodie Station (**Figure 2-7**). The anticipated opening of the Confederation Line West LRT extension is 2025.

Figure 2-7 Confederation Line West LRT Extension Alignment



2.2.1.6 Barrhaven and Merivale Road Rail-Grade Separation Study (2017)

The Barrhaven and Merivale Road Rail-Grade Separation Study (BMRRGSS), completed in June 2017 (Parsons Inc.), addressed five potential rail-grade separations along the VIA Rail line (Smiths Falls Subdivision) between Merivale Road in the east and Jockvale Road in the west. The study was undertaken in response to TSB Recommendation R15-05 from the Transportation Safety Board of Canada in its Railway Investigation Report R13T0192 on the VIA Rail/OC Transpo train and bus collision that occurred on 18 September 2013 at the VIA Rail line/Southwest Transitway level crossing. The TSB Recommendation R15-05 states: "*The City of Ottawa reconsider the need for grade separations at the Woodroffe Avenue, [Southwest] Transitway, and Fallowfield Road level crossings*".

As per the Railway Investigation Report, "*the safety of a crossing is dependent on a roadway vehicle driver making appropriate decisions based on the information displayed and responding appropriately to any additional warnings. Consequently, the only way to ensure that similar accidents do not occur at such high-traffic locations is to physically separate the roadway from the railway though grade separation* (Section 4.2.4)."

The BMRRGSS assessed opportunities for rail grade-separation and made recommendations based on an assessment of the "Grade Crossing Regulations" prepared by Transport Canada which provide guidance as to when grade-separation should be considered. Common practice for determining grade-separation requirements in Canada is to use a Crossing Exposure Index (CEI) calculation, also known as cross-product value, and a review of risks at the crossing. Historically a cross-product value of 200,000 has been accepted as the benchmark used by Transport Canada in determining when grade-separation should be considered. The cross-product is determined by multiplying the Average Annual Daily Traffic (AADT) by the average daily number of trains at the at-grade crossing.

Table 2-1 provides a summary of the cross-product values for Woodroffe Avenue, Southwest Transitway and Fallowfield Road with the preferred grade-separation solution.

Table 2-1 Crossing Exposure Index analysis and recommended solution

VIA Rail (Smiths Falls Subdivision line) crossing	Mile	Traffic Volume *AADT 2016 2021 2031	Train Volume HFR 2016 2021 2031	Crossing Exposure Index / Cross-Product Value 2016 2021 2031	Preferred Grade-Separation Solution
Woodroffe Ave	3.28	30,619 33,806 41,209	26 33 49	796,094 1,115,598 2,019,241	Overpass Road over rail
Southwest Transitway	3.30	1,136 x 32 1,389 x 32 2,076 x 32	26 33 49	945,152 1,466,784 3,255,168	Overpass Road over rail
Fallowfield Road	3.88	29,468 32,535 39,660	19 21 37	559,892 683,235 1,467,420	Overpass Road over rail

The BMRRGSS recommended that the grade-separations be phased over time. Prioritization could be based on the greatest exposure of vehicle/train conflict which would result in an implementation order, from first to last, of: Woodroffe Avenue and the Southwest Transitway, Fallowfield Road, Merivale Road and Jockvale Road.

As the alignment identified for the Barrhaven LRT project will follow the existing Southwest Transitway corridor, which crosses the VIA Rail line at-grade immediately adjacent to the existing Woodroffe Avenue crossing of the VIA Rail line, and also will need to be grade-separated at Fallowfield Road, it is prudent to consider an integrated planning and EA approach to both LRT extension and rail grade-separation facilities.

2.2.2 ADDRESSING TRANSPORTATION ISSUES

Currently, transit service within the Study Area consists of a mixture of local, express and transitway services. Local routes generally circulate within the community and connect with transitway Stations. “Connexion” (express) routes are peak only direct services provided by OC Transpo between various neighborhoods and downtown Ottawa. Transitway routes serve as the backbone of the rapid transit network, connecting Barrhaven with downtown Ottawa and other important destinations across the City.

With implementation of the Stage 1 and Stage 2 LRT projects, the existing BRT corridor will be converted to LRT technology as far as Tunney’s Pasture (2019) and Baseline Station (2025). While implementation of LRT should address some of the existing short-term capacity and reliability issues currently affecting transit service to the Barrhaven community (by eliminating reliability issues due to on-street operation through the downtown core and permitting reallocation of existing resources to provide capacity improvements), conversion of the existing BRT corridor north/east of Baseline Station will introduce a transfer requirement for trips originating in Barrhaven and travelling beyond the LRT terminus point. While transfers are a component of many transit trips, particularly those not beginning and ending along a rapid transit line, the introduction of a transfer and resulting increase in travel time can impact ridership, particularly where the transfer represents a break in a journey to continue in the same direction and at the same or similar level of service quality (i.e., BRT to LRT). However, in the long-term, conversion of existing BRT corridors to LRT technology will improve the overall customer experience, particularly as Ottawa’s LRT network is extended to serve more destinations.

With respect to the Woodroffe Avenue, Southwest Transitway and Fallowfield Road/rail level crossings, existing issues revolve around the safety and traffic operations impacts associated with conflicts between trains, transit, and vehicular traffic. Given the limited road network serving north-south travel into and out of Barrhaven, disruptions at these crossings can result in significant congestion and delay to both the road and transit networks and represent a potential public safety issue.

2.3 LRT Maintenance and Storage Facility

Expansion of the City's LRT network will require additional Light Rail Vehicles (LRVs) to operate services and support ridership growth. As part of the Stage 1 (Tunney's Pasture – Blair) Confederation Line LRT project, the City has constructed a Maintenance and Storage Facility (MSF) at Belfast Road, with an additional Light Maintenance and Storage Facility (LMSF) identified and under construction as part of the Stage 2 Confederation Line East and West LRT Extensions project, located west of Moodie Drive.

As part of this study a review of future fleet requirements was undertaken to confirm the number of additional LRVs needed to operate the Barrhaven LRT extension as well as to reflect overall fleet growth to the year 2048, based on current planned LRT projects and anticipated ridership growth. The conclusion of this review was that the Belfast and Moodie sites will have sufficient capacity to accommodate heavy maintenance and storage of the LRV fleet in the long-term. However, given the distance from either the Moodie or Belfast facility to Barrhaven Town Centre and the need for trains travelling to/from the Moodie facility to make a reverse move at Lincoln Fields Station, it was determined that a storage and servicing facility capable of accommodating 16 LRVs (8 trains) be provided as part of the Barrhaven LRT extension. This will permit off-peak and overnight storage as well as servicing of trains (e.g., cleaning, inspection and minor "running repairs"), improving the efficiency of LRT operations by reducing non-revenue train movements and increasing the overnight time window available to undertake inspection and maintenance of LRT infrastructure.

Alternative locations for the Train Storage and Servicing Facility (TSSF) and their evaluation are discussed in the evaluation of alternative designs section of this report (**Section 6.2.4**).

2.4 Opportunities

2.4.1 MEETING FUTURE RIDERSHIP TARGETS

The City's OP encourages areas around major transit stations to develop as compact, walkable, mixed-use developments with densities that support transit use. The areas to be served by the Barrhaven LRT are anticipated to grow substantially over the planning horizon. The City's population is forecasted to grow 23% from 2011 to 2031 with 79% of that growth predicted to occur in urban areas outside the Greenbelt. The number of jobs is projected to grow about 24% from 2011 to 2031, with 72% occurring in the inner area and suburbs. This points to a need to move an increased number of people efficiently, reliably, and safely from outer areas into the central area, and vice-versa. As such, the number of transit trips taken into the inner area and suburbs is expected to rise substantially. The areas targeted for Transit Oriented Development (TOD) and intensification at mixed-use centres located at Centrepointe and Barrhaven Town Centre within the Study Area will see an increased demand for people wanting to live, play and work both in their neighborhood and downtown. Higher rapid transit technology such as LRT supports these forecasted trends by fueling growth and redevelopment.

Coinciding with this growth are the aggressive modal splits the City aims to achieve by 2031. By 2031, the City of Ottawa aims to have nearly 26% of all morning-peak period travel occur via public transit. This is an aggressive target considering that over the same period, the total number of trips taken is projected to grow by 32%. To support achievement of these splits, the Barrhaven LRT will provide a more efficient and reliable level of transit service, as well as an improved user experience than the current BRT service. With substantial planned improvements to transit service downtown and limited planned increases to road capacity, the modal share of transit within the travel market will increase. High rates of transit ridership to, from and within the inner area and suburbs are expected to continue.

Future transportation demand for both road and transit networks is modelled using the City's Regional Transportation (TRANS) model, which uses future population/employment projections, broken down by traffic zone, and assigns trips to various modes and on to the future transportation network. The model is calibrated based on existing travel data (origin-destination, traffic volumes) and provides a good approximation of likely future travel demand at both the screenline and corridor level.

As part of the 2013 TMP, future (2031) transit ridership projections were developed based on the proposed affordable rapid transit network. This model was further refined as part of the Stage 2 LRT project. The model indicates an existing (2011) transit demand of 5,900 two-way trips along the Southwest Transitway crossing the Greenbelt screenline during the weekday

morning peak period. This demand is estimated to increase to 9,750 by 2031. Extension of LRT to Barrhaven would generate approximately 1,400 additional trips during the same period.

The Barrhaven LRT corridor will connect two major areas of the planned growth – the Barrhaven Town Centre and Centrepointe Town Centre. Both are designated for future intensification and development as mixed-use centres. It will also connect Barrhaven directly with downtown and allow connections to many other destinations and transit corridors across the City.

The Barrhaven LRT will provide for a connection with the existing VIA Rail Fallowfield Station. The LRT project and potential VIA Rail High Frequency Rail project offer increased access for intercity rail travel to/from the south and west areas of the City of Ottawa as well as the potential opportunity for an integrated multi-modal station at Fallowfield.

Construction of the LRT project will also offer opportunities to advance additional transit priority measures along the corridor to increase local transit integration with rapid transit services, improving transit rider experience and encouraging additional transit ridership by prioritizing transit services.

2.4.2 ENVIRONMENTAL GAINS

Electric LRT can have net positive environmental impacts when compared against comparable levels of diesel BRT service required to move a similar number of people. In addition to electric propulsion, which reduces greenhouse gases, particularly sulphur and nitrogen oxides and other contaminants, LRT also reduces the number of vehicles required to carry the large volumes of passengers predicted. Modern LRT vehicles are also typically quieter than the buses they replace and provide a high-quality service for riders while reducing impacts on the areas around BRT facilities. The rail grade-separations will also provide an opportunity to eliminate vehicle idling and congestion while waiting for trains to pass, thus contributing to a cleaner local environment.

Replacement of existing BRT services in the Southwest Transitway corridor will remove approximately 200,000 annual revenue bus trips, resulting in lower diesel fuel consumption and greenhouse gas emissions. Conversion of the existing bus-only roadway between Nepean Sportsplex and Barrhaven Centre will reduce the amount of road salt needed during winter operations, resulting in improved water run-off quality from transit infrastructure in the corridor.

As part of the LRT project, additional pedestrian and cycling connectivity elements will be identified and constructed to encourage station access by those modes. These facilities will also add to the overall pedestrian and cycling network in the City, providing greater opportunities for residents to use walking or cycling modes for local trips, reducing automobile dependence and associated environmental impacts.

2.4.3 SAFETY

Implementation of the rail grade-separations at the Woodroffe, Southwest Transitway and Fallowfield crossings of the VIA Rail line represent a significant opportunity to improve safety, accessibility and connectivity in this area of the City. As per the 1997 Southwest Transitway EA as well as 1997 Fallowfield Road EA, rail grade-separation has been one of the fundamental design criteria for construction of the transitway as well as major roads. Extension of LRT to Barrhaven will require grade-separation at the existing Southwest Transitway and Fallowfield Road crossings of the VIA Rail line based on operating requirements for LRT. These grade-separations will eliminate risk of collision between trains and roadway users at the Woodroffe and Fallowfield crossings and between trains and transit at the Southwest Transitway crossing. As mentioned in Section 2.2.1.6, Woodroffe, Fallowfield and the Southwest Transitway crossings with the railway are all currently above the 200,000 cross-product value thresholds and by 2031 will be well beyond the threshold.

2.4.4 ENHANCED TRANSIT EXPERIENCE

The current BRT system within the Study Area includes a mixture of exclusive roadway (transitway) and dedicated (curb) bus lanes between Baseline Station and Barrhaven Town Centre. A completely segregated LRT system extending into Barrhaven Town Centre will enhance the experience for all transit passengers by increasing accessibility to LRT, reducing bus-rail transfers for many users, and providing high quality connecting facilities that promote walking and cycling access to stations along the LRT corridor.

Modern LRVs provide a higher quality trip through increased rider comfort, frequent and predictable travel times and efficient connections with bus feeder routes at stations. New stations provide the opportunity for enhanced amenities and services to passengers including information about next train arrival and journey times as well as increased capacity and weather protection for passenger transfers. Station facilities will be sized to meet expected need, preventing over-crowding and improving the customer experience.

A new Park and Ride facility at Barrhaven Centre Station will provide Improved transit access for residents beyond the LRT terminus. This Park and Ride facility is envisaged as a temporary facility to accommodate existing demand and support transit ridership, with ultimate co-location of parking facilities within a proposed "Civic Complex" to be located adjacent to Barrhaven Centre station.

Stations along the line, particularly within the Barrhaven Town Centre provide significant opportunities for economic uplift through new transit-oriented development which will enable residents to access housing, retail, institutional and employment opportunities by transit.

The insertion of the LRT infrastructure within the Woodroffe Avenue corridor, including the alignment shift and reconstruction of a portion of that roadway between Knoxdale Road and the Nepean Sportsplex, and conversion of the existing Southwest Transitway offer opportunities to refresh existing landscape/streetscaping and provide for new amenities including public art, pathways and benches, parks and public gathering spaces.

2.4.5 HEALTH BENEFITS

The OP lays out strategic directions to meet the challenge of growth in ways that support healthy and liveable communities and healthy environments. This includes a focus on making services accessible by transit, encouraging walking and cycling, and will contribute to the needs of an aging population by increasing accessibility to health services and community facilities.

Healthy, liveable communities are at the core of the OP and are addressed in part through the strategic direction of providing infrastructure (OP Section 2.3), with a focus on complete streets, active transportation, and transit (City of Ottawa 2013, as amended). Healthy communities are further defined by Ottawa Public Health (OPH) as being: Compact, Complete, Connected, Cool, and Convivial (Ottawa Public Health, 2019). The project supports a compact, complete, and connected built environment through public transit which improves access for a variety of ages and incomes to shops and services, schools, and employment, as well as improved access to green spaces throughout the city including the NCC Greenbelt and Capital Pathways network. This complements the goal of creating complete streets, which support public health through the integration of transit with active modes of transportation such as walking and cycling, which are often included in the trip chain for transit users. OPH identifies active modes of transportation as contributing to overall healthy living including mental health and disease prevention (Ottawa Public Health, 2020).

Additionally, benefits of the project include a reduction in greenhouse gas (GHG) emissions and associated improvements to air quality, supporting cooler air temperatures through the increased capacity and service of the public transit network and the associated reduction of vehicle kilometres travelled through private and corporate fleet automobiles. GHG emissions are identified in the Climate Change Master Plan (2020) as a major contributing factor to climate change and have related implications to human health. The City of Ottawa tracks GHG emissions annually, with transportation accounting for 44% of community GHG emissions by sector and fleet accounting for 68% of corporate GHG emissions in the 2017-2018 inventory results (City of Ottawa 2019). The project has the potential to significantly reduce emissions, particularly those associated with commuters travelling from the rapidly growing suburbs of Barrhaven, Riverside South, and the surrounding rural area.

2.5 Conclusion

The justification for extending LRT to Barrhaven Town Centre and implementing the associated rail grade-separations is well established in the City's OP and TMP, as well as within previous EA studies dating back to 1997. Extending LRT to Barrhaven Town Centre will support increased transit ridership as well as TOD-growth and development of compact and sustainable communities, while reducing overall greenhouse gases and other contaminant emissions through the shift to electrically powered transit. Additional pedestrian and cycling infrastructure constructed as part of the project will encourage use of

active transportation modes for transit access as well as supporting local trips within the corridor, allowing residents to reduce dependence on private vehicles and access housing, employment and services by sustainable travel modes.

The proposed rail grade-separations will address TSB Recommendation R15-05 in its Railway Investigation Report R13T0192 on the September 2013 VIA Rail/OC Transpo train and bus collision at the VIA Rail line/Southwest Transitway level crossing. This need is further established and confirmed by the recently completed study (BMRRGSS, 2017).

An expanded LRT network, supported by rail grade-separations to create a safer environment, will increase the attractiveness of transit thereby helping the City achieve many of its key strategic directions and objectives. Combining the planning of LRT extension and rail grade-separations within this EA study enables the City to investigate integrated design solutions for both the rapid transit and roadway crossings, which are within the same Study Area.

3 Existing Environmental Conditions

3.1 Study Area

This section of the EPR presents the studies and investigations undertaken to document the existing conditions within the Study Area. Overall, baseline data was collected and analyzed for key environmental parameters to:

- Provide an understanding of existing conditions;
- Allow for future predictions of how the proposed project may cause these environmental conditions to change;
- Allow for future predictions of how adverse effects can be mitigated and beneficial effects enhanced; and,
- Provide a basis for designing monitoring programs.

3.1.1 PHYSICAL AND TEMPORAL BOUNDARIES

The Study Area is shown in **Figure 1-1.** However, the Study Area limits may change depending on the element of the environment being assessed as some potential environmental effects (e.g., noise) may be much more localized, whereas others may have broader extents.

The information in this section is intended to represent a 'snapshot' in time and was documented primarily during 2018-2019. Information will continue to be updated during the study period as it becomes available. Results of subsequent detailed and seasonal field surveys are provided in **Section 5** of the EPR, and additional analysis of existing conditions as they pertain to the modification to the Preferred Design is described in **Section 6.7** and **Annex 18 of Appendix B**.

3.2 Methods of Investigation

The information presented in this section was prepared by a multidisciplinary team of land use planners, biologists, geologists, archaeologists, landscape architects, municipal engineers, transportation planners, and experts in rail safety, agriculture, air quality, noise, and vibration. This team of specialists collected, consolidated, reviewed and screened the available information with a view towards establishing the basis for development, analysis and evaluation of alternatives.

The existing conditions reporting considered all available background material. The inventory is of sufficient detail to enable the analysis and evaluation of alternative transportation solutions, designs, mitigating measures and monitoring programs. As noted, this information will be supplemented by on-site surveys and/or detailed studies where warranted.

The general methodology involved the following elements:

- The submission of requests for data, drawings and reports to relevant agencies;
- Contacting and meeting with affected parties as required;
- Consolidating, reviewing and analyzing relevant material for each element;
- Conducting air photo interpretation and field verification as required; and,
- Identifying elements or criteria that could be considered potential evaluation criteria.

Specific methods of investigation may be discussed in further detail in respective sections below as warranted. Transportation conditions and planning policies related to transportation were summarized in the Needs and Opportunities section of the report and form part of the existing conditions for the Study Area.

3.3 Social Environment

The social environment for the Study Area is documented through a review of relevant policy and summary of existing conditions throughout the following sections.

3.3.1 REGULATORY PLANNING POLICIES

3.3.1.1 Federal Policy

The federal policy and development context affecting the study corridor consists of National Capital Commission (NCC) policy documents as described below and includes the Plan for Canada's Capital and more specifically, the Greenbelt Master Plan.

3.3.1.1.1 The Plan for Canada's Capital, 2017 - 2067

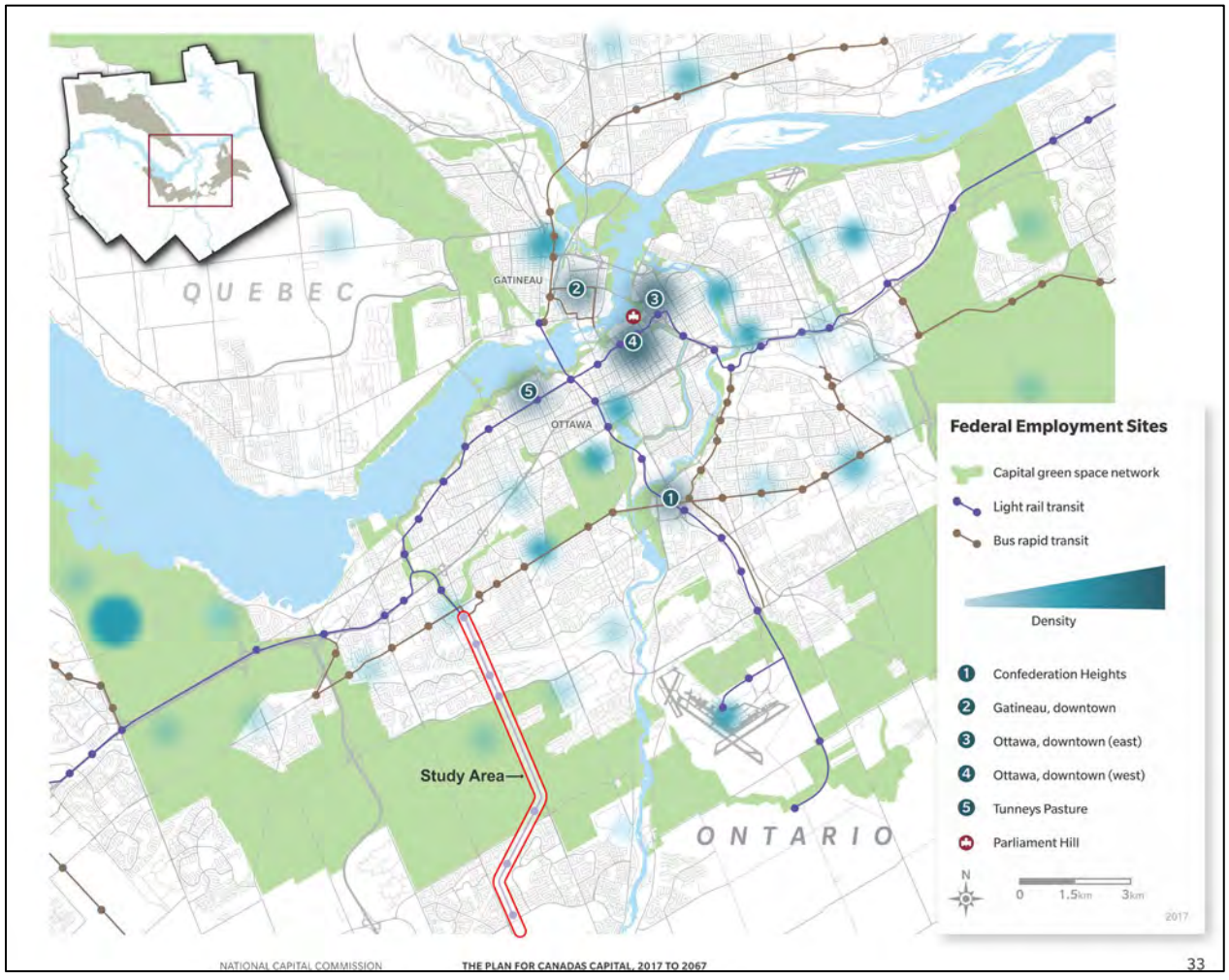
The Plan for Canada's Capital, 2017-2067 (the Plan) is a long-range planning document that acts as a blueprint for the planning and use of federal lands within the National Capital Region. It guides the federal management of lands to ensure that the capital reflects its national importance. The Plan acknowledges a shared and collective responsibility with municipal and provincial planning authorities to achieve the objectives of the plan.

The Plan has three strategic pillars that guide it, including:

- An Inclusive and Meaningful Capital;
- A Picturesque and Natural Capital; and,
- A Thriving and Connected Capital.

The Plan aims to protect the legacy from the past while building on and strengthening the unique character of Canada's Capital Region looking towards Canada's bicentennial in 2067. The Plan acknowledges investments in LRT and BRT networks (including the extension to Barrhaven) to connect residents across the large geography of the City (**Figure 3-1**).

Figure 3-1 Plan for Canada's Capital Transit Context



3.3.1.1.2 NCC Greenbelt Master Plan (2013)

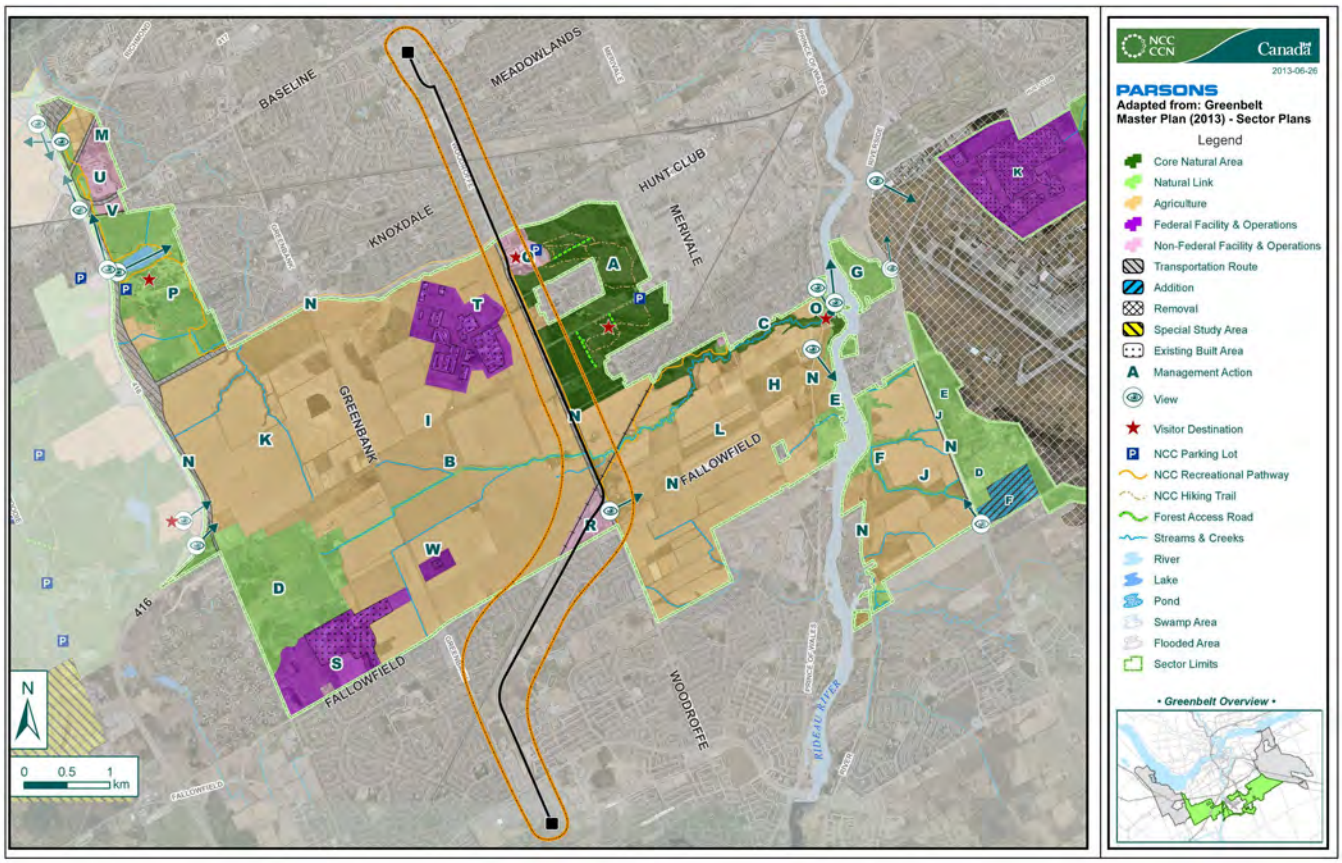
The Greenbelt Master Plan (GMP) directs and guides the preservation and evolution of the National Capital Greenbelt out to 2067. One of the goals outlined in the GMP with respect to sustainable transportation and infrastructure involves ensuring that *"environmental best management practices are applied in the design, operation and maintenance of existing infrastructure."* Furthermore, the GMP highlights that new infrastructure within the Greenbelt should not be permitted "*unless there is demonstration that there are no alternatives outside of the Greenbelt and no net loss will result to ecological or overall Greenbelt integrity.*" The GMP is updated approximately every 10 years.

The portion of the Study Area within the Greenbelt is within or adjacent to four land use designations: 1) Agriculture, 2) Core Natural Areas, 3) Natural Link and 4) Non-Federal Facility. The primary objectives of these land use designations are outlined in **Table 3-1** and shown in **Figure 3-2**.

Table 3-1 Greenbelt Master Plan Land Use Designations

Land Use Designation	Primary Objectives
Agriculture	• Practice sustainable agriculture • Support productive Greenbelt farms that contribute to local and regional food supply • Diversify Greenbelt farming and provide opportunities for agri-tourism • Reduce the area covered by large mono-culture farming operations and promote diverse agriculture lands • Enhance Canada's Capital through conservation of natural visual landscapes
Core Natural Area	• Protect biodiversity and ecosystem health for the long term • Restore and enhance terrestrial and aquatic biodiversity • Enhance Canada's Capital through the conservation of natural visual landscapes
Natural Link	• Protect natural linkages between Core Natural Areas • Establish or restore terrestrial and aquatic linkages in fragmented landscapes with the Greenbelt • Provide public activities and interpretation away from sensitive features • Facilitate adaption to environmental change (resiliency) • Enhance Canada's Capital through conservation of natural visual landscapes
Non-Federal Facility	• Complement the Natural Environment, Agriculture, and Capital Experiences & Recreation • Ensure Agriculture Canada Research Facility located within the Study Area contributes to the Greenbelt's visual landscape

Figure 3-2 Greenbelt Sector Plan applicable within the Study Area



Greenbelt Implementation: Sector Plans

The GMP includes Sector Plans which provides more detailed information on the land use designations, Capital experiences, and the recreation networks in specific parts of the Greenbelt. The Southern Farm & Pinhey Forest Sector Plans are applicable to the Study Area. The GMP aspires to enhance the VIA Rail Train Station located at the intersection of Fallowfield Road and Woodroffe Avenue as a Capital Arrival through visitor information and promotion of the Greenbelt and the Capital, illustrating the importance of the location of the Study Area. The Plan identifies transportation as a key component of the Capital experience, committing to achieving sustainable transportation that complies with environmental conservation best practices. Potential impacts to the visual quality, natural links and farming practices in the Greenbelt need to be mitigated/avoided to preserve Greenbelt value.

The Sector Plan illustrated in **Figure 3-2** identifies several Guidelines and Actions (denoted by characters on the Sector Plan) that may impact the evaluation of alternatives. These include:

A – The Pinhey Forest Core Natural Area:

- The sector is accessible to visitors and residents by transit, boat (via the Rideau River) and recreational pathways. and aspires to offer outdoor recreational and educational experiences in a forest setting.
- The Plan aims at preserving and promoting visual landscapes of farms and forest.
- The adjacent Nepean Sportsplex, (denoted as Q) will help in integrating conservation, forest management and recreational value into an urban setting.
- The Plan suggests working with community and agency partners to enhance the promotion and education value of the Visitor Destination.

B – Southern Farms Natural Link

- To aim for a fully functioning natural link; reduce the tile drain system area as part of regular maintenance.

- To partner with Rideau Valley Conservation Authority (RVCA), farm owners and tenants to restore riparian areas and enhance natural links along Black Rapids Creek and the headwaters of Graham Creek.

I – Greenbelt Research Farm Lands

- Encourage use and demonstration of provincial and federal recognized farm best management practices and diversify farm crop production over time.

N – Visual Quality along Sector Roadways:

- To enhance visual quality of Greenbelt along transportation routes through context sensitive design and landscape management (planting of naturalized trees and shrubs), that maintain views and reduce effects of wind on roads.
- Protect views and enhance visual quality.
- Explore ways to protect and enhance visual experience along scenic routes of Fallowfield Road, Woodroffe Avenue.

Q – The Nepean Sportsplex and Confederation Education Centre

- Permit future continued intensive use and adaptive re-use of the site, including maintenance of existing sports fields and use of the (former) school's existing site for recreational uses.

R – The Fallowfield Park and Ride Facility

- Enhance the VIA Rail Train Station as a Capital Arrival through visitor information and promotion of the Greenbelt and the Capital.

T – Greenbelt Research Farm:

- Allow shared and mixed use of built facilities and explore potential for partnerships to provide sustainable agriculture support at this site, through activities such as farming, processing or value-added facilities, markets, asset sharing.
- Reserve this site for federal use in the long-term.

3.3.1.2 Provincial Policy

The Provincial Policy Statement (PPS) (MMAH, 2020) is issued under Section 3 of the *Planning Act*. The Provincial Policy Statement provides policy direction on matters of provincial interest related to land use planning and development. As a key part of Ontario's policy-led planning system, the PPS sets the policy foundation for regulating the development and use of land. It also supports the provincial goal to enhance the quality of life for all Ontarians by building strong, healthy, and resilient communities with long-term economic prosperity. It includes policies on key issues that affect our communities, such as:

- The efficient use and management of land and infrastructure;
- Protection of public health and safety;
- Protection of the environment and wise use and management of resources; and,
- Ensuring appropriate opportunities for employment and residential development, including support for a mix of these uses.

Municipalities use the PPS to develop their Official Plans and to guide and inform decisions on planning matters. All decisions affecting land use planning matters "shall be consistent with" the PPS (MMAH, 2020).

The PPS defines *Development* as "*the creation of a new lot, a change in land use, or the construction of buildings and structures requiring approval under the Planning Act*." Many land use policies outlined in the PPS restrict development in and/or near elements of provincial interest (e.g., provincially significant wetlands) unless it can be demonstrated that there will be no negative impact on the environmental features nor their ecological functions. However, as per the PPS, "*activities that create or maintain infrastructure authorized under an environmental assessment process*" are not considered development.

Notwithstanding, environmental assessments have regard to matters of provincial interest and where impacts cannot be avoided shall be minimized to the extent possible through appropriate mitigation, monitoring and/or compensation.

3.3.1.3 Municipal Policy

The municipal policy context affecting the Study Area consists of the City of Ottawa Official Plan (OP); Secondary Plans; and the Comprehensive Zoning By-Law.

3.3.1.3.1 City of Ottawa Official Plan (2013, as amended)

During the course of finalizing this study the City of Ottawa adopted a new OP that was approved by the Ministry of Municipal Affairs and Housing in November 2022. The information provided in this section remains the basis for subsequent evaluation and development of the Recommended Plan therefore, it remains unchanged. Discussion of the new OP and its influence on the project or process is documented in **Section 6.8**.

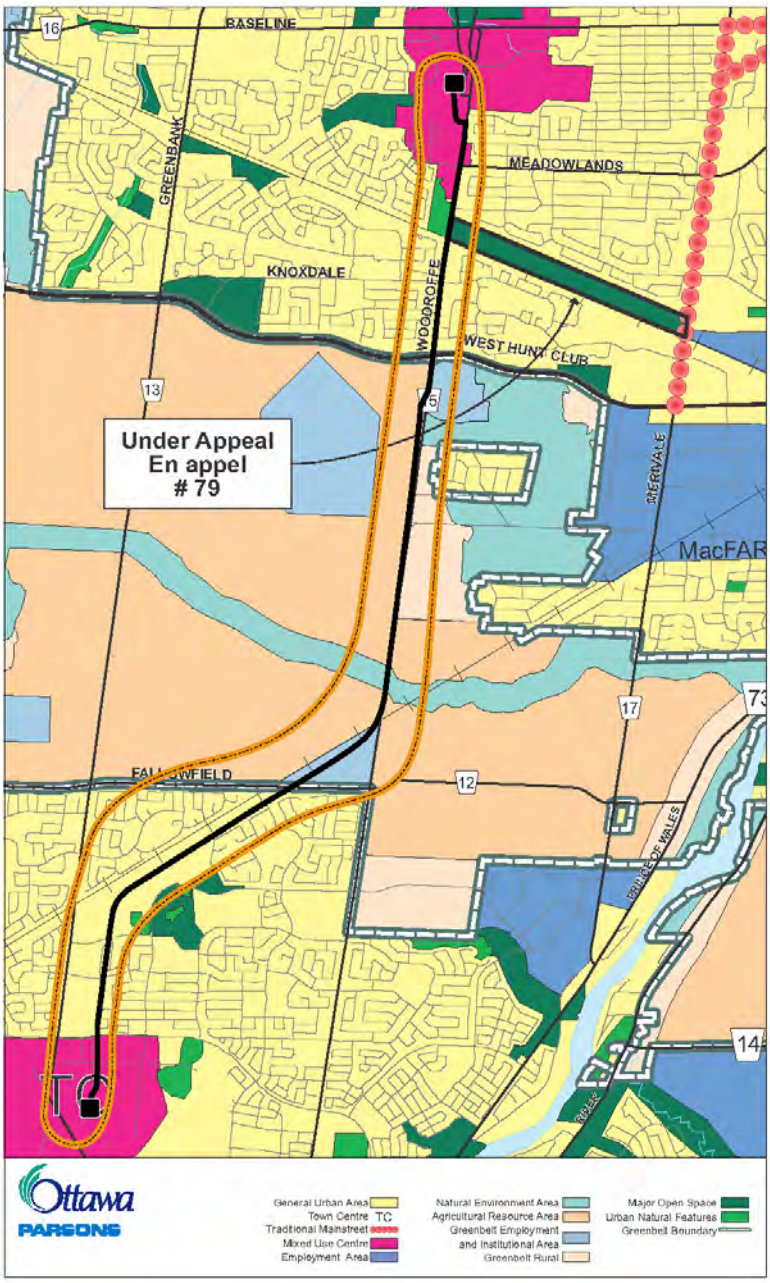
The OP provides a vision of the future growth of the City and a policy framework to guide its physical development to the year 2031. It is a legal document that addresses matters of provincial interest defined by the PPS. The OP serves as a basis for, and provides guidance on, a wide range of municipal activities. **Table 3-2** outlines the various land use and other designations that apply within the Study Area. **Figure 3-3** illustrates the land use designations of the OP. Municipal services (including LRT) are generally permitted in all land use designations if authorized under an EA where issues of impact and mitigation are addressed.

Table 3-2 Land Use Designations applicable to the Study Area

Schedule	Designation	Location within Study Area
B – Urban Policy Plan	GENERAL URBAN AREA	Lands north and south of the Greenbelt and includes existing and developing residential communities.
	MIXED USE CENTRE	Just south of Meadowlands Drive north to Baseline Road and South of Strandherd Drive.
	AGRICULTURE RESOURCE AREA	Greenbelt lands more specifically, between West Hunt Club Road and Fallowfield Road to the west and portions north of Fallowfield Road to the east.
	GREENBELT EMPLOYMENT AND INSTITUTIONAL AREA	Defined area just west of the Study area south of West Hunt Club Road and includes the former Agricultural Research Farm. VIA Rail Station at Fallowfield Road and Woodroffe Avenue.
	MAJOR OPEN SPACE	Corridor extending east from Woodroffe Avenue along the CN Railway and narrow corridor along the north side of West Hunt Club Road and South Nepean Park.
	NATURAL ENVIRONMENT AREA	Greenbelt lands coinciding with Pinhey forest and along Black Rapids Creek
	GREENBELT RURAL	Greenbelt lands east of Woodroffe Avenue south of the Nepean Sportsplex to just north of Black Rapids Creek.
	URBAN NATURAL FEATURE	Tallwood Woods south of Tallwood Drive, north of the CN Railway and Highbury Woods north of Highbury Park Drive, west of Longfields Drive.
C – Primary Urban Cycling Network	ON-ROAD CYCLING ROUTES	Woodroffe Avenue and Fallowfield Road.
	OFF-ROAD CYCLING ROUTES	Portions of Woodroffe Avenue and along the VIA Rail corridor in the southern portion of the Study Area.
D – Rapid Transit and Transit Priority Network	BUS RAPID TRANSIT (BRT)	West of Woodroffe Avenue
	INTER-REGIONAL STATION	The VIA Rail Station at the intersection of Woodroffe Avenue and Fallowfield Road
E – Urban Road Network	ARTERIAL ROADS	Baseline Road West Hunt Club Road Woodroffe Avenue

Schedule	Designation	Location within Study Area
		Fallowfield Road Strandherd Road Greenbank Road
	MAJOR COLLECTOR ROADS	Meadowlands Drive Longfields Drive Jockvale Road Tallwood Drive Centrepointe Drive
	COLLECTOR ROADS	Berrigan Drive Highbury Park Drive Mountshannon Drive Holitman Drive Foxfield Drive Wolfgang Drive Grenfell Crescent Riocan Avenue Slack Road Vaan Drive Majestic Drive Knoxdale Road Medhurst Drive Norice Street Constellation Drive Navaho Drive
K – Environmental Constraints	INTAKE PROTECTION ZONE	Woodroffe Avenue from Baseline Road to approximately Slack Road
	UNSTABLE SLOPES	Main channel of Black Rapids Creek Pinecrest Creek northern limit of Study Area to Meadowlands Drive
L1 – Natural Heritage System Overlay (East)	GREENBELT	West Hunt Club Road to Fallowfield Road
	NATURAL HERITAGE SYSTEM FEATURES	Tallwood Woods at Tallwood Drive to CN Rail line Pinhey Forest West Hunt Club Road to Grenfell Crescent Wetland parcel west of Woodroffe Avenue on main channel of Black Rapids Creek Highbury Woods
Annex 2a – Watershed and Subwatershed Plans	OTTAWA WATERSHED, PINECREST CREEK SUBWATERSHED	Northern limit of Study Area to mid-Greenbelt
	LOWER RIDEAU WATERSHED, BLACK RAPIDS CREEK AND BARRHAVEN CREEK SUBWATERSHEDS	Mid Greenbelt to Fallowfield Road and Fallowfield Road to approximately Berrigan Drive
	JOCK WATERSHED, JOCK DOWNSTREAM REACH SUBWATERSHED	Berrigan Drive to southern limit of the Study Drive
Annex 2b – Subwatershed Studies and Environmental Plans	PINECREST CREEK STORMWATER MANAGEMENT RETROFIT STUDY	Northern Study Area limit to approximately mid Greenbelt
	LOWER RIDEAU WATERSHED STRATEGY	Mid Greenbelt to approximately Berrigan Drive
	JOCK RIVER REACH 1 SUBWATERSHED STUDY	Berrigan Drive to southern limit of Study Area
Annex 10 – Land Use Constraints Due to Aircraft Noise	25 LINE (COMPOSITE 25 NEF/NEP)	Fallowfield Road, along transitway alignment to Greenbank Road south to Strandherd Drive
	AIRPORT ZONING REGULATIONS/AIRPORT VICINITY DEVELOPMENT ZONE	East side of Woodroffe Avenue from the Nepean Sportsplex to Fallowfield Road and Study Area limits south of Fallowfield Road

Figure 3-3 City of Ottawa Official Plan



3.3.1.3.2 City of Ottawa Secondary Plans

The City of Ottawa OP is supported by a collection of Secondary Plans and Site-Specific Policies prepared by former municipalities for specific areas. The plans contain complementary and more detailed policy direction for specific areas and neighbourhoods in the City.

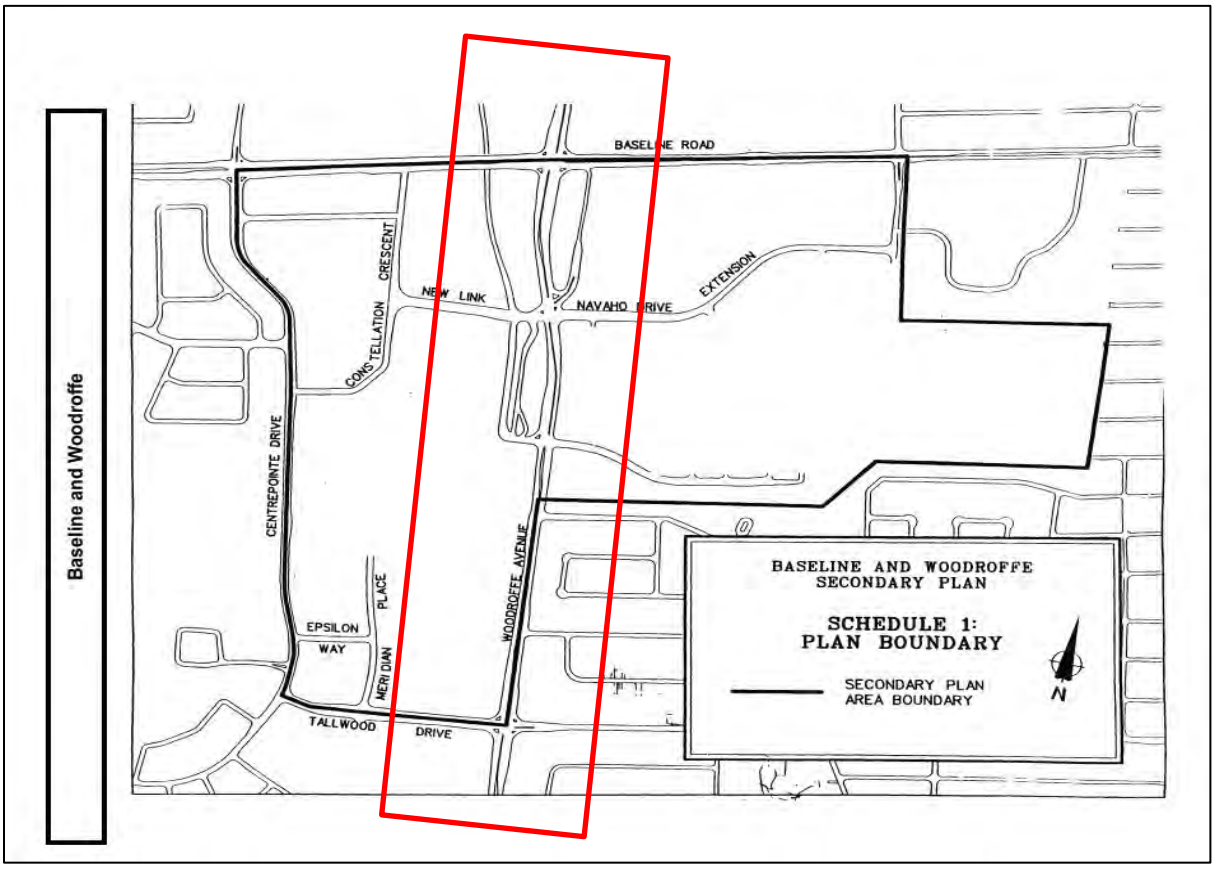
The three (3) secondary plans which provide policy direction within the Study Area are:

- Baseline and Woodroffe Secondary Plan;
- South Nepean Urban Plan for Areas 1, 2 and 3; and,
- Barrhaven Downtown Secondary Plan.

Baseline and Woodroffe Secondary Plan

The Baseline and Woodroffe Secondary Plan illustrated in **Figure 3-4** is intended to function as a focal point for business and activity, accommodating a large amount of employment and related development with good access to transit. The transportation system forms the skeletal structure of the area and determines the level of development that can be accommodated. A notable objective of the plan is creating transit-oriented development at Baseline Station.

Figure 3-4 Baseline and Woodroffe Secondary Plan

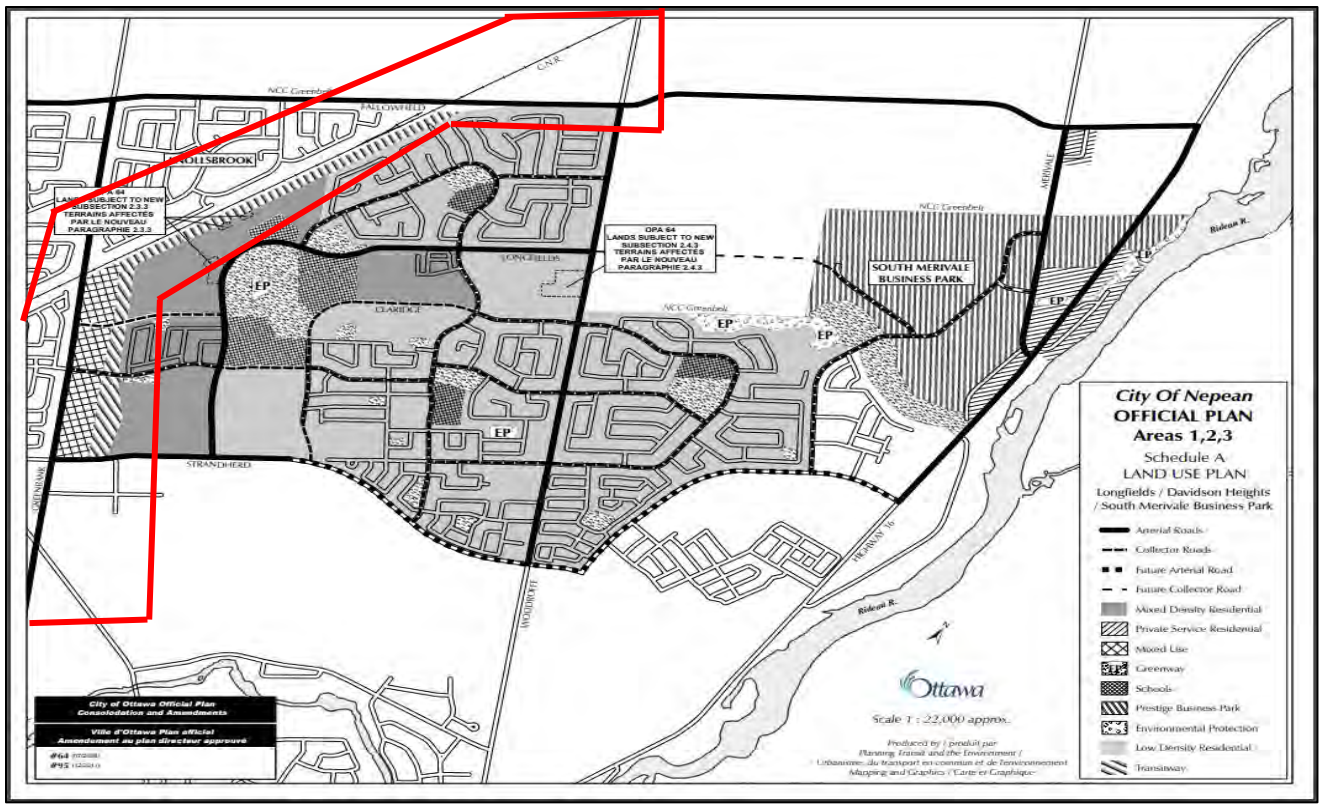


South Nepean Urban Plan for Areas 1, 2 and 3

The South Nepean Urban Plan for Areas 1, 2 and 3 is illustrated in **Figure 3-5.** Fallowfield Road acts as the northern boundary for the Plan and applies to the southern portion of the Study Area. Fallowfield Road is highlighted as it is an Arterial Road for use by pedestrians, cyclists, transit vehicles, trucks and cars and separates the Greenbelt from the mixed-density residential area of the South Nepean Urban Plan Area.

The Secondary Plan emphasizes strong support to the development of transit within the area. It identifies that the Rapid Transit Corridor will be located adjacent to the VIA Rail corridor south of Fallowfield Road (note the railway is labelled as C.N.R. on **Figure 3-5**), extending south to the South Nepean Activity Centre provided there is future service demand.

Figure 3-5 South Nepean Urban Plan for Areas 1, 2 and 3



Barrhaven Downtown Secondary Plan (2019)

During the course of the EA study, the Barrhaven Downtown Secondary Plan (**Figure 3-6**) was drafted and supersedes the Area 7 plan. The new plan puts forward area-based policy direction to support the Barrhaven Town Centre's evolution into a compact, mixed-use, and transit-supportive community. The Secondary Plan acknowledges OP direction for area intensification and infill and highlights a vision of the Barrhaven Downtown as a meeting place for the community. High-quality urban design, a mix of land uses, and accessible greenspace and transportation are emphasized to support community growth.

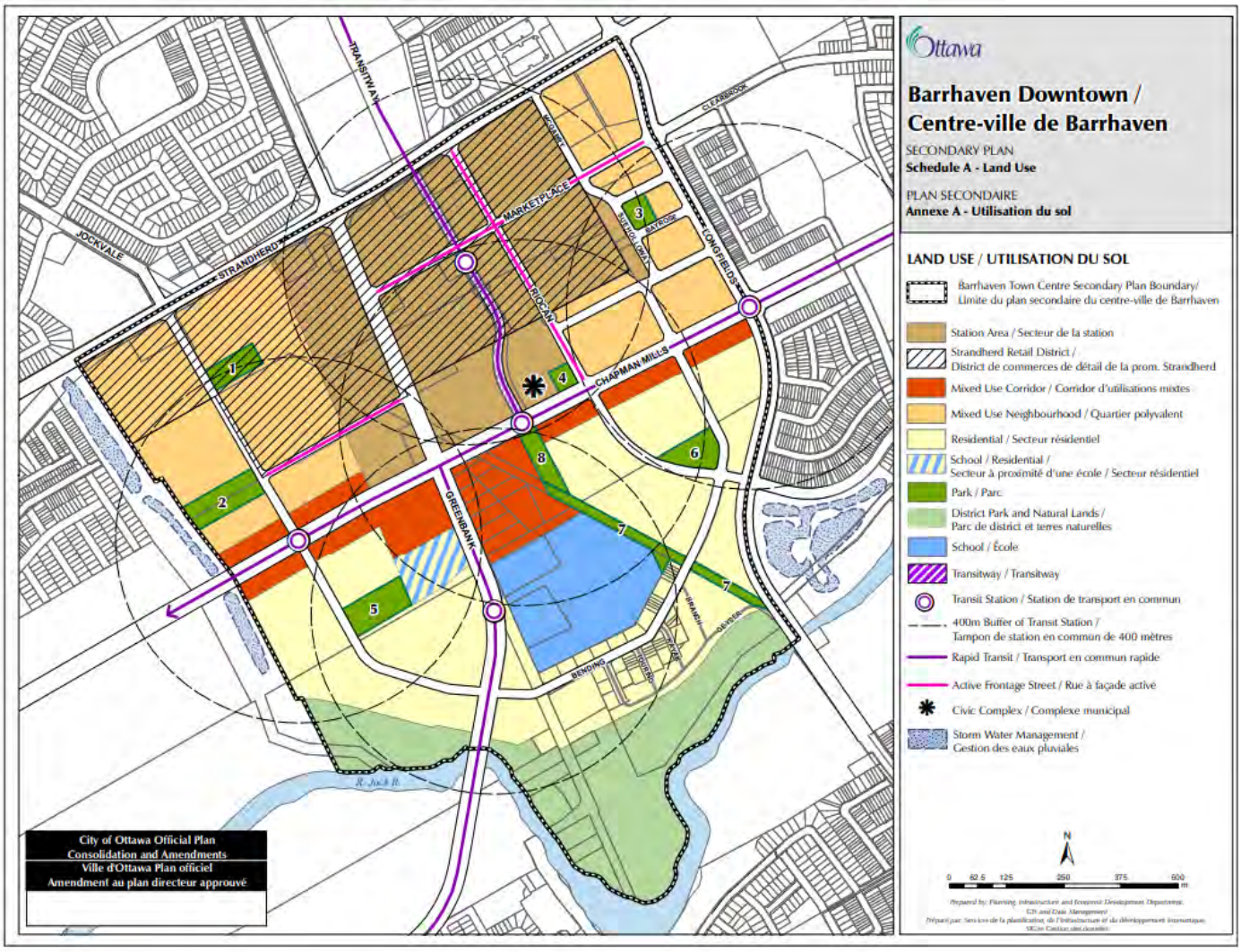
The planning area is intended to be developed with a mix of different building heights and typologies. The southern corridor of Chapman Mills Drive is designated a Mixed-Use Corridor with corresponding policies intended to promote a vibrant streetscape. The lands north of Chapman Mills Drive and south of Strandherd Drive are primarily designated as Station Area. The corresponding planning policies are intended to support future O-Train Line 1 (Barrhaven LRT Extension) by way of a wide range of land uses, an inviting public realm, and a concentration of height and density. The southern portion of the Town Centre towards the Jock River takes on a more residential character according to the suburban context.

The supportive transportation network for the Town Centre will be comprised of transit, street, active transportation, and parking networks, all focused on accessibility and sustainability. For example, all Arterial roads (i.e., Greenbank, Longfields, and Strandherd) and Major Collector roads (Chapman Mills) are to have pedestrian and cycling facilities and a recreation corridor is proposed. The transportation network features two transitway lines (one East-West and one North-South). The East-West line operates entirely in median-separated central lanes along Chapman Mills Drive, while the North-South line uses a dedicated transit corridor north of Chapman Mills and central lanes south of Chapman Mills along Greenbank Road. Five transitway stations (existing and proposed) are identified in the Secondary Plan Downtown area. The intersection of these two transitway lines is considered a transit "hub" as well as a community focal point which is intended to evolve over time as construction of rapid transit lines occurs. The Transit Hub is planned adjacent to the municipal civic complex.

As part of the transit network, the Plan highlights that temporary Park & Ride facilities are permitted within any land use designation in the Town Centre in the immediate vicinity of planned or existing transit stations. Policy for temporary Park &

Ride facilities intends to locate them where they conform with plans for long-term acquisition of public streets or public parks and plans for transit-supportive development. The Plan also permits permanent Park & Ride facilities. Policy promotes locating permanent facilities where they can be integrated with a proposed development, below- or above-grade, or shared with other uses in the Barrhaven Downtown.

Figure 3-6 Barrhaven Downtown Secondary Plan, 2019



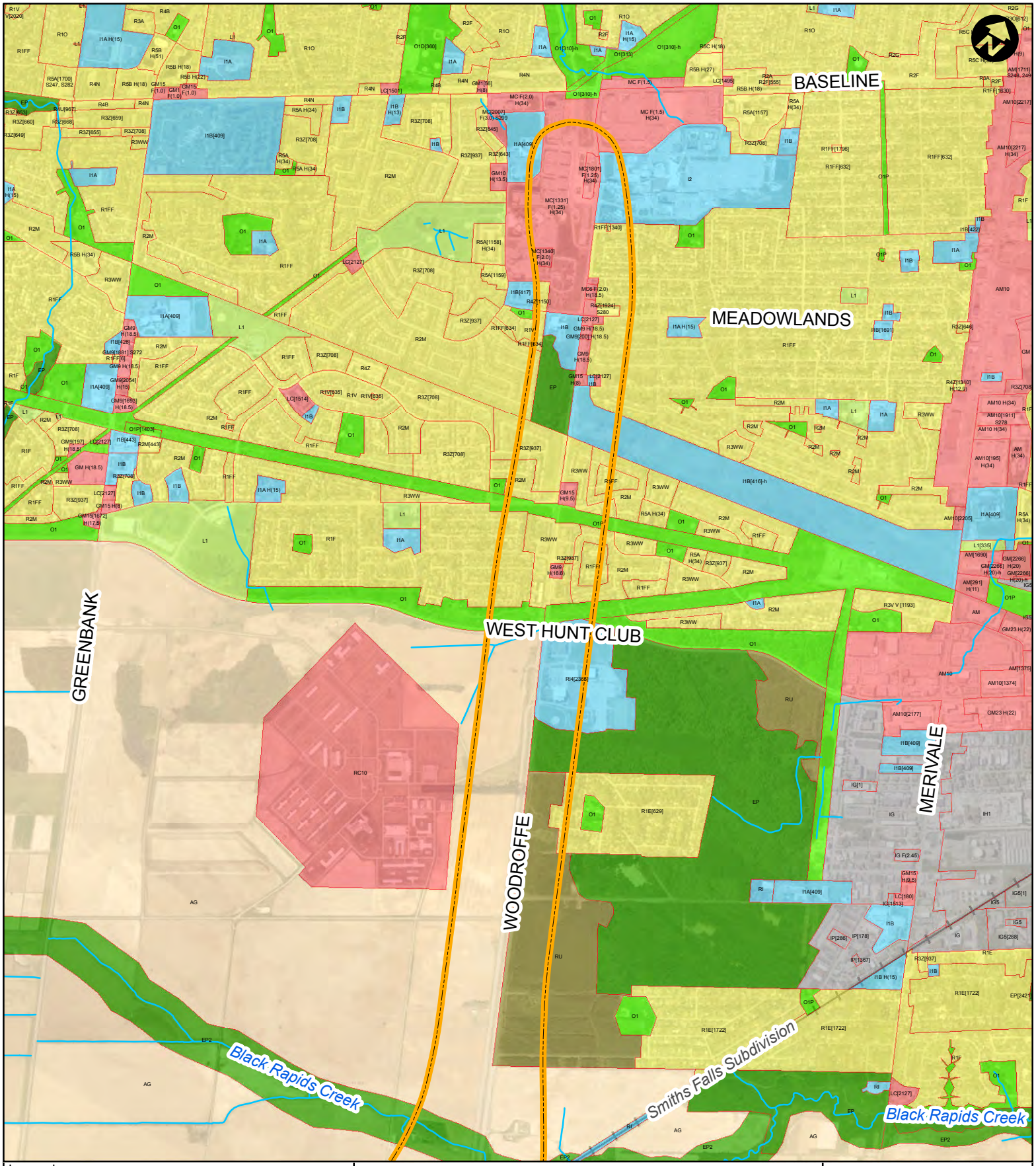
3.3.2 COMPREHENSIVE ZONING BY-LAW

The City of Ottawa Zoning By-Law implements the land use objectives of the Official Plan at a site-specific level. Given the detailed nature of land use zoning provisions, a characterization of zoning is provided rather than a detailed inventory of applicable zones and related standards. Zoning for the Study Area is shown in **Figure 3-7, Figure 3-8** and **Figure 3-9**.

The lands adjacent to the Study Area are contained within a range of zones including Agricultural (AG), Environmental Protection (EP), Ground Transportation (T2), Residential First Density (R1), Residential Second Density (R2), Residential Third Density (R3), General Mixed-Use (GM), Mixed-Use Centre (MC), Minor Institutional (I1), Major Institutional (I2), Local Commercial (LC), Parks and Open Space (O1), as well as Rural Countryside (RU).

3.3.3 EXISTING LAND USE

Figure 3-10, **Figure 3-11** and **Figure 3-12** illustrate existing land use within the Study Area.



Legend

- Study Area
- Watercourse

Zoning (Sept 2018)

- Commercial/Mixed Use
- Environmental Protection
- Institutional
- Industrial
- Leisure
- Open space
- Residential
- Rural Country Side
- Agriculture

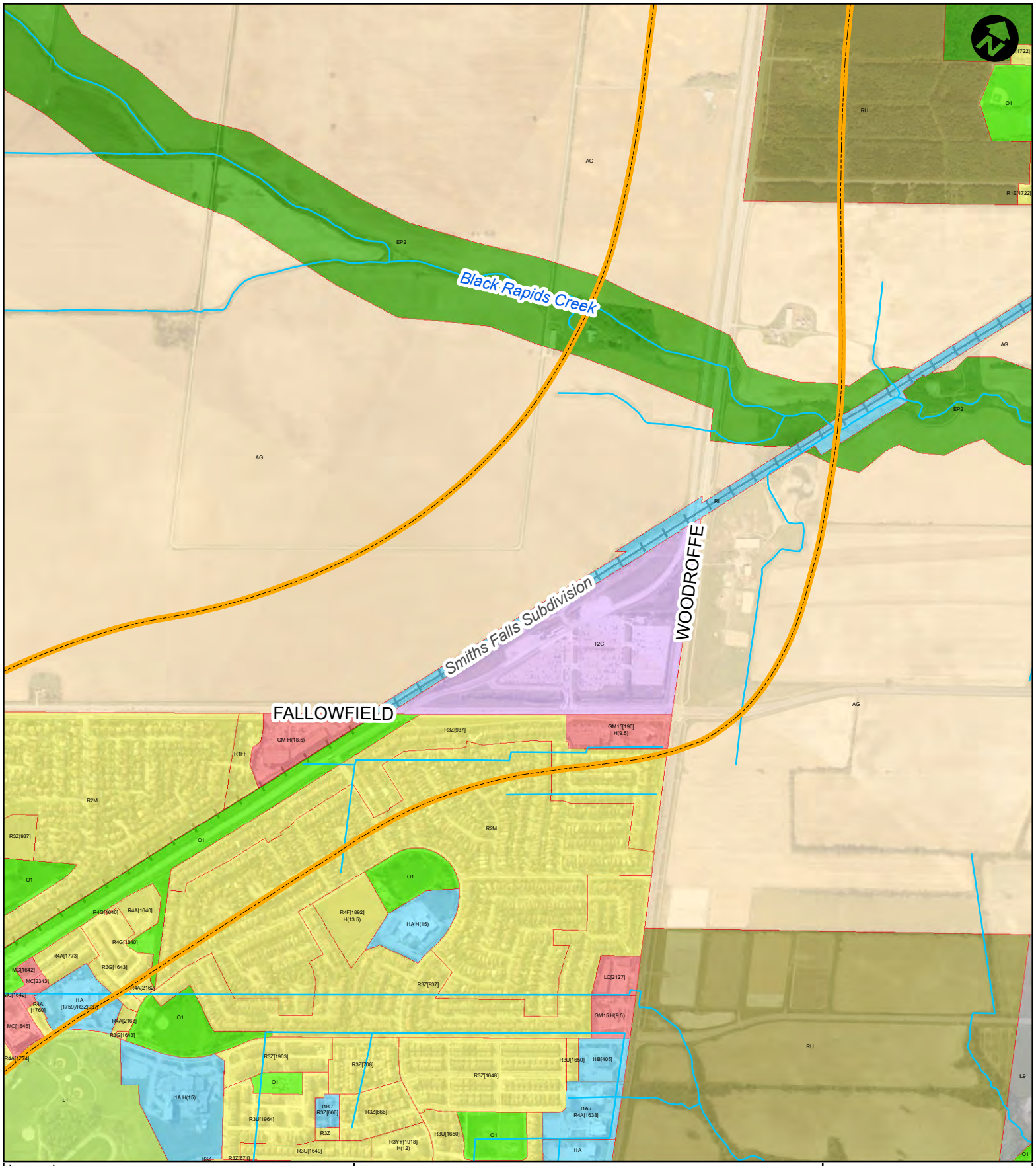
Barrhaven Light Rail Transit
(Baseline Station to Barrhaven Town Centre)

Planning and Environmental Assessment Study

0 0.325 0.65 1.3 Km

Zoning

Ottawa PARSONS



Legend

- Study Area
- Watercourse

Zoning (Sept 2018)

- Commercial/Mixed Use
- Environmental Protection
- Institutional
- Industrial
- Leisure
- Open space
- Residential
- Rural Country Side
- Transportation
- Agriculture

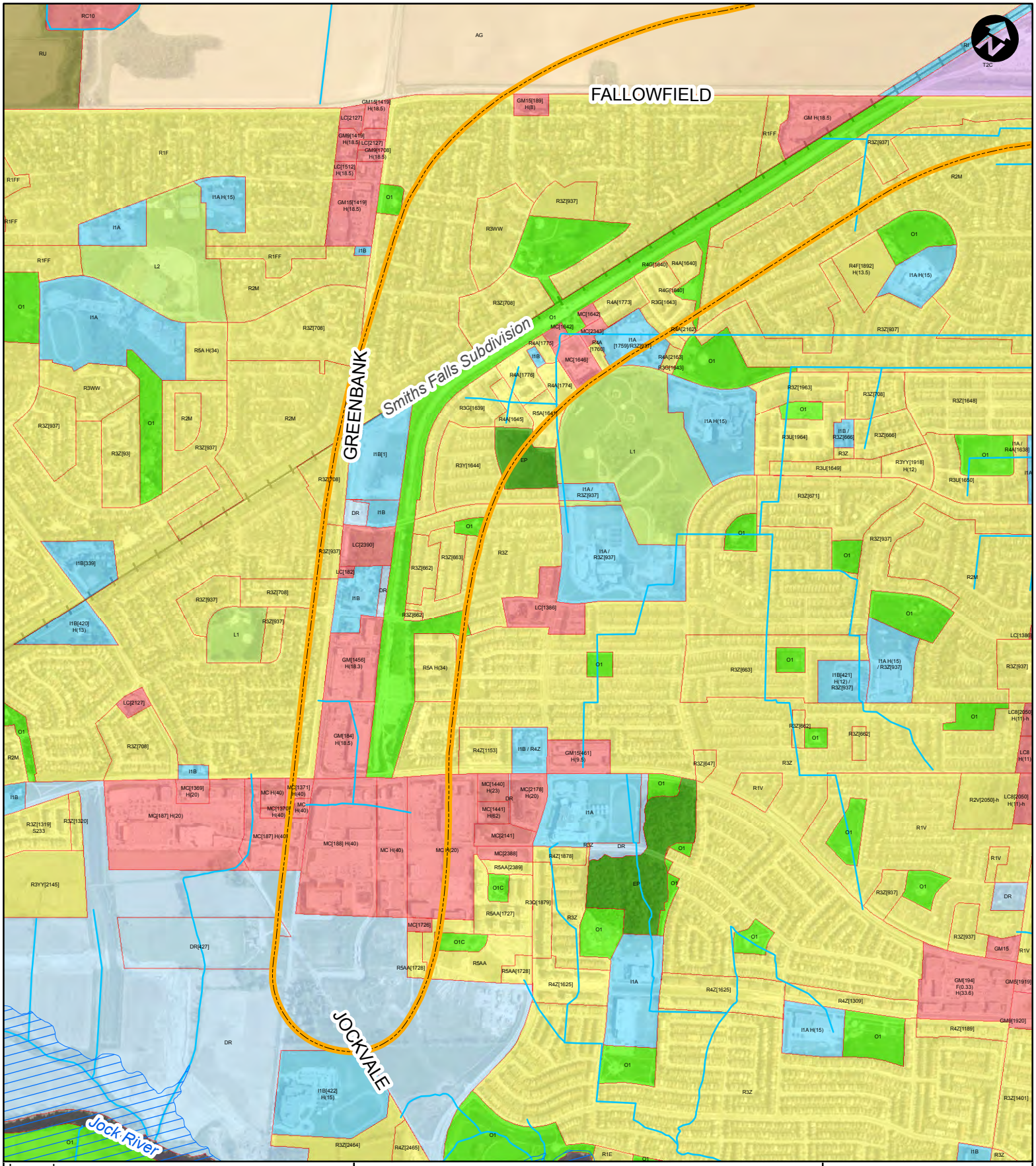
Barrhaven Light Rail Transit
(Baseline Station to Barrhaven Town Centre)

Planning and Environmental Assessment Study

0 0.15 0.3 0.6 Km

Zoning

Ottawa PARSONS



Legend

- Study Area
- Watercourse

Zoning (Sept 2018)

- Commercial/Mixed Use
- Development Reserve
- Environmental Protection
- Institutional
- Leisure
- Open space
- Residential
- Rural Country Side
- Transportation
- Agriculture
- Flood Plain

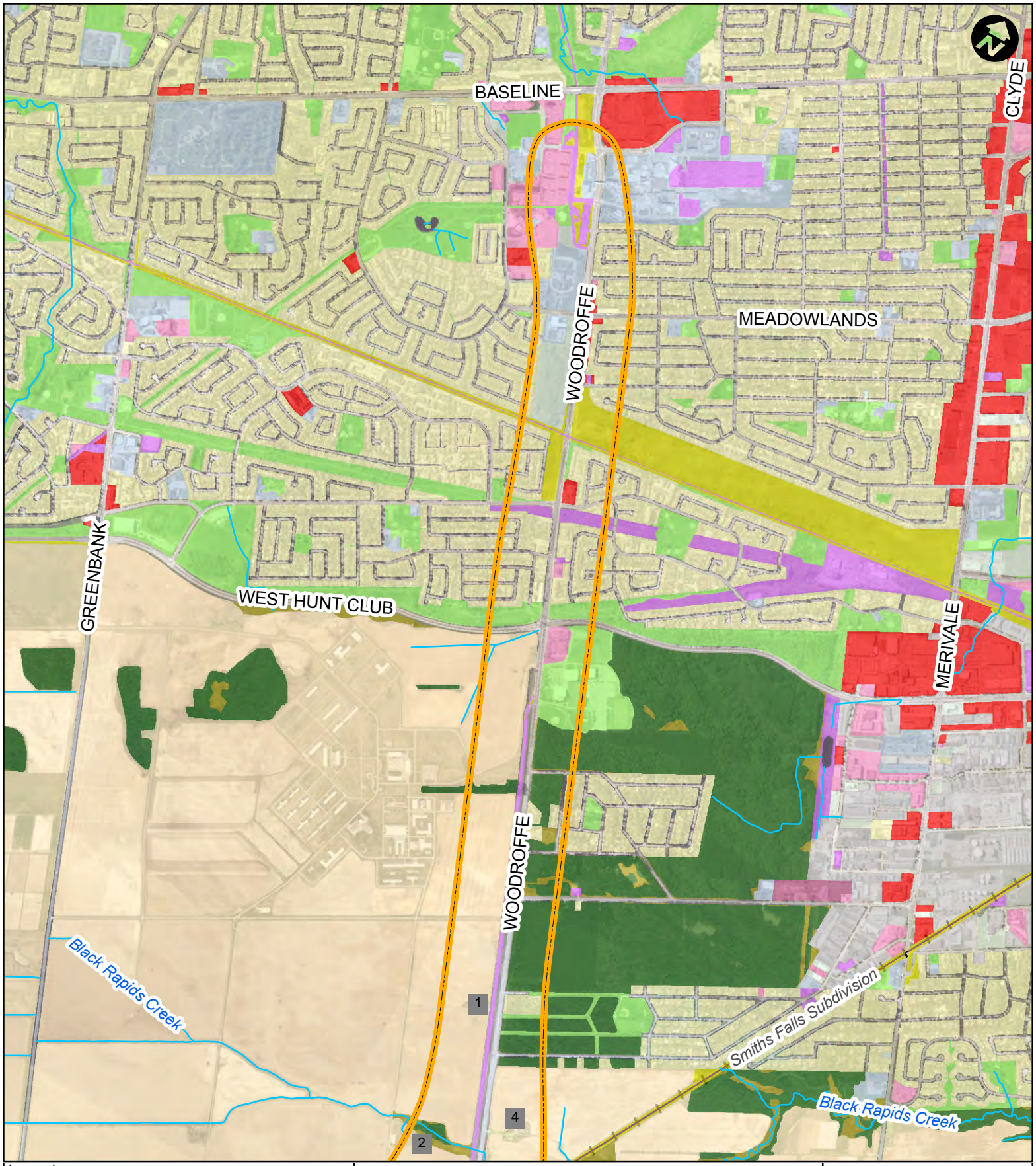
Barrhaven Light Rail Transit
(Baseline Station to Barrhaven Town Centre)

Planning and Environmental Assessment Study

0 0.2 0.4 0.8 Km

Zoning

Ottawa PARSONS



Legend

- Study Area
- Watercourse
- Residential
- Commercial
- Institutional
- Industrial
- Trans and Utility
- Office
- Recreation
- Open space
- Idle and shrub land
- Agriculture
- Quarries
- Vacant land
- Vacant building
- Forest
- Wetland
- # Farm Number

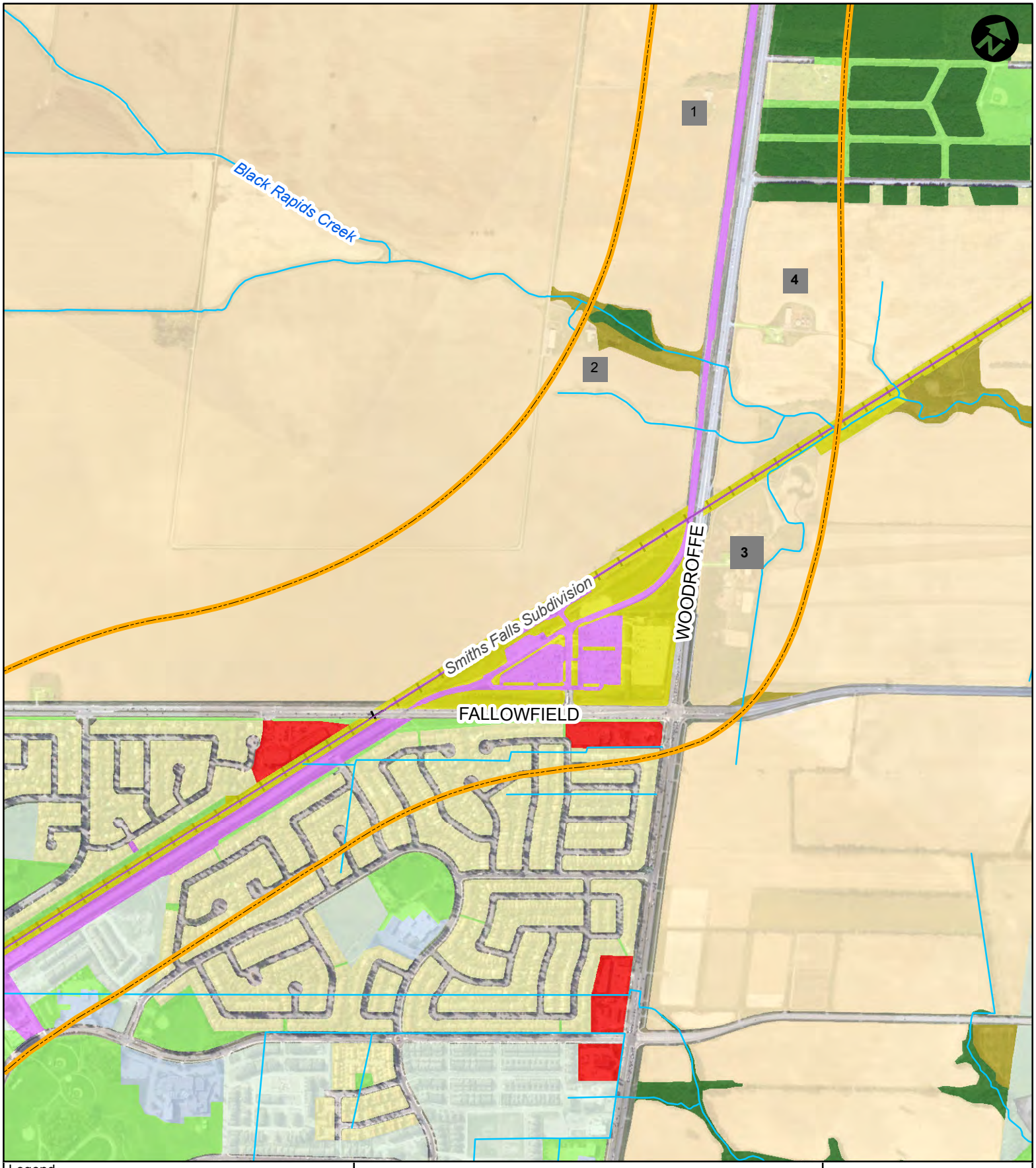
Barrhaven Light Rail Transit
(Baseline Station to Barrhaven Town Centre)

Planning and Environmental Assessment Study

0 0.325 0.65 1.3 Km

Land Use

Ottawa PARSONS



Legend

- Study Area
- Watercourse
- Residential
- Commercial
- Institutional
- Industrial
- Trans and Utility
- Office
- Recreation
- Open space
- Idle and shrub land
- Agriculture
- Quarries
- Vacant land
- Vacant building
- Forest
- Wetland
- # Farm Number

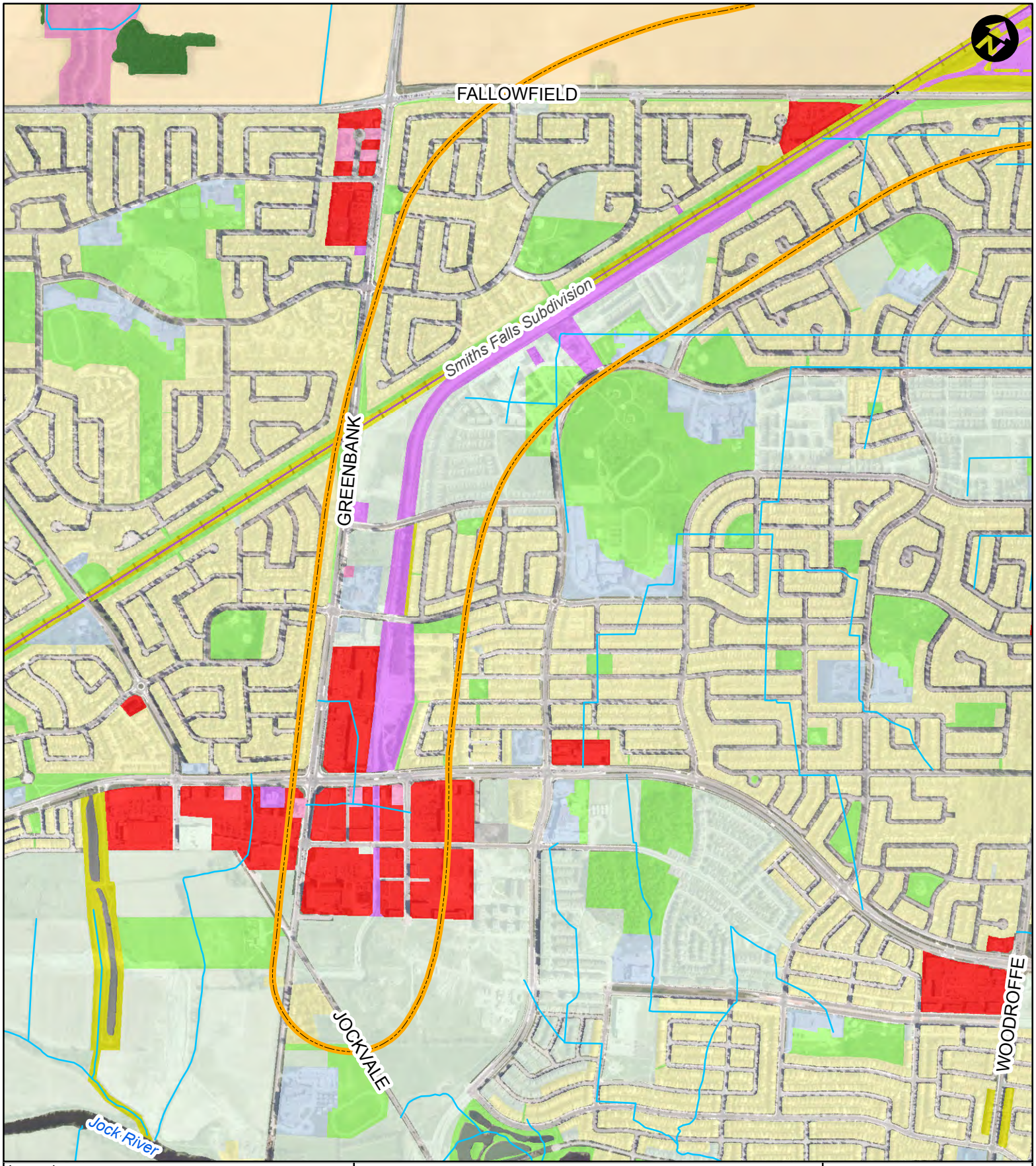
Barrhaven Light Rail Transit
(Baseline Station to Barrhaven Town Centre)

Planning and Environmental Assessment Study

0 0.15 0.3 0.6 Km

Land Use

Ottawa PARSONS



Legend

- Study Area
- Watercourse
- Residential
- Commercial
- Institutional
- Industrial
- Trans and Utility
- Office
- Recreation
- Open space
- Idle and shrub land
- Agriculture
- Quarries
- Vacant land
- Vacant building
- Forest
- Wetland

Barrhaven Light Rail Transit
(Baseline Station to Barrhaven Town Centre)

Planning and Environmental Assessment Study

0 0.2 0.4 0.8 Km

Land Use

Ottawa PARSONS

3.3.3.1 Agricultural Land Use

An Agricultural Assessment was undertaken to support the EA study. The full report is located in **Appendix B**. Four farms were identified within the Study Area (**Figure 3-10** and **Figure 3-11**), two of which are retired operations (Farms 1 and 2), while Farm 3 is a former livestock operation that is currently in crop production and Farm 4 is the Royale Equestrian Centre (horse riding stables). The retired farms still have outbuildings that could be suitable if farm operations were started up again.

Aside from the farms, crop production is most common throughout the Greenbelt lands. Investments include tile drainage and an interior road network.

3.3.4 LANDSCAPE AND URBAN DESIGN CHARACTER

3.3.4.1 Woodroffe Avenue: North edge of the Study Area to Baseline Station

In the northern part of the study area, Algonquin College is located between Navaho Drive and College Avenue. An arched glass pedestrian bridge is located above Woodroffe Avenue providing connection to the campus on both sides of Woodroffe Avenue (**Figure 3-13**). North of the pedestrian bridge, there are nine (9) travel lanes including dedicated northbound and southbound bus lanes. A median chain-link fence separates northbound from southbound traffic in this section. There is an approximately 1.8m wide concrete sidewalk along both sides of Woodroffe Avenue and a southbound bike lane commencing at Navaho Drive. There are no bus stops nor shelters along this section. Ornamental plantings, grass boulevards and trees are located along the Right-of-Way. Standard utilities such as hydro lines, water hydrants, light poles, street signage and overhanging directional signs are located within the boulevard space. This section contains public realm enhancements associated with Algonquin Campus in the form of picnic tables and benches.

Figure 3-13 Pedestrian bridge across Woodroffe Avenue looking south

3.3.4.2 Woodroffe Avenue: Baseline Station to Knoxdale Road/Medhurst Drive

Along this section, Woodroffe Avenue includes six (6) travel lanes, the northbound and southbound dedicated bus lanes continue in the curbside lane; concrete road medians replace the chain-link fence and transition to grassed medians further south. An on-road bike lane is provided southbound. However, a northbound bike lane exists between Medhurst Drive and at Norice Street. Sidewalks are located on both sides of Woodroffe Avenue and are approximately 2m throughout. Bus stops and shelters are located within this section. Standard utilities such as hydro lines, water hydrants, light poles, street signage and overhanging directional signs are located within the Right-of-Way. Noise walls are located on the east side of the road for the residences at Parkglen Drive and David Drive siding onto Woodroffe Avenue. Grassed medians and boulevards are the only landscaping enhancements provided along this section.

Baseline Station and affiliated Park & Ride facility are located at the intersection of College Avenue on the west side of Woodroffe Avenue (**Figure 3-14**). They are setback considerably from Woodroffe Avenue accommodating grass boulevards, some trees, overhead signage posts and road signage. Major institutional areas on the west side include the City of Ottawa offices located on Constellation Drive (Mary Pitt Centre), Meridian Theatres, Centrepointe Library, Ben Franklin Place and the Peter D. Clark Long Term Care Centre (**Figure 3-15**). A small asphalt path connects the Centre's parking lot to a transit stop

located on Woodroffe Avenue. The east side is composed of residential homes behind commercial uses fronting on Woodroffe Avenue located between David Drive and Norice Street.

Figure 3-14 Transit priority corridor along Woodroffe Avenue entering the Baseline Southwest Transitway Station and Park-and-Ride looking southwest

Figure 3-15 Woodroffe Avenue looking south. Southwest Transitway Park-and-Ride (west) with the Peter D. Clark Centre behind, noise walls for residences (east)

Tallwood Woods is located on the west side of Woodroffe Avenue, south of Tallwood Drive, and acts as a natural buffer between Woodroffe Road and the Centrepointe residential community (**Figure 3-16**). A multi-use pathway (MUP) extends through the woods to Woodroffe Avenue. The Crestview-Meadowlands community is located on the east side of Woodroffe Avenue. A large open space is located south of Norice Street extending eastwards adjacent to the CN Rail line. The CN Rail line passes over Woodroffe Avenue between Norice Street and Knoxdale Road/Medhurst Drive (**Figure 3-17** and **Figure 3-18**).

Tallwood woods gives way to open space buffering Beechcliffe Street to Woodroffe Avenue on the west (**Figure 3-19**). The Tanglewood community is located to the east.

Figure 3-16 Woodroffe Avenue north of Norice Street looking south. Tallwood Woods (west) Commercial uses (east)

Figure 3-17 CN Rail line overpass of Woodroffe Avenue looking south

Figure 3-18 CN Rail line overpass of Woodroffe Avenue

Figure 3-19 Woodroffe Avenue south of the CN Rail line overpass looking south. Open space to the west with residences on Beechcliffe Street behind (west) and Brockington Court residences backing onto Woodroffe Avenue (east)

3.3.4.3 Woodroffe Avenue: Knoxdale Road/Medhurst Drive to West Hunt Club Road

Along this section Woodroffe Avenue, residences are located immediately adjacent to the Right-of-Way on both sides of the roadway. Woodroffe Avenue continues to maintain six (6) travel lanes including the northbound and southbound dedicated curbside bus lanes; with a combination of concrete and grass medians. Northbound and southbound on-road bike lanes are provided on the outer edges of the roadway. 2m concrete sidewalks continue along both sides of Woodroffe Avenue. Bus stops and shelters are located within this section. Standard utilities such as hydro lines, water hydrants, light poles, street signage and overhanging directional signs are located within the Right-of-Way. Noise walls are located on the west side of the road for the residences at Manor Village and Cheryl Gardens backing onto Woodroffe Avenue (**Figure 3-20**). There is an 11m grassed buffer to the residences on the east side. Grassed medians provide the only landscaping enhancements along this section.

In this section, Hydro One transmission lines cross Woodroffe Avenue twice. Two sets of lines –115 kV circuit (C7BM) twin wood pole line and a 230 kV transmission line (M32S) supported by steel towers. are located immediately south of the

intersection of Knoxdale Road/Medhurst Drive (**Figure 3-21**). Two sets of lines, four transmission lines on two sets of steel towers voltages vary from 115 kV to 500 kV are located north of West Hunt Club Road. These transmission line corridors stretch to the east and west, with both corridors incorporating MUPs throughout (**Figure 3-22**).

Figure 3-20 Noise walls located along the residential area on the west side of Woodroffe Avenue (Cheryl Gardens)

Figure 3-21 Hydro One transmission lines crossing Woodroffe Avenue south of the intersection of Knoxdale Road/Medhurst Drive looking south

Figure 3-22 Hydro One transmission line crossing Woodroffe Avenue north of the intersection of West Hunt Club Road looking southwest

3.3.4.4 Woodroffe Avenue: West Hunt Club Road to Fallowfield Road

The Greenbelt is located on both sides of Woodroffe Avenue between West Hunt Club Road and Fallowfield Road and is the dominant land use within this section (**Figure 3-23**). Six (6) travel lanes with curbside northbound and southbound dedicated bus lanes transition to four (4) travel lanes separated by a 2m central concrete median (width varies to accommodate turn lanes). The transit facilities transition to the Southwest Transitway on the west side of Woodroffe Avenue opposite the Nepean Sportsplex (**Figure 3-24**). Northbound and southbound on-road bike lanes transition to paved shoulders at the Nepean Sportsplex. Sidewalks on both sides of Woodroffe Avenue transition to a MUP on the east side only. The MUP crosses water

features via bridges. The only bus stop (there are no shelters) located within this section is at Vaan Drive. Standard utilities such as hydro lines, water hydrants, light poles, street signage and overhanging directional signs are located within the Right-of-Way. The MUP and the Southwest Transitway are buffered from the roadway.

The agricultural vistas of the Greenbelt expand to the west of the roadway with some shelterbelt elements and a guard rail in the Right-of-Way. The east side of the Greenbelt is shaded by the mature coniferous Pinhey Forest (**Figure 3-25**). South of Pinhey Forest the landscape opens up to agriculture and the Royale Equestrian Centre.

Figure 3-23 Woodroffe Avenue looking south. Greenbelt Agriculture lands and the Southwest Transitway to the west. The Nepean Sportsplex and Pinhey Forest to the east

Figure 3-24 The Southwest Transitway exiting Woodroffe Avenue to the west

Figure 3-25 Woodroffe Avenue looking south with Pinhey Forest to the east

The VIA Rail line crosses Woodroffe Avenue and the Southwest Transitway at-grade just north of Fallowfield Road (**Figure 3-26**). The rail-crossing contains train gates, bells and lights including a set for pedestrians using the MUP and a set for buses using the Southwest Transitway. The MUP at this location is secured by a chain-link fence as it approaches the at-grade rail crossing. An east-west NCC Pathway connects to a north-south MUP running parallel to Woodroffe Avenue just south of the VIA Rail line on the east side.

Figure 3-26 Woodroffe Avenue VIA Rail line at-grade crossing looking south. Southwest Transitway crossing (west) and MUP crossing (east)

3.3.4.5 Southwest Transitway: Woodroffe Avenue to Fallowfield Road

The OC Transpo Fallowfield Station and affiliated Park & Ride facility is located in the northwest quadrant of the intersection of Woodroffe Avenue and Fallowfield Road. The entrance to the Park & Ride facility serves the Fallowfield Transit Station and provides access to the VIA Rail Fallowfield Station (**Figure 3-27**). The Park & Ride facility is accessed from Via Park Place connected to Fallowfield Road. The Southwest Transitway has four (4) travel lanes through the station area. The station area specific to the Southwest Transitway consists of a lighted platform and bus shelter area. A memorial dedicated to the bus and train collision of September 18, 2013 is located in the northeast portion of the parking area.

Figure 3-27 Fallowfield Transit Station on the Southwest Transitway looking west. VIA Rail Station (west)

3.3.4.6 Fallowfield Road: Woodroffe Avenue to Greenbank Road

In this section, Fallowfield Road has four (4) travel lanes, and eastbound and westbound bike lanes with a concrete median. It also includes ten bus stops (five eastbound and five westbound) provided to serve the local community. From Woodroffe Avenue to Via Park Place there is a sidewalk on the south side of the roadway and a MUP on the north side. Low-rise commercial uses and parking lots are setback from the roadway. West of Via Park Place to the Study Area boundary of Greenbank Road there is a MUP on the south side of the road and an approximately 15m of sidewalk at the three transit stops on the north side of the road. Noise walls typically setback approximately 7.5m from the edge of pavement are located

along the residences that are backing onto Fallowfield Road. Standard utilities such as hydro poles, light poles, and signage posts are located within the Fallowfield Road Right-of-Way.

West of Via Park Place the Southwest Transitway and the VIA Rail line cross Fallowfield Road on an angle at-grade (**Figure 3-28**). The crossings are approximately 65m apart. Traffic is controlled via traffic lights and train gates, bells and lights for the rail line including a set for pedestrians using the MUP. There is a median chain-link fence between Via Park Place and Barrhaven Crossing commercial retail plaza. West of the Southwest Transitway where it crosses Fallowfield Road, the westbound bike lane transitions to a paved shoulder.

Beyond the at-grade crossings, the vista of the NCC Greenbelt is located to the north while the Barrhaven West residential community is located to the south (**Figure 3-29**). Nearing Greenbank Road, the median becomes grassed and bus stops contain shelters with benches (in some cases).

Figure 3-28 Fallowfield Road at-grade crossing of the Southwest Transitway and VIA Rail line looking west

Figure 3-29 Fallowfield Road Greenbelt vistas (north) looking west

3.3.4.7 Southwest Transitway: Fallowfield to Barrhaven Town Centre

The Southwest Transitway is two lanes wide in this section and runs parallel to the VIA Rail line until just north of Highbury Park Drive where it turns south to head towards the Barrhaven Town Centre. Stations located along the Southwest Transitway in this section include Longfields, Strandherd, Marketplace and Barrhaven Centre. Trees are located along both sides of the Southwest Transitway, providing a green buffer to the commercial uses on Greenbank Road on the west side and residential community on the east side. A MUP is located parallel on the east side of the Southwest Transitway to Strandherd Drive. Another MUP is located along the east side of the Southwest Transitway starting just south of Marketplace Avenue (**Figure 3-31**). The Southwest Transitway crosses Berrigan Drive at-grade just before widening to four (4) lanes at the Strandherd Station (**Figure 3-30**). South of Berrigan Drive there are sidewalks on the east side until Marketplace Avenue. South of Marketplace Avenue sidewalks continue on the west side and tie into the MUP from the east side at the terminus of the Southwest Transitway.

The Southwest Transitway intersects Market Place Avenue arriving at the Market Place Station through a narrow concrete corridor in the commercial core of Marketplace (**Figure 3-32** and **Figure 3-33**). Within this intersection the street character changes to accommodate wide sidewalks, light poles, signal posts, and signage posts on both sides of the Southwest Transitway.

The Southwest Transitway ends intersecting with Jockvale Road. Areas south and east are largely undeveloped. West and south, there are some houses (**Figure 3-34**). Jockvale Road in this area is two (2) lanes, with gravel shoulders and no cycling or pedestrian facilities. There are two bus stops on Jockvale Road but no shelters.

Figure 3-30 Strandherd Transit Station and Park & Ride

Figure 3-31 MUP located to the east of the Southwest Transitway underpass at Highbury Park looking south

Figure 3-32 Southwest Transitway at Marketplace Avenue Intersection looking south

Figure 3-33 Southwest Transitway seen from Strandherd Drive overpass

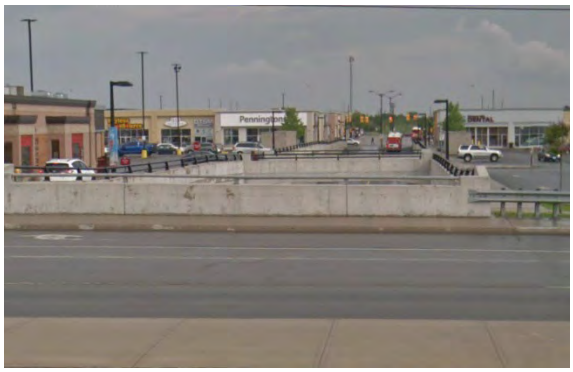
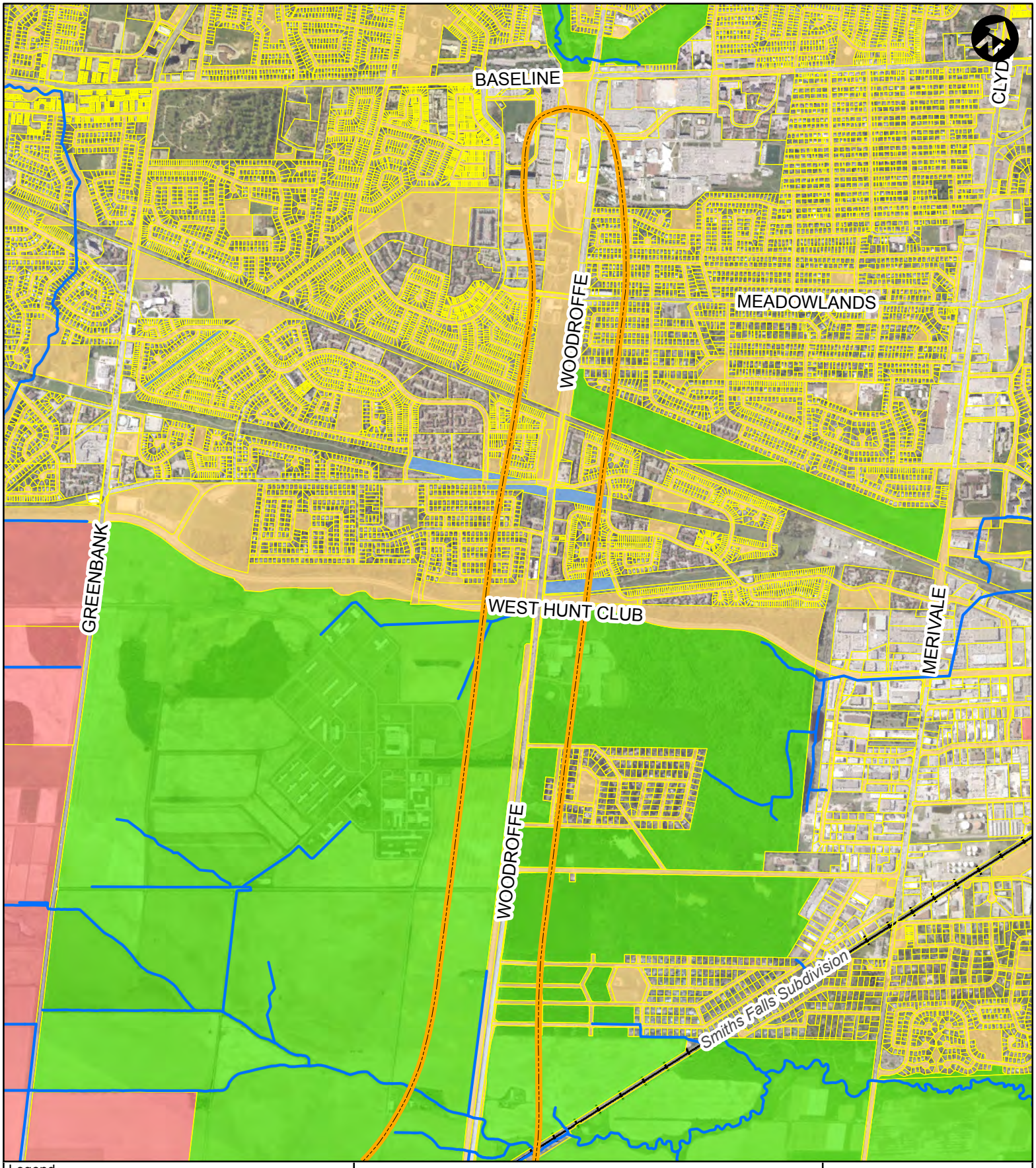


Figure 3-34 Terminus of the Southwest Transitway at Jockvale Road looking south

3.3.5 LAND OWNERSHIP

Figure 3-35, Figure 3-36 and Figure 3-37 illustrate land ownership in the Study Area. A major landowner in the Study Area is the NCC.



Legend

- Study Area
- Watercourse
- Parcels

Public Ownership

- Federal parcels
- NCC parcels
- Ontario parcels
- Ottawa parcels

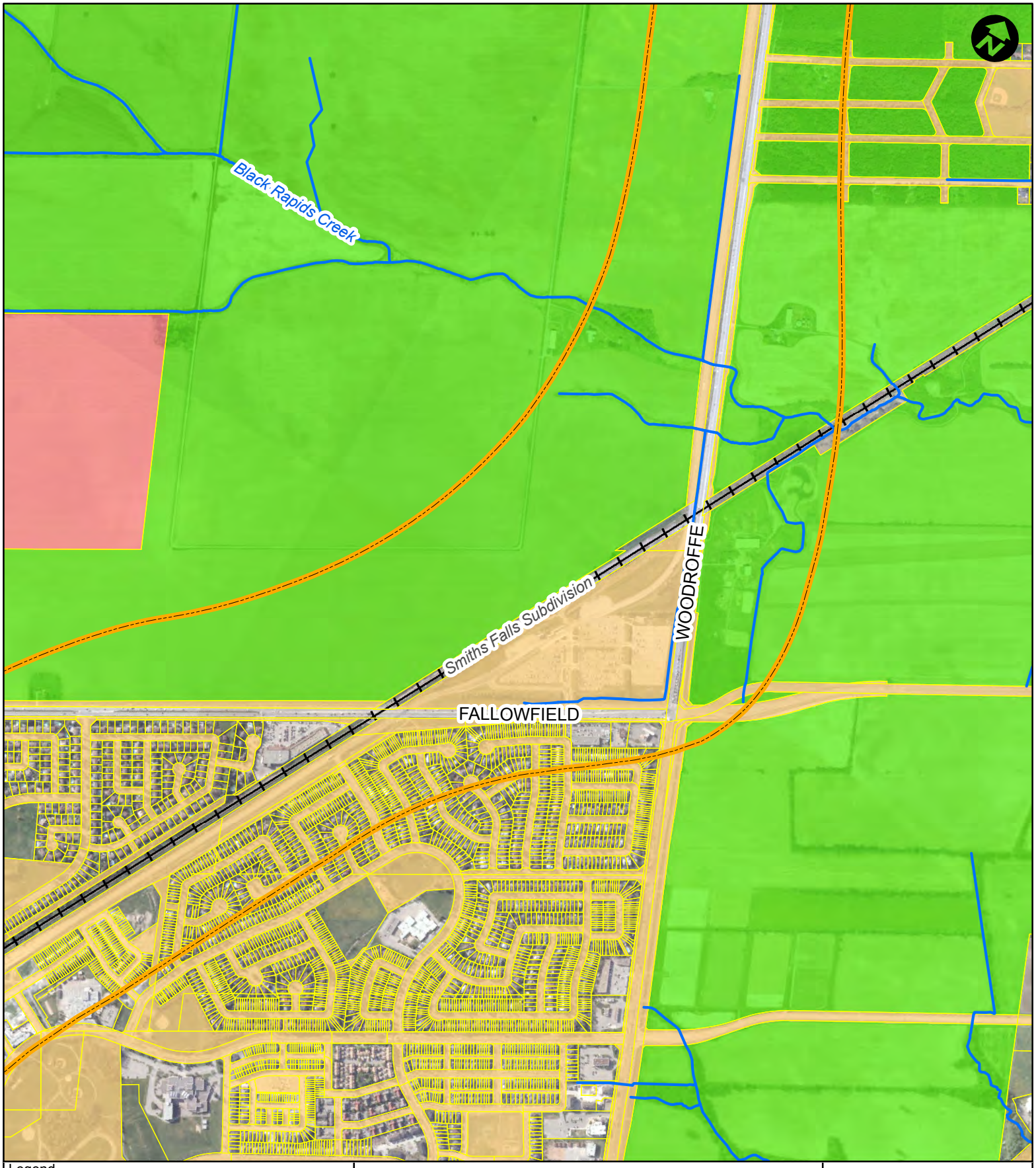
Barrhaven Light Rail Transit
(Baseline Station to Barrhaven Town Centre)

Planning and Environmental Assessment Study

0 0.325 0.65 1.3 Km

Land Ownership

Ottawa PARSONS



Legend

- Study Area
- Watercourse
- Parcels

Public Ownership

- Federal parcels
- NCC parcels
- Ottawa parcels

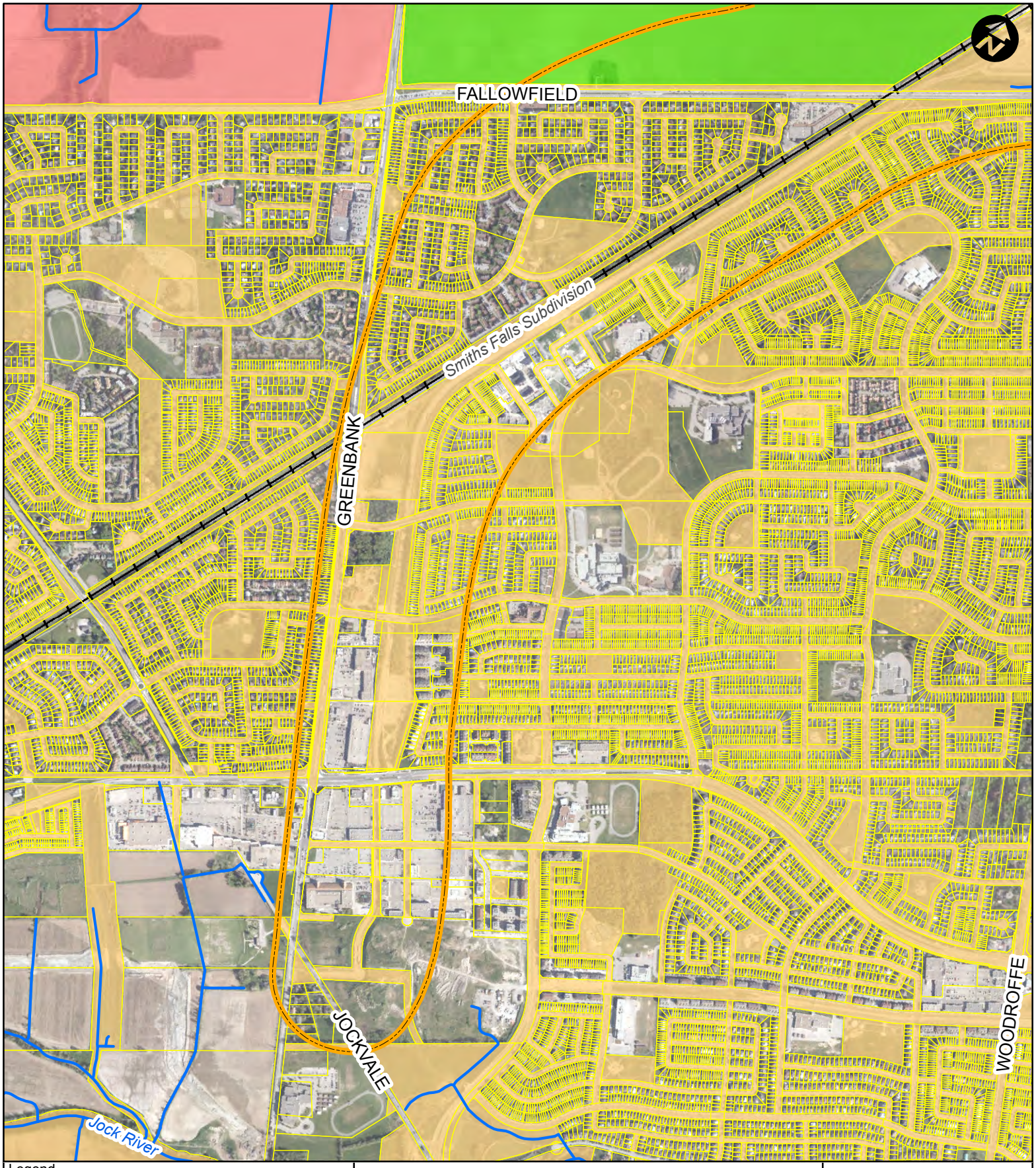
Barrhaven Light Rail Transit
(Baseline Station to Barrhaven Town Centre)

Planning and Environmental Assessment Study

0 0.15 0.3 0.6 Km

Land Ownership

Ottawa PARSONS



Legend

- Study Area
- Watercourse
- Parcels

Public Ownership

- Federal parcels
- NCC parcels
- Ottawa parcels

Barrhaven Light Rail Transit
(Baseline Station to Barrhaven Town Centre)

Planning and Environmental Assessment Study

0 0.2 0.4 0.8 Km

Land Ownership

Ottawa PARSONS

3.3.6 CLIMATE CHANGE

There is global consensus that planet Earth is experiencing climate change resulting from anthropogenic effects. Climate change effects include such things as increased drought, flooding, heat waves, extreme storm events and warmer winters. The impacts of these events in Ontario have resulted in water shortages, forest fires, flooding, declines in agricultural production, lower Great Lakes water levels, power outages and outbreaks of water-borne diseases (OCCIAR (2012). These impacts result in unexpected economic and social costs.

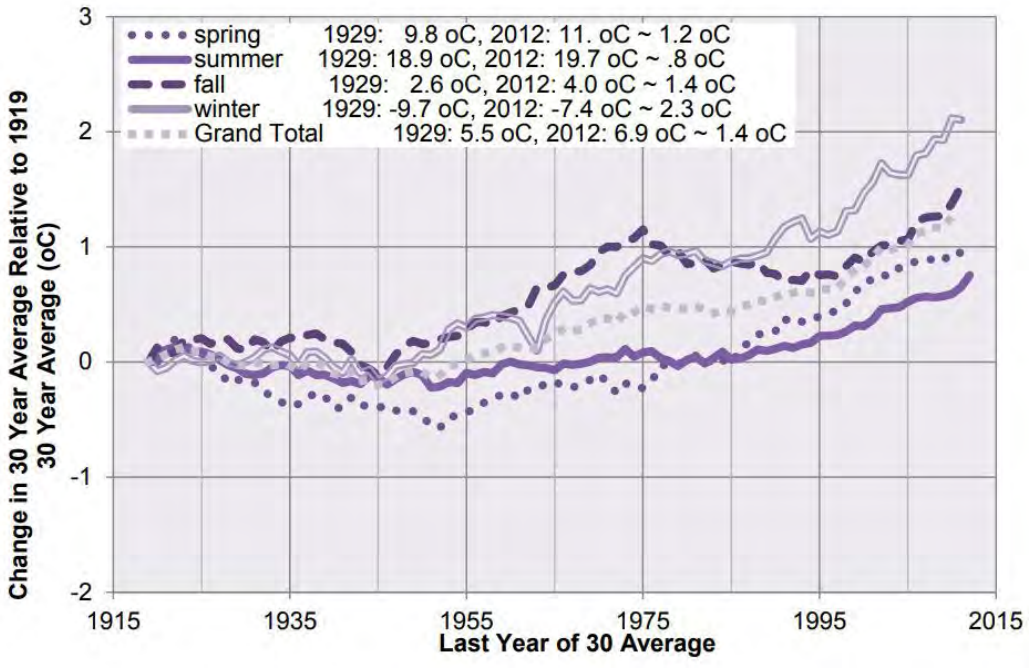
The existing conditions information related to common climate change effects are described in the sections below. Most studies discuss climate change on provincial or national scales, however, where possible, Ottawa specific information is described.

3.3.6.1 Temperature

The average annual mean temperature in the City of Ottawa has increased over the last century by 1.7°C (City of Ottawa, 2014), as shown in **Figure 3-38**. This in turn results in an increase of the number of extreme heat days, days in a year when temperature exceeds 30°C and increases to daily maximum and minimum temperatures. Research analyzing historical temperature trends to predict future trends for Ottawa is consistent with global trends of warming temperatures (Zhai, 2018).

The Ontario Climate Change Data Portal (Ontario CCDP) models climate data regionally throughout Ontario. This model indicates that the mean average annual temperature in the Ottawa region has and will continue to increase by approximately 2.27°C from the period 1960-1990, to the current period, 2015-2045 (Ontario CCDP, 2018).

Figure 3-38 Average Temperatures (City of Ottawa, 2013)



3.3.6.2 Precipitation

The body of Canadian research indicates it is getting wetter across Canada. The World Meteorological Organization has found that wetter-than-average conditions occurred in 2013, compared to averages dating back to 1960 (World Meteorological Organization, 2013). Over the last century, there has been a 25% to 30% increase in the number of days with precipitation (City of Ottawa, 2013). Additionally, the frequency of precipitation events lasting three or more consecutive days has increased from 18% to 31% (City of Ottawa, 2013).

The Ontario CCDP indicates that annual precipitation in the Ottawa region has and will continue to increase by approximately 50mm from the period 1960-1990, to the current period, 2015-2045 (University of Regina, 2018). In the winter months, this increase is approximately 15mm from the period 1960-1990, to the current period, 2015-2045 (University of Regina, 2018).

3.3.6.3 Wind

High wind speeds and wind gusts are a significant meteorological hazard. Ontario has been experiencing increased windstorms and is projected to experience more frequent and severe wind gust events in the future as a result of the changing climate (Cheng, 2012). Studies have found that all regions across Canada are expected to see the frequency of localized windstorms, particularly in summer season, increase due to warmer temperatures under a future changing climate. Increased wind events can also lead to the uproot of trees in forested areas, leaving areas susceptible to fire.

3.3.6.4 Extreme Weather Events

Extreme weather events are increasing in both frequency and intensity, resulting in larger, torrential style precipitation events, punctuated with droughts and dry conditions. Both Natural Resources Canada and the MECP expect that precipitation will change to more pronounced periods of both flooding and drought (McBean, 2012) (Ministry of Enivronment, 2014). These events are also increasing in randomness (McBean, 2012).

There has been an increase in the occurrence of hot dry periods over the last thirty years, compounding the risks from the urban heat island effect (Martin, G. and P. Ballamingie, 2016). Extreme weather events featuring high temperatures and a lack of precipitation are contributing to the occurrence of forest fires. Climate change provides the appropriate weather conditions, which allows for the drying of fuel and subsequent spread of wildland fires (Wotton, 2017). Fire activity in boreal forest environments is anticipated to increase with climate change (Wotton, 2017).

There have been increases in the extreme minimum temperatures in Ottawa since 1919 to present day (City of Ottawa, IMP, 2013). As a result, it is expected that snowmelt amounts will increase as well as winter rainfall, possibly leading to an increase in flood events. Recent flood events have caused significant stress on private and public property, and indications are that these conditions will continue to occur.

3.3.7 ARCHAEOLOGICAL RESOURCES

A Stage 1 Archaeological Assessment was undertaken for the Study Area to determine areas with archaeological potential. The Stage 1 Archaeological Assessment consisted of a review of available previously completed reports, historical, archaeological and environmental research relevant to the local area. The full report is available in **Appendix B.**

The results of the study indicate that there are portions of the Study Area that exhibit archaeological potential. Developed areas, a portion of the Southwest Transitway (Fallowfield Road to Berrigan Drive) and some areas near Greenbank Road are "cleared" of archaeological potential through previous studies. Portions of the Study Area that still contain archaeological potential are illustrated in **Figure 3-39** and **Figure 3-40**.

LHC Letourneau Heritage Consulting Inc.

0 0.25 0.5 1
Kilometers

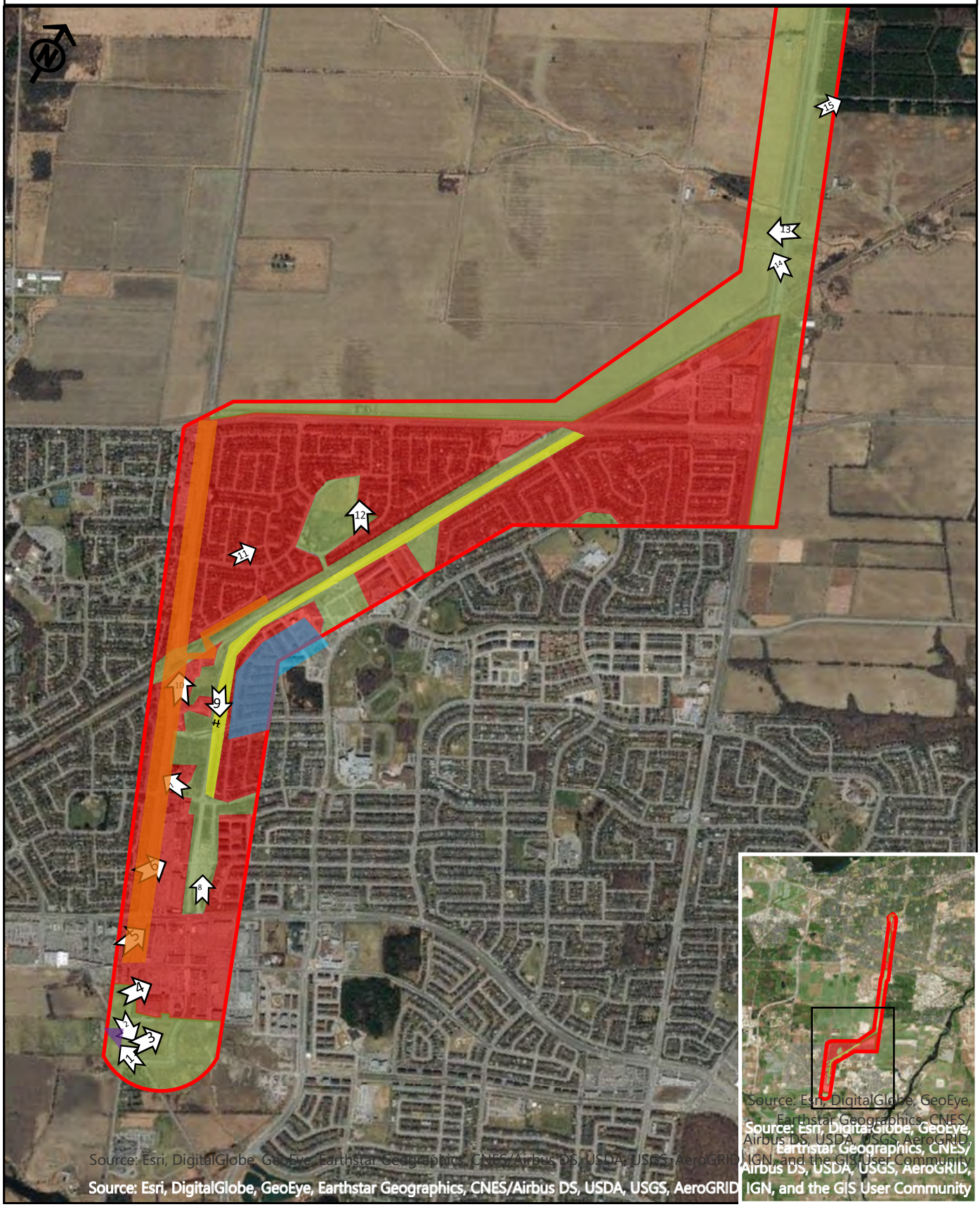
Study Area

Archaeological Potential

Stage 2 Assessment Recommended

Low Archaeological Potential

Developed Lands



LHC Letourneau Heritage Consulting Inc.

0 0.25 0.5 1
Kilometers

Study Area
Photo Location

Archaeological Potential
Stage 2 Assessment Recommended

Low Archaeological Potential
Developed Lands
Previously Assessed (Golder 2008)
Previously Assessed (Paterson 2013)
Previously Assessed (Stantec 2011)
Previously Assessed (Golder 2011)

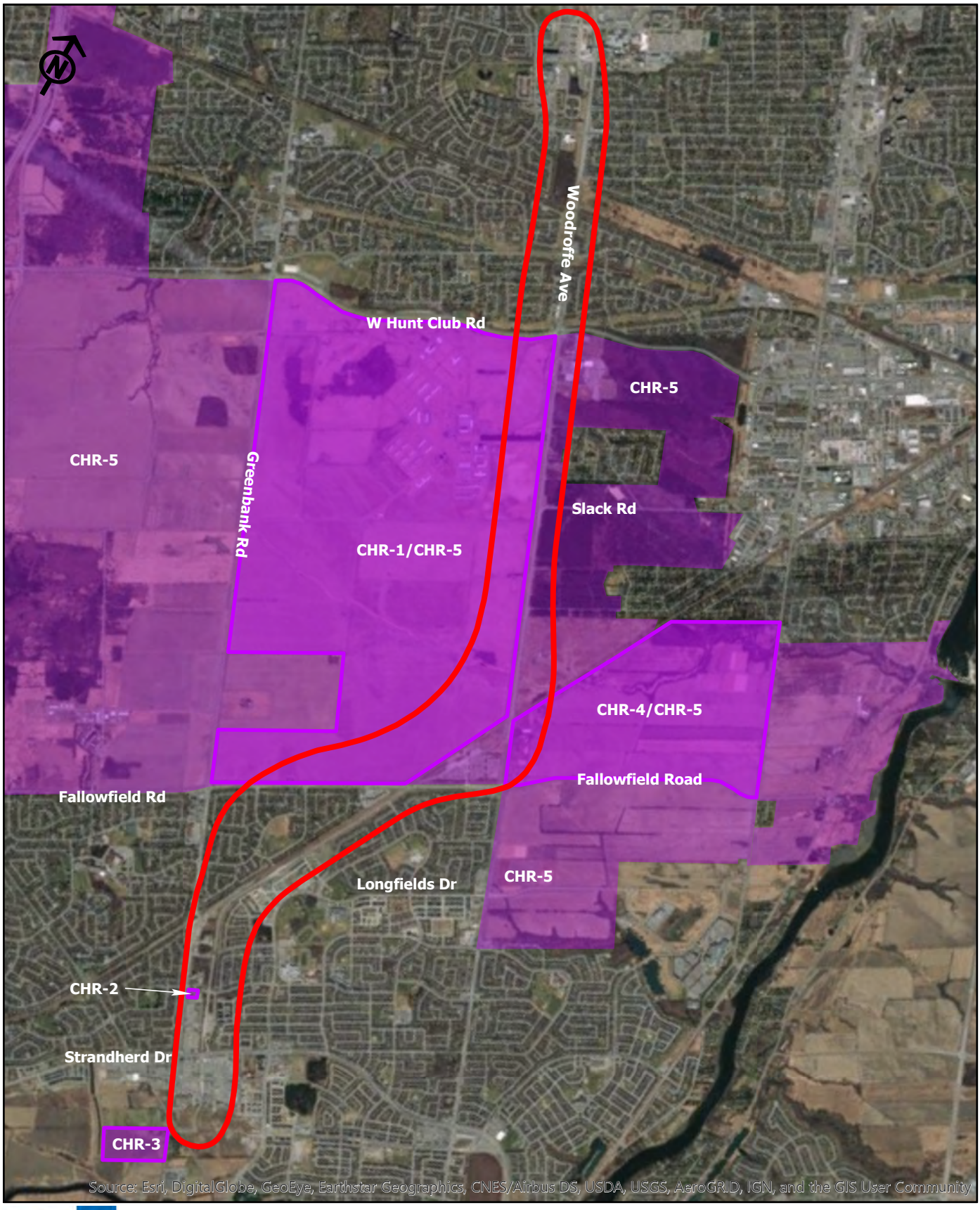
3.3.8 BUILT HERITAGE RESOURCES AND CULTURAL HERITAGE LANDSCAPES

A Cultural Heritage Evaluation Report (CHER) (later renamed to: *Cultural Heritage Report: Existing Conditions and Preliminary Impact Assessment and Addendum - Heritage Impact Assessment*, 2020) was undertaken for the Study Area to provide an overview of recognized and potential Cultural Heritage Resources (CHR) which includes both built heritage resources (BHR) and cultural heritage landscapes (CHL). Built heritage resource means a building, structure, monument, installation, or any manufactured remnant that contributes to a property's cultural heritage value or interest as identified by a community, including an Aboriginal community. Built heritage resources are generally located on a property that has been designated under Parts IV or V of the *Ontario Heritage Act*, or included on local, provincial and/or federal registers. A cultural heritage landscape means a defined geographical area that may have been modified by human activity and is identified as having cultural heritage value or interest by a community, including an Aboriginal community. Farms and cemeteries are examples of cultural heritage landscapes. The complete heritage report can be found in **Appendix B.** The heritage report included completion of the Cultural Heritage Screening Checklist, previously completed cultural heritage reports, a review of online databases and historical and environmental background research of the Study Area.

Known and potential CHRs are listed in **Table 3-3** and shown in **Figure 3-41**. No properties which are subject to federal, provincial, or municipal heritage protections are located within, or adjacent to the Study Area. Portions of the Study Area are located within the NCC Greenbelt, which is considered by the NCC as a CHL. Two properties within the Greenbelt are also individually identified as CHLs: 2191 Woodroffe Avenue (part of 2070 Merivale Road) and 3641 Fallowfield Road (part of 1470 Woodroffe Avenue). 3641 Fallowfield Road is also included on the Heritage Reference List. Two additional properties, 1081 Greenbank Road and 3288 Greenbank Road were identified during the screening process as properties of potential cultural heritage value or interest. These potential CHRs were screened for their potential to meet the criteria outlined in Ontario Regulation 9/06: *Criteria for Determining Cultural Heritage Value or Interest* under the *Ontario Heritage Act* and it was determined that both properties have the potential to meet one or more of the criteria.

Table 3-3 Summary of Known and Potential Cultural Heritage Resources

CHR	Category	Address	Current Recognition
CHR-1	Cultural Heritage Landscapes (CHL)	3641 Fallowfield Road (part of 1740 Woodroffe Avenue)	Heritage Reference List, NCC Greenbelt
CHR-2	Built Heritage Resources (BHR)	1081 Greenbank Road	None
CHR-3	CHL	3288 Greenbank Road	None
CHR-4	CHL	2191 Woodroffe Avenue (part of 2070 Merivale Road, NCC Greenbelt lands) Royale Equestrian Centre	NCC Greenbelt
CHR-5	CHL	National Capital Greenbelt	NCC Greenbelt



LHC Letourneau Heritage Consulting Inc.

0 0.5 1 2
Kilometers

Study Area

Cultural Heritage Resource, CHR-#

3.3.9 NOISE, AIR QUALITY AND VIBRATION

Existing conditions for noise, air quality, and vibration were assessed within the Study Area, with results summarized below. The full report is available in **Appendix B**.

3.3.9.1 Noise

Environmental noise levels in the Study Area vary based on proximity to high-volume roadways and the VIA Rail corridor. The City of Ottawa's Environmental Noise Control Guidelines (ENCG) (2016) objective level is 55 A-weighted decibel unit (dBA) before noise attenuation should be provided as part of transportation infrastructure projects and mitigation.

Based on the ENCG, the following categories are applicable to describe the existing noise conditions from transportation sources for the Study Area:

- ELEVATED Daytime (daytime equivalent sound energy level) Leq noise levels at receivers are expected to exceed 60 dBA.
- MODERATE Daytime Leq noise levels at receivers are expected to fall in the range of 55 to 60 dBA.
- LOW Daytime Leq noise levels are expected to fall below 55 dBA.

Noise levels throughout the Study Area fall into one of the three above categories. Environmental noise levels are generally moderate to elevated depending on proximity to roadways and railways. Generally, beyond 100m from arterial roadways and 300m from railways, noise levels fall below the ENCG objective level of 55 dBA.

3.3.9.2 Air Quality

In the Study Area, roadway vehicle traffic is the primary source of air-borne pollutants. Emissions from roadway vehicles Carbon Monoxide (CO), Hydrocarbons (HC), Oxides of Nitrogen (NOx) and Particulate Matter (PM), among other volatile organic compounds (VOC), which contribute to ambient air quality levels.

Based on the Ambient Air Quality Criteria (AAQC), recorded ambient levels and land usage within the Study Area, the following categories are applicable to describe air quality conditions from transportation sources in the Study Area:

- ELEVATED Selected pollutants are expected to approach AAQC standards on a regular basis, or occasionally exceed them.
- MODERATE Selected pollutants are expected to approach AAQC standards occasionally.
- LOW Selected pollutants are expected to rarely approach AAQC standards.

Existing conditions found the concentrations of pollutants produced by vehicle and train emissions are low throughout the Study Area.

3.3.9.3 Ground Vibrations and Ground Borne Noise Assessment

Railway traffic and heavy roadway vehicles on uneven terrain can produce perceptible levels of ground vibrations, and incidentally ground-borne noise.

Based on the ground vibration criteria for human perception, the following categories are applicable to describe the existing ground vibrations within the Study Area:

- ELEVATED Vibrations at receptors exceed 1 mm/s (92 dBV) rms particle velocity and are likely to cause adverse reactions with building occupants.
- MODERATE Vibrations at receptors fall between 0.1 mm/s (72 dBV) to 1 mm/s (92 dBV) rms particle velocity and will be noticeable but will not cause adverse reactions in the building occupants.
- LOW Vibrations at receptors fall below 0.1 mm/s (72 dBV) and will not be noticeable to building occupants.

The estimated ground vibration levels are low to moderate throughout the Study Area based on the analysis undertaken as part of the EA study. The highest concentrations of ground vibrations are along the VIA Rail, within 50m of the centerline. Ground-borne noise levels produced by ground vibrations have similar impacts.

3.3.10 INDIGENOUS LAND CLAIMS

The Study Area is within the Algonquins of Ontario land claim area. There is no known current use of lands and/or resources for traditional purposes within the Study Area. Known areas used for traditional fishing include the Rideau River which is more than 3 km east of the Study Area (Algonquins of Ontario, 2014). Potential past use of lands for traditional purposes is described in the Stage 1 Archaeological Assessment found in **Appendix B**.

The negotiators for the Algonquins of Ontario and the Canadian and Ontario Government drafted an Agreement-in-Principle in December 2012. The aforementioned parties signed this non-binding Agreement-in-principle, by the signing, negotiations towards a Final Agreement can begin. Within the revised Agreement-in-Principle (2016) there are land parcels within the Ottawa area identified for potential transfer to the Algonquins of Ontario. There are no identified parcels of land for transfer within the Study Area.

3.4 Natural Environment

This section provides a high-level summary of natural environment features of provincial interest as identified by the PPS (MMAH, 2014), MNRF and City's Official Plan (2013). The full Natural Environment Existing Conditions Report can be found in **Appendix B.** Existing Natural Environment Features are shown in **Figure 3-42**, **Figure 3-43** and **Figure 3-44.**

3.4.1 TERRESTRIAL ENVIRONMENT

The Study Area is mostly comprised of agricultural fields (in the NCC Greenbelt), transit corridors, commercial and residential properties. Small watercourse channels with naturally occurring riparian areas represent a small portion of the Study Area. Mature coniferous plantations and other deciduous woodlands of moderate size are also present within the central portion of the Study Area.

The Study Area is located within the Kemptville Ecodistrict 6E-12. The physiography of this area consists of limestone plain and sandstone bedrock with sand, silt, loam, and clay soils (OMAFRA, 2018); (Henson & Bodribb, 2005). The Study Area occurs close to the northern boundary of the physiographic region between the Russell and Prescott Sand Plains and the Ottawa Valley Clay Flats. Vegetated natural cover within this Ecodistrict is primarily deciduous forest at 37%, where 22% is composed of swamp wetlands (Henson and Brodribb 2015).

The Study Area is located within the Great Lakes-St. Lawrence Forest Region, within the forest section of Upper St. Lawrence. Although the Forest Region is characterized by deciduous forests of sugar maple (*Acer saccharum*), American beech (*Fagus grandifolia*), red maple (*Acer rubrum*), yellow birch (*Betula alleghaniensis*), basswood (*Tilia americana*), and white ash (*Fraxinus americana*) (Rowe, J.S., 1972) to name a few; the Study Area is now highly developed with urban lands and only small, fragmented deciduous woodlots occur.

3.4.1.1 Wildland Fire Risk

Table 3-4 provides a description of forest species composition categorized by wildland fire risk level as described in the Wildland Fire Risk Assessment and Mitigation Reference Manual (Ministry of Natural Resources and Forestry (MNRF), 2017). The risks associated with wildland fire in the Study Area are anticipated to be generally low, with some areas of moderate risk, based on the MNRF's generalized wildland fire hazard data which provides a coarse scale assessment of areas with the greatest potential for risks associated with wildland fire.

The Study Area contains several mixedwood and coniferous communities which present a moderate risk of wildland fire, located within Pinhey Forest. However, these communities may represent a higher risk level based both on forest species composition, age and other available fuel types and factors (i.e., forest density, needle litter accumulation, woody debris, ladder fuels), therefore further fire risk assessment is recommended to confirm.

Potential fire risk forest species communities present in the Study Area include ELC communities: Naturalized Coniferous Hedgerow, Naturalized Coniferous Plantation, Dry-Fresh White Pine Naturalized Coniferous Plantation, Dry-Fresh Red Pine Naturalized Coniferous Plantation, Dry-Fresh Scots Pine Naturalized Coniferous Plantation, Dry-Fresh White Pine-Hardwood Mixed Forest. Detailed ELC results are discussed in **Section 5.1.1**.

Table 3-4 Hazardous Forest Types Characteristic and Risk Level (MNRF, 2017)

Wildland Fire Risk Level	Forest Species Composition
Extreme	• Immature jack pine • Boreal spruce • Black or white spruce • Balsam fir • Immature red, white pine
High	• Mature jack pine • Mixedwood with >50% conifer (jack pine, spruce, balsam fir, immature red or white pine)
Moderate to Low	• Mixedwood forests ranging from 25% (low) to 50% (moderate) conifer composition. • Mature red, white, and Scots pine • Hardwood/deciduous forests composed of maple, birch, oak, poplar, ash etc. • Typically standing cedar, hemlock and tamarack are low risk • Mature red, white and Scots pine with clean or deciduous understory are low risk.

3.4.2 AQUATIC ENVIRONMENT

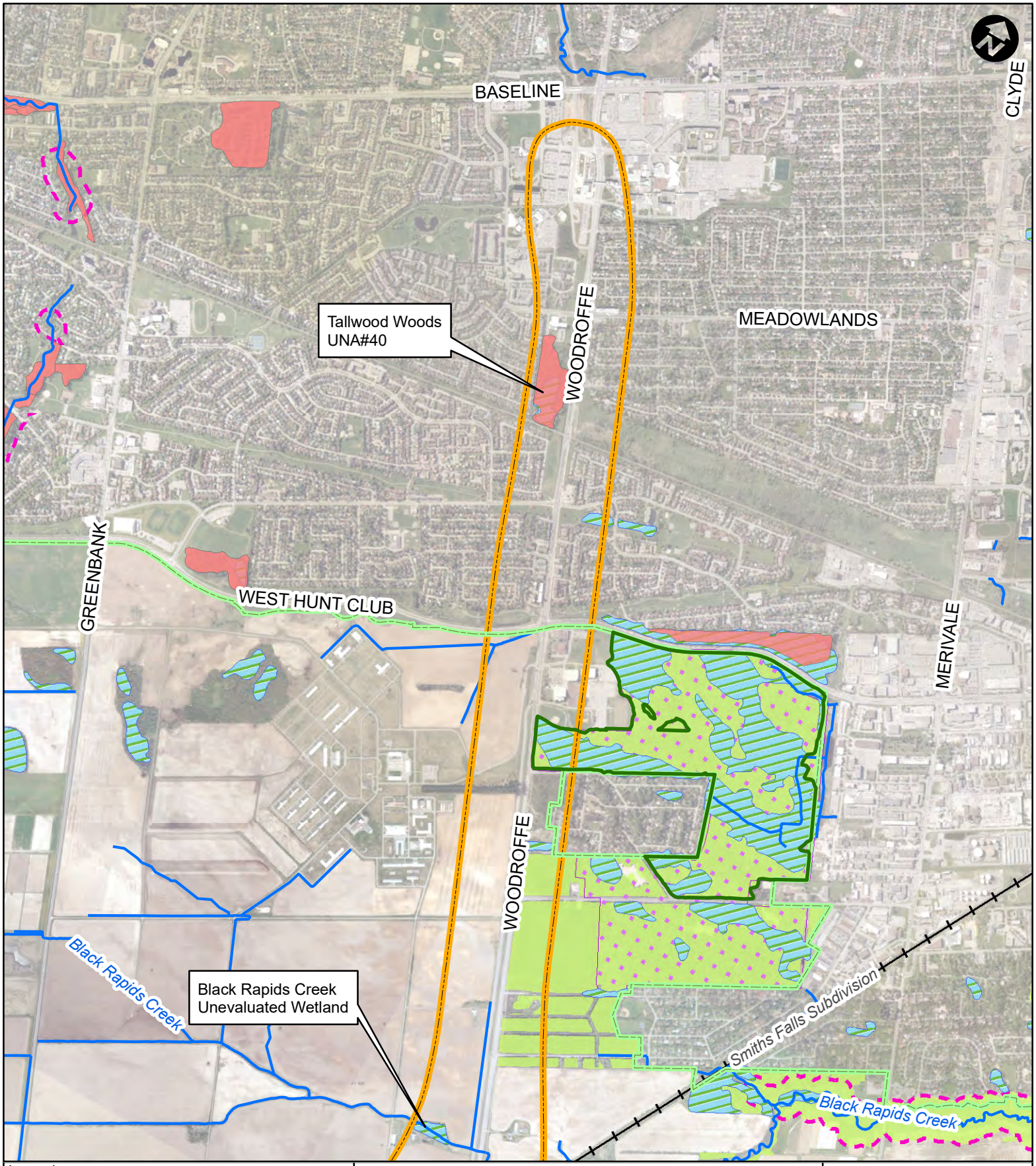
3.4.2.1 Hydrology

The hydrology in the Study Area includes three subwatersheds of the Rideau River and one of the Ottawa River. The Study Area falls primarily within two catchments of the Lower Rideau subwatershed, and partially within the Jock River subwatershed. The Lower Rideau is the most populated and urbanized subwatershed of the Rideau River system as it occupies the confluence of the Rideau and Ottawa Rivers. The Pinecrest Creek catchment area is also present in the Study Area but is part of the Ottawa River West subwatershed and is 17.1 square kilometers (RVCA, 2017).

Water quality within the Lower Rideau subwatershed ranges from good to poor depending on the sampling site and adjacent land uses. There are no surface water features that drain into the catchment areas of Nepean Creek (RVCA, 2012c) and Barrhaven Creek (RVCA, 2012d). Subwatershed catchment areas for the Study Area are listed in Table 3-5 and shown in Figure 3-45 below.

Table 3-5 Rideau River Subwatersheds and Catchment Areas related to the Study Area

Drainage Area	Subwatershed	Catchment Area
Baseline Road to south of Nepean Sportsplex	Ottawa River West	Pinecrest Creek
Nepean Sportsplex to south of Fallowfield Road	Lower Rideau River	Black Rapids Creek
South of Fallowfield Road to south of Berrigan Drive	Lower Rideau River	Barrhaven Creek
South of Berrigan Drive to Jockvale Road	Jock River	Jock River – Barrhaven



Legend

- Study Area
- Watercourse
- Unevaluated Wetlands (City of Ottawa)
- Significant Valleylands
- Pinhey Forest Candidate ANSI, Life Science
- Natural Heritage System (City OP)
- Urban Natural Areas
- Greenbelt Limits 2013 (NCC)
- Significant Woodlands (City of Ottawa 2011)

Barrhaven Light Rail Transit
(Baseline Station to Barrhaven Town Centre)

Planning and Environmental Assessment Study

0 250 500 1,000 Meters

Natural Environment

Ottawa PARSONS

Legend

- Study Area
- Watercourse
- Signficant Woodlands 2011 (City of Ottawa)
- Unevaluated Wetland (City of Ottawa)
- Significant Valleylands
- Pinhey Forest Candidate ANSI, Life Science
- Natural Heritage System (City OP)
- Urban Natural Areas
- Greenbelt Limits 2013 (NCC GBMP)

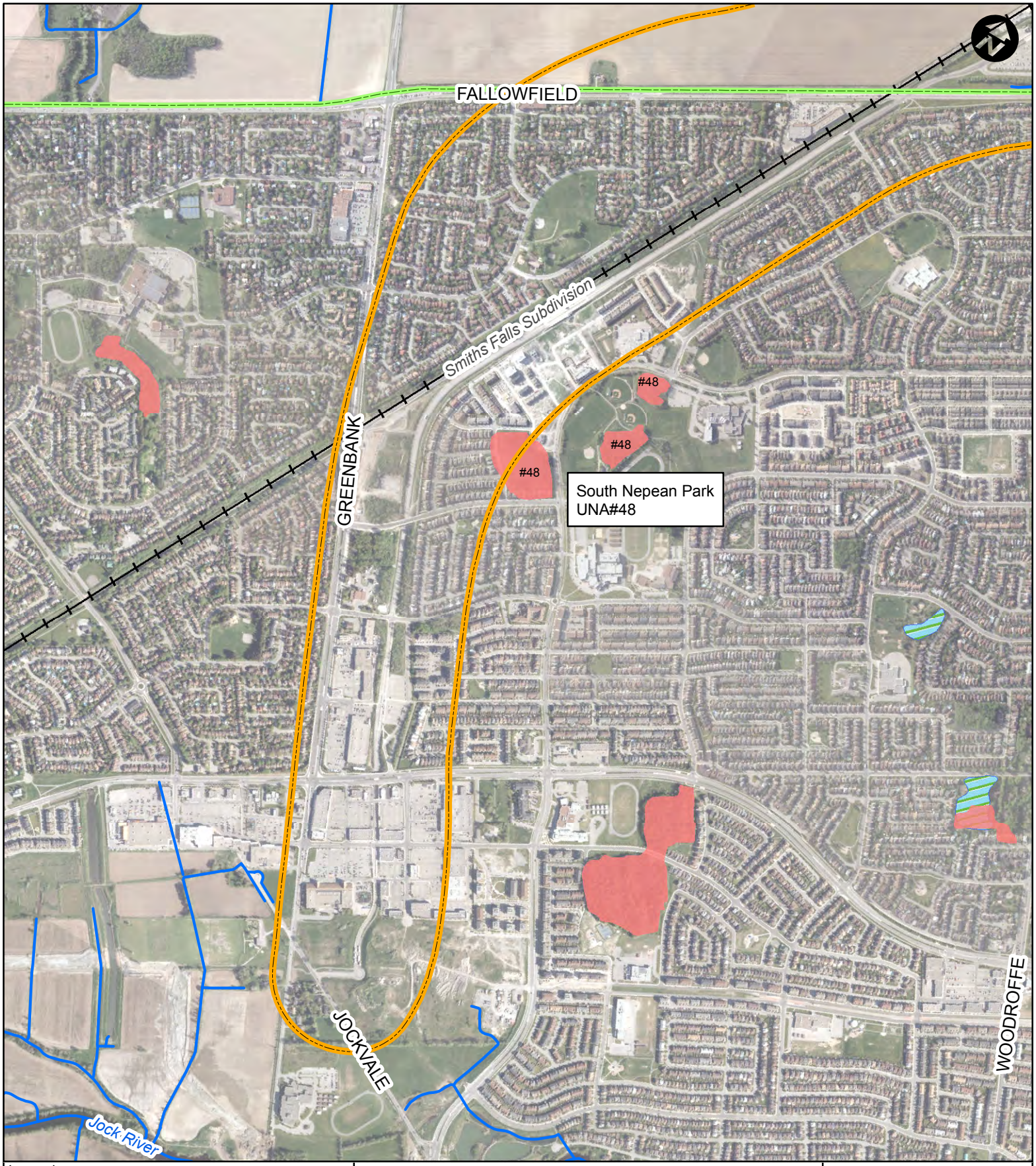
Barrhaven Light Rail Transit
(Baseline Station to Barrhaven Town Centre)

Planning and Environmental Assessment Study

0 125 250 500 Meters

Natural Environment

Ottawa PARSONS



Legend

- Study Area
- Watercourse
- Signficant Woodlands 2011 (City of Ottawa)
- Unevaluated Wetland (City of Ottawa)
- Significant Valleylands
- Natural Heritage System (City OP)
- Urban Natural Areas
- Greenbelt Limits 2013 (NCC GBMP)

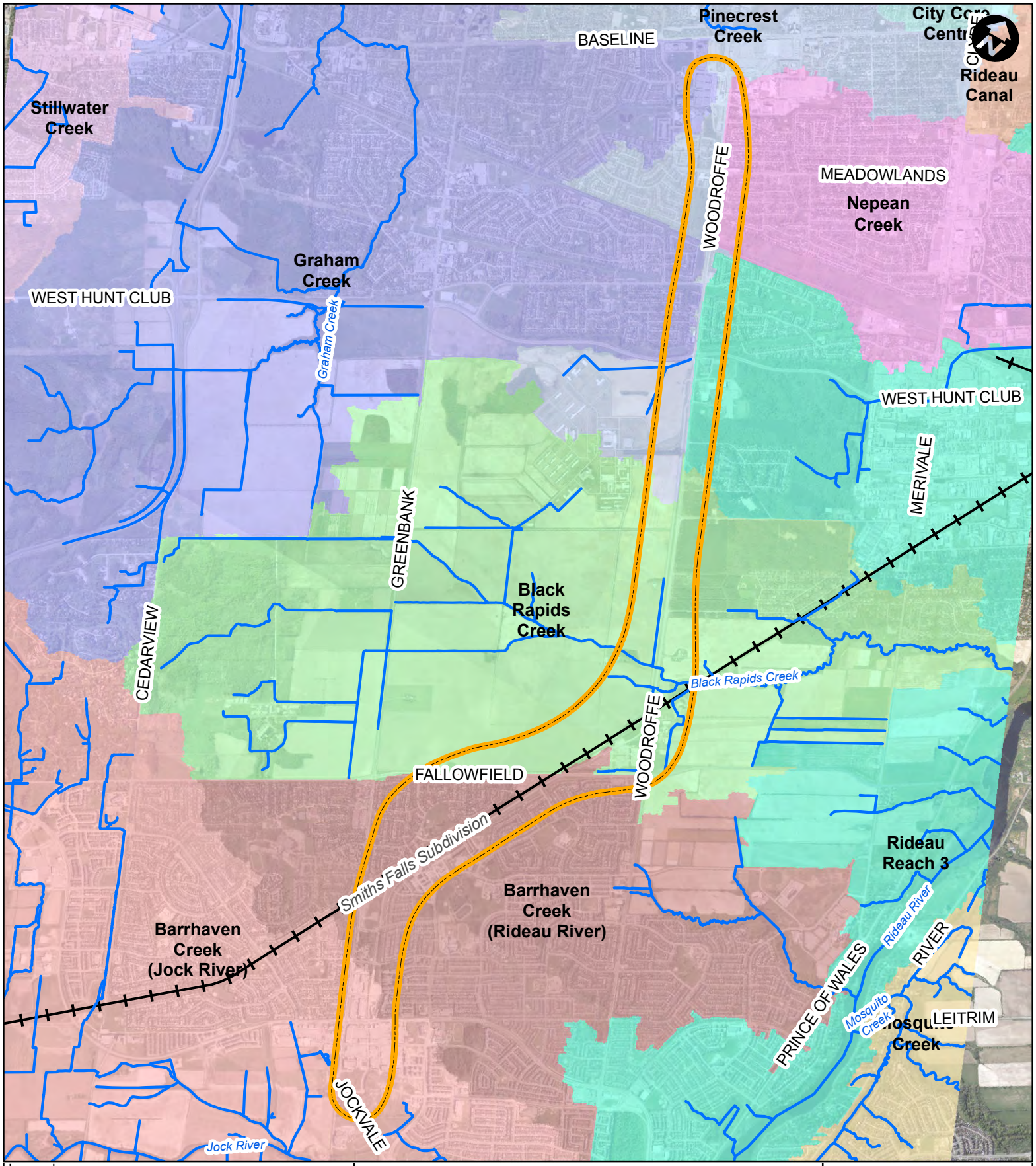
Barrhaven Light Rail Transit
(Baseline Station to Barrhaven Town Centre)

Planning and Environmental Assessment Study

0 125 250 500 Meters

Natural Environment

Ottawa PARSONS



Legend

- Study Area
- Watercourse
- Rail Lines
- Barrhaven Creek
- Barrhaven Creek_
- Black Rapids Creek
- City Core Centre
- Graham Creek
- Mosquito Creek
- Nepean Creek
- Pinecrest Creek
- Rideau Canal
- Rideau Reach 3
- Stillwater Creek

Barrhaven Light Rail Transit
(Baseline Station to Barrhaven Town Centre)

Planning and Environmental Assessment Study

0 0.5 1 2 Km

Subwatershed Catchment Areas

Ottawa PARSONS

3.4.2.2 Surface Water Features

Black Rapids Creek is the only perennial natural watercourse within the Study Area (Figure 3-42). It is approximately 6km long and flows east from its headwaters near Greenbank Road through the NCC Greenbelt to the Rideau River, where it has been identified as an important ecological link for fish and wildlife (RVCA, 2014). It is comprised of two branches (north and south) and crosses both Woodroffe Avenue and the Southwest Transitway. The north branch is approximately 1-3m wide and 10 to 40cm deep. The south branch is approximately one meter wide and 5 to 25cm deep (McCormick Rankin, 1997a). Black Rapids Creek is classified as a cool to warmwater system and permanent water channel (RVCA, 2014).

Surface water quality conditions are monitored through the City of Ottawa's Baseline Water Quality Program. The water quality rating for Black Rapids Creek was "Fair" in 2016 and based on parameters such as nutrients (i.e., total phosphorous, nutrients, and nitrates), E. coli, metals (i.e., aluminum and copper), and additional chemical/physical parameters (i.e., alkalinity, chlorides pH, and suspended solids). To summarize; the nutrients, E. coli, and metals all exceeded guidelines and it was recommended that efforts should be made to reduce contamination to the creek for overall water quality and aquatic life (RVCA, 2012a). However, the Black Rapids Creek Restoration Project began in 2016 and since that time water quality may have improved due to recent enhancements. An updated monitoring/summary report has yet to be released at the time of this review.

3.4.2.3 Fish and Fish Habitat

Black Rapids Creek contains habitat that supports various fish species that have adapted to cool-warmwater systems. It has been classified as habitat primarily for warmwater baitfish in the vicinity of Woodroffe Avenue (RVCA, 2012a), (EcoTec Environmental Consultants, 2003). During the City Stream Watch monitoring activities in 2003, 2008, and 2014; 29 fish species were observed throughout Black Rapids Creek (RVCA, 2012a)(RVCA, 2014) and eight fish species during EcoTec's investigations (2003). Those fish species captured where Black Rapids Creek intersect with Woodroffe Avenue are highlighted in Table 3-6. Mottled sculpin (*Cottus bairdii*) was captured within the south branch of Black Rapids Creek at Woodroffe Avenue.

Table 3-6 Fish Species observed in Black Rapids Creek

Common Name	Scientific Name	RVCA 2012a, 2014	EcoTec 2003
Black crappie	*Pomoxis nigromaculatus*	X	
Blackchin shiner	*Notropis heterodon*	X	
Blacknose shiner	*Notropis heterolepis*	X	
Bluntnose minnow	*Pimephales notatus*	X	X
Brassy minnow	*Hybognathus hankinsoni*	X	
Brook stickleback	*Culaea inconstans*	X	X
Central mudminnow	*Umbra limi*	X	X
Common shiner	*Luxilus cornutus*	X	
Sculpin species	*Cottus spp.*	X	
Creek chub	*Semotilus atromaculatus*	X	X
Carp/Minnow species	*Cyprinid spp.*	X	
Darter species	*Etheostoma spp.*	X	
Fallfish	*Semotilus corporalis*	X	
Fathead minnow	*Pimephales promelas*	X	X
Finescale dace	*Phoxinus neogaeus*	X	X
Largemouth bass	*Micropterus salmoides*	X	
Common logperch	*Percina caprodes*	X	
Longnose dace	*Rhinichthys cataractae*	X	
Mottled sculpin	*Cottus bairdii*	X	

Common Name	Scientific Name	RVCA 2012a, 2014	EcoTec 2003
Northern redbelly dace	*Chrosomus eos*	X	X
Pearl dace	*Margariscus margarita*	X	
Pumpkinseed	*Lepomis gibbosus*	X	
Rock bass	*Ambloplites rupestris*	X	
Slimy sculpin	*Cottus cognatus*	X	
Smallmouth bass	*Micropterus dolomieu*	X	
Tesselated darter	*Etheostoma olmstedi*	X	
Walleye	*Sander vitreus*	X	
White sucker	*Catastomus commersonii*	X	X
Yellow perch	*Perca flavescens*	X	

3.4.3 WETLANDS

Wetlands within Ontario can have varying designations based on whether a wetland has been evaluated as per the Ontario Wetland Evaluation System (OWES). This is the only means of evaluating wetlands within Ontario to determine Provincial Significance and is administered through the MNRF. As such, wetlands can be defined as either provincially significant, other-evaluated, or unevaluated. Provincially Significant Wetlands (PSW) are the most valued and receive protection under the PPS (MMAH, 2014) and the City of Ottawa Official Plan (2013). Any wetlands found in association with significant woodlands, however, are considered part of the City's Natural Heritage System (City of Ottawa, 2013) and must be considered during planning processes. Wetlands on federal lands regardless of provincial significance are subject to the federal policies and the corresponding Canadian Wetland Classification system. The Canadian Wetlands Classification system is discussed further in Section 5.1.5.

3.4.3.1 Provincially Significant Wetlands

No wetlands within the Study Area have been designated as provincially significant and are therefore considered absent from the Study Area.

3.4.3.2 Other-Evaluated Wetlands

No wetlands within the Study Area have been evaluated as per the provincial evaluation system and are therefore considered absent from the Study Area.

3.4.3.3 Unevaluated Wetlands

Unevaluated wetlands are mapped by the MNRF and the City of Ottawa (2011) in the Study Area and are illustrated in Figure 3-42, Figure 3-43 and Figure 3-44. Several small isolated unevaluated wetlands occur throughout and in proximity to the Study Area, including some found in association with the Pinhey Forest Significant Woodland.

The Black Rapids Creek unevaluated wetland occurs on the west side of Woodroffe Avenue and the Southwest Transitway, adjacent to Black Rapids Creek. It occurs on federal lands and as such is subject to the Federal Policy on Wetland Conservation.

One section of Black Rapids Creek (located east of Woodroffe Avenue and south of the VIA Rail) has recently undergone an extensive restoration project due to findings of poor water quality and overall lack of wildlife habitat. The RVCA in collaboration with NCC and the Great Lakes Guardian Community Fund has enhanced and enlarged the wetland to improve water quality, increase biodiversity, and to provide important habitat and movement corridors for flora and fauna. Enhancements include side slopes, woody debris, and re-planting of native vegetation (RVCA, 2018).

3.4.4 NATURAL HERITAGE FEATURES

3.4.4.1 NCC Greenbelt Lands

The NCC Greenbelt consists of farms, forests, and wetlands covering approximately 20,000 hectares (ha) of land within the City of Ottawa and is a mosaic of land uses and facilities. The Study Area includes a large portion of the Greenbelt, specifically, the Southern Farm & Pinhey Forest Sector which includes a large portion of Agricultural Resource Area, Pinhey Forest as well as Black Rapids Creek (Figure 3-2).

Southern Farm/Pinhey Forest became a conservation area in 1948. This tract of land was donated to the NCC to enhance overall forest cover in the watershed, demonstrate forest conservation practices, and for human health. The NCC currently maintains the woodland and the rare post-glacial sand dunes on which it grows (NCC, 2018).

3.4.4.2 Areas of Natural and Scientific Interest

Areas of Natural and Scientific Interest (ANSI) are identified by the MNRF. Pinhey Forest is a Candidate Life Science ANSI within the Study Area (Figure 3-42). This forest contains a rare inland sand dune complex with eastern white pine (*Pinus strobus*) and red pine (*Pinus resinosa*) occurring either naturally in small areas or as large plantations. It extends from Woodroffe Avenue just south of the Nepean Sportsplex to the Grenfell Crescent and Burnbank Street intersection (NCC, 2018). Deciduous swamp forests of red maple and silver maple (*Acer saccharinum*) also occur amongst the dunes and support unique and regionally rare flora which are known to occur in wet acidic sites (MNRF, 2018). Despite historical disturbance to the site and extensive coniferous plantations, the area still hosts rare flora and insect species indicative of exceptional dune elements (MNRF, 2018). As previously noted, this forest is also part of the NCC Greenbelt.

3.4.4.3 Significant Woodlands

Criteria established for Significant Woodlands in the City of Ottawa are defined by the Official Plan (City of Ottawa, 2013) as amended by Official Plan Amendment (OPA) 179. The City identifies one Significant Woodland feature in proximity to the Study Area, within Pinhey Forest. This woodland includes several small areas of unevaluated wetlands which are also part of the City's Natural Heritage System.. The criteria for significance are different for urban and rural (i.e., Greenbelt) policy areas. In consultation with Amy MacPherson at the City, the Study Team was made aware of the change to the criteria and completed the analysis of Significant Woodlands based on the new criteria. Any changes to the status of woodlands within the Study Area as a result of the new policies will be addressed through subsequent stages of the planning process for this project if applicable.

3.4.4.4 Significant Valleylands

The City of Ottawa identifies Significant Valleylands by slopes greater than 15% and a length of more than 50m with water present for some period of the year and are typically, part of the Natural Heritage System (City of Ottawa, 2013).

There are no Significant Valleylands within the Study Area. However, one is present approximately 700m east of the Study Area boundary. This area coincides with Black Rapids Creek to the east of Woodroffe Avenue.

3.4.4.5 Linkage Features

A strong component of the Natural Heritage System incorporates and promotes linkages/corridors to support ecological functions. OPA 150 describes and maps areas that provide linkage opportunities between significant features (City of Ottawa 2013, Schedule L).

OPA 150 identifies land parcels within the NCC Greenbelt, specifically the southern portions of Pinhey Forest and a small wet woodland (unevaluated wetland) on Black Rapids Creek, and beyond the Study Area as wildlife linkage opportunities. The creek corridor has also been designated as a Natural Link within the GMP (National Capital Commission, 2013).

3.4.4.6 Urban Natural Features

The City of Ottawa undertook the Urban Natural Areas Environmental Evaluation Study (UNAEES; (Muncaster and Brunton, 2006) (Muncaster and Brunton, 2005) in conjunction with the Greenspace Master Plan (City of Ottawa, 2006). The purpose

of the UNAEES was to identify woodlands, wetlands and ravines throughout the City of Ottawa urban area and evaluate their environmental significance.

Once the UNAEES was completed, those Urban Natural Areas (UNAs) worthy of protection and/or acquisition were identified using strategic guidelines set forth within the Urban Natural Features Strategy (City of Ottawa, 2007). UNAs identified as priority areas included high and moderate-rated sites, natural features currently in City ownership (including sites with low environmental rating), areas with recognized planning status, and the ability to promote environmental stewardship on privately-owned lands with a low environmental rating (City of Ottawa, 2007). A total of 40 UNAs were re-designated to Urban Natural Features based on this strategy. UNFs are shown on Schedule B of the Official Plan (2013) as land use designations and are included on Schedule L as part of the City's Natural Heritage System.

Two Urban Natural Areas (UNA) are located within the Study Area: Tallwood Woods (UNA #40) and South Nepean Park (UNA #48), both of which have been designated as Urban Natural Features.

Tallwood Woods is approximately 5.4 ha in size and located at the northwest corner where the CN Rail corridor and Woodroffe Avenue meet (**Figure 3-42**). This woodlot has been described as a lowland deciduous forest over substrates of sand and clay. A mature canopy of red maple and sugar maple is present within the central portion of the forest; however, the edge boundary is composed of early successional trees of trembling aspen, white birch, and green ash (*Fraxinus pennsylvanica*) (Muncaster and Brunton, 2005). At the time of the evaluation, no standing or flowing water occurred within the forest. A formal paved pathway bisects the forest along with several informal trails offering recreational opportunities to nearby residents. This greenspace is highly valued and the pathways are well-used by the surrounding community (MacPherson, Amy, November 2018). It received an overall ecological rating of "Moderate" due to habitat maturity that potentially supports uncommon flora and fauna, and for its aesthetic value within an urban landscape (Muncaster and Brunton, 2005).

South Nepean Park is approximately 5.5 ha and located southwest of Fallowfield Road and the VIA Rail corridor **Figure 3-44**. Three isolated disturbed forest units occur amongst a recreational park and have been described as disturbed upland deciduous forests with a canopy of white elm (*Ulmus americana*), green ash, and sugar maple. The understorey is densely occupied by buckthorn species limiting natural diversity. It received an overall ecological rating of "Low" due to urban disturbances and lack of biodiversity, connectivity, and wildlife habitat (Muncaster and Brunton, 2006). As a City-owned natural area, however, it was preserved and integrated into the greenspace network for the developing Longfields community.

One of the three forest units, known locally as Highbury Woods is located along the edge of the Study Area.

3.4.4.7 Official Plan Designations

Land use designations for the Study Area are discussed in **Section 3.3.1.3.1**. Designations specific to natural heritage features include: Natural Environment Area, Agricultural Resource Area, Greenbelt Rural, Major Open Space and Urban Natural Features. These are briefly described below and shown in **Figure 3-3**.

3.4.4.7.1 Natural Environment Area

Natural Environment Areas are lands that hold a high environmental value assessed through either federal, provincial, and/or municipal studies. Lands with such a designation contain components of wetlands, significant woodlands, and wildlife habitat and are of most significance within the City as they maintain biodiversity and ecological functions. Natural Environment Areas within the Greenbelt were identified by the NCC. Designated lands are protected and preserved to ensure the inherent function of natural features (Section 3.2.2; City of Ottawa, 2013).

Black Rapids Creek and Pinhey Forest have been designated as a Natural Environment Area.

3.4.4.7.2 Agricultural Resource Area

To protect this resource for future generations, the City limits development in prime agricultural areas (Section 3.7.3; City of Ottawa, 2013). Agricultural Resource Areas may also support valuable habitat for wildlife, including some species at risk, depending upon their use and management.

Prime agricultural lands are present in the Study Area west of Woodroffe Avenue.

3.4.4.7.3 Greenbelt Rural

This designation is part of the greater Greenbelt policy but has specific policy activities for farming, forestry, recreation, and small-scale commercial uses directly related to rural activities within the Greenbelt (Section 3.5.1; City of Ottawa, 2013).

The pine plantation within Pinhey Forest is designated Greenbelt Rural lands within the Study Area.

3.4.4.7.4 Urban Natural Features

Tallwood Woods (UNA # 40) and South Nepean Park (UNA #48) have been designated as urban natural features in the Study Area (Section 3.2.3; City of Ottawa, 2013). This designation contributes to biodiversity and wildlife habitat in the urban area.

3.4.4.7.5 Major Open Space

Major open space areas are a key component of the Greenspace Network which also contributes to neighbourhood quality of life and the overall integrity of the natural environment (Section 3.3.1; City of Ottawa, 2013). A linear stretch of major open space area is present in the Study Area north of the Canadian National (CN) Railway and Medhurst Drive on the east side of Woodroffe Avenue, across from Tallwood Woods as well as along the north side of West Hunt Club Road. The non-wooded portions of South Nepean Park are also designated as Major Open Space.

3.4.4.8 Other

One natural heritage feature that the MNRF classifies only as a "Life Science Site" is located within the Study Area (**Figure 3-42**). The footprint of this feature is similar to that of Tallwood Woods, located within the northwest section of the Study Area. MNRF describes this feature as a disturbed lowland deciduous forest with occurrences of red maple, yellow birch, black ash (*Fraxinus nigra*), white cedar (*Thuja occidentalis*), and white elm on Clay Plain (MNRF, 2018).

3.4.5 SPECIES AT RISK AND SPECIES OF CONSERVATION CONCERN

A review of online resources and personal communication (e.g., wildlife atlas records, NHIC database, A. MacPherson, 2018) identified 27 species at risk (SAR) with current occurrence records (≤ 30 years) that exist in the vicinity of the Study Area either within 1km (as per NHIC and A. MacPherson 2018) or 10km (as per wildlife atlas records; **Table 3-7**). S-Ranks are a provincial status used by the NHIC to set protection priorities for rare species and is based on the number of occurrences in Ontario. The MNRF tracks species with S1 to S3 (vulnerable to critically imperiled) designations and are considered Species of Conservation Concern. SAR potential will be confirmed following completion of focused field studies detailed in a subsequent section of the Environmental Study Report: Update to Existing Conditions (**Section 5.1.4**).

Table 3-7 SAR and Species of Conservation Concern Wildlife Records for the Study Area

Common Name	Scientific Name	S-Rank[1]	ESA Status[2]	SARA (Schedule 1) Status[3]
PLANTS				
Butternut	*Juglans cinerea*	S2?	Endangered	Endangered
INSECTS				
Monarch	*Danaus plexippus*	S2N, S4B	Special Concern	Special Concern
REPTILES				
Blanding's Turtle	*Emydoidea blandingii*	S3	Threatened	Threatened
Northern Map Turtle	*Graptemys geographica*	S3	Special Concern	Special Concern
Snapping Turtle	*Chelydra serpentina*	S3	Special Concern	Special Concern
Eastern Milksnake	*Lampropeltis triangulum*	S4	Not at Risk	Special Concern
BIRDS				
Black-crowned Night-heron	*Nycticorax nycticorax*	S3B, S3N	No status	No status
Peregrine Falcon	*Falco peregrinus*	S3B	Special Concern	Special Concern
Short-eared Owl	*Asio flammeus*	S2N, S4B	Special Concern	Special Concern
Common Nighthawk	*Chordeiles minor*	S4B	Special Concern	Threatened
Chimney Swift	*Chaetura pelagica*	S4B, S4N	Threatened	Threatened

Common Name	Scientific Name	S-Rank[1]	ESA Status[2]	SARA (Schedule 1) Status[3]
Eastern Wood-pewee	*Contopus virens*	S4B	Special Concern	Special Concern
Purple Martin	*Progne subis*	S3S4B	No status	No status
Bank Swallow	*Riparia riparia*	S4B	Threatened	Threatened
Barn Swallow*	*Hirundo rustica*	S4B	Threatened	Threatened
Wood Thrush	*Hylocichla mustelina*	S4B	Special Concern	Threatened
Grasshopper Sparrow	*Ammodramus savannarum*	S4B	Special Concern	Special Concern
Bobolink	*Dolichonyx oryzivorus*	S4B	Threatened	Threatened
Eastern Meadowlark	*Sturnella magna*	S4B	Threatened	Threatened
MAMMALS				
Little Brown Myotis	*Myotis lucifugus*	S4	Endangered	Endangered
Northern Myotis	*Myotis septentrionalis*	S3	Endangered	Endangered
FISH				
Northern Brook Lamprey	*Ichthyomyzon fossor*	S3	Special Concern	Special Concern
Bridle Shiner	*Notropis bifrenatus*	S2	Special Concern	Special Concern
River Redhorse	*Moxostoma carinatum*	S2	Special Concern	Special Concern
Greater Redhorse	*Moxostoma valenciennesi*	S3	No status	No status
Channel Darter	*Percina copelandi*	S2	Special Concern	Threatened

* Species downlisted prior to finalizing EPR. Special Concern under provincial ESA as of January 25, 2023

Status Source:
[1]S-Rank (MNRF 2017)

S1: Critically Imperiled – Critically imperiled in the nation or state/province because of extreme rarity (often 5 or fewer occurrences) or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the state/province.
S2: Imperiled – Imperiled in the nation or state/province because of rarity due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the nation or state/province.
S3: Vulnerable – Vulnerable in the nation or state/province due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation.
S4: Apparently Secure – Uncommon but not rare; some cause for long-term concern due to declines or other factors.
S5: Secure – Common, widespread, and abundant in the nation or state/province.
SNA: Not Applicable – A conservation status rank is not applicable because the species is not a suitable target for conservation activities.
S#S#: Range Rank – A numeric range rank (e.g., S2S3) is used to indicate any range of uncertainty about the status of the species or community. Ranges cannot skip more than one rank (e.g., SU is used rather than S1S4).
SR or ? - Recorded within a nation or subnation, but local status not available or not yet determined. When combined with a global rank of G1 to G3, local status is 'Indeterminate,' but the entity is nevertheless presumed vulnerable, if still extant.
N – rank for non-breeding populations in the province.
B – rank for breeding populations in the province.

[2]**ESA** (Endangered Species Act) Status (MNRF 2018)
[3]**SARA** (Species at Risk Act) Status (federal status - listed) (Government of Canada, 2018)
Extinct - A species that no longer exists anywhere.
Extirpated (EXT) - Lives somewhere in the world, and at one time lived in the wild in Ontario, but no longer lives in the wild in Ontario.
Endangered (END) - Lives in the wild in Ontario but is facing imminent extinction or extirpation.
Threatened (THR) - Lives in the wild in Ontario, is not endangered, but is likely to become endangered if steps are not taken to address factors threatening it.
Special Concern (SC) - Lives in the wild in Ontario, is not endangered or threatened, but may become threatened or endangered due to a combination of biological characteristics and identified threats.
Not at Risk (NAR) - A species that has been evaluated and found to be not at risk.
Data Deficient (DD) - A species for which there is insufficient information for a provincial status recommendation.

3.5 Physical Environment

The physical environment is documented through several varying studies including an agricultural assessment, geotechnical report and a Phase I Environmental Site Assessment (ESA).

3.5.1 SOIL SERIES

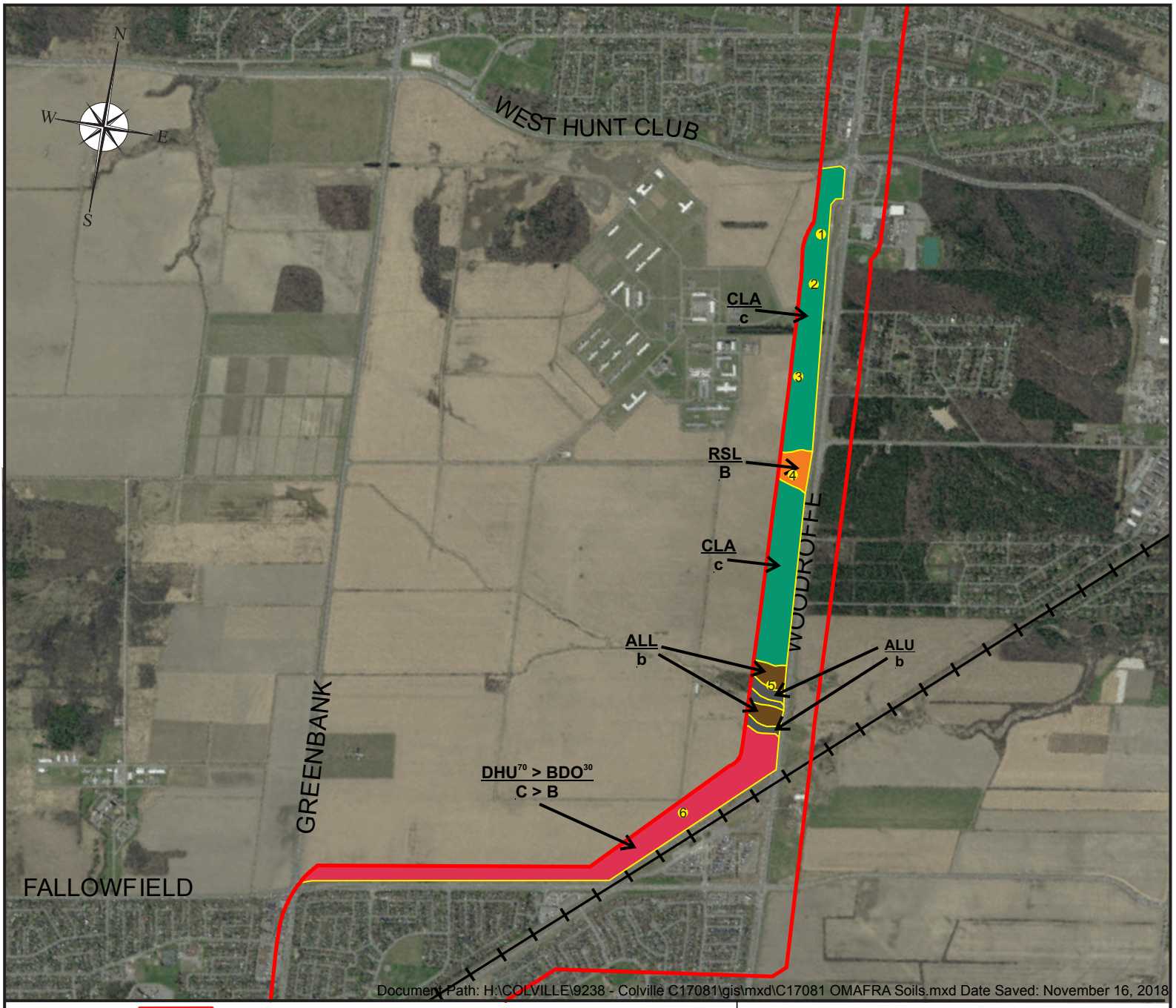
An Agricultural Assessment for the Study Area was undertaken to support the study. The full report is included in **Appendix B**. Detailed soil surveys confirmed the presence of Carlsbad, Ramsayville, Dalhousie, Brandon, Allendale and Alluvial soils within the Study Area (**Figure 3-46**).

Canada Land Inventory (CLI) capability rating indicates that the Study Area has a mix of prime and non-prime agricultural lands with CLI capability ratings of CLI Class 2, 3, 4 and 5 (descending in quality from Class 1 having no limitations and is

absent from the Study Area) (Table 3-8) (Figure 3-47). Approximately 44.04% of the lands within the Study Area consist of prime agricultural lands (CLI Classes 2 and 3).

Table 3-8 CLI Capability Ratings for the Study Area

Soil Series	Area (Ha)	% of Study Area	CLI Capability Class
Carlsbad	30.18	48.57	4
Dalhousie	16.86	27.14	2
Brandon	7.35	11.83	3
Allendale	3.15	5.07	3
Ramsayville	2.90	4.67	4
Alluvial	1.70	2.74	5



Legend

Study Area

Soil Boundary

1 Soil Sample Location

Soil Symbol

Soil Name → **ALL** / **b** ← Slope

Soil Series

Soil Symbol

Soil Name → **DHU70 > BDO30** ← Percent

C > B ← Slope

DHU Dalhousie: imperfectly drained and consists of soils developed in fine-textured, modified marine materials.

BDO Brandon: poorly drained and found in combination with Dalhousie series, on level to very gently sloping topography.

CLA Carlsbad: well drained member of the Uplands association and developed from marine and estuarine deposition medium to fine grained sands.

RSL Ramsayville: imperfectly drained and developed from marine and estuarine deposition medium to fine grained sands. Soils has a higher groundwater table found in upper metre of soil.

ALL Allendale sandy loam: poor drainage and consists of water-laid sand over clay.

ALU Alluvial: variable drainage and soil textures and consist of finer textured sediments.

Figure 3-46 Refined Soil Series Mapping

Scale 1:28,000

Metres

50 00 280 500

SLOPE CLASSES(%)

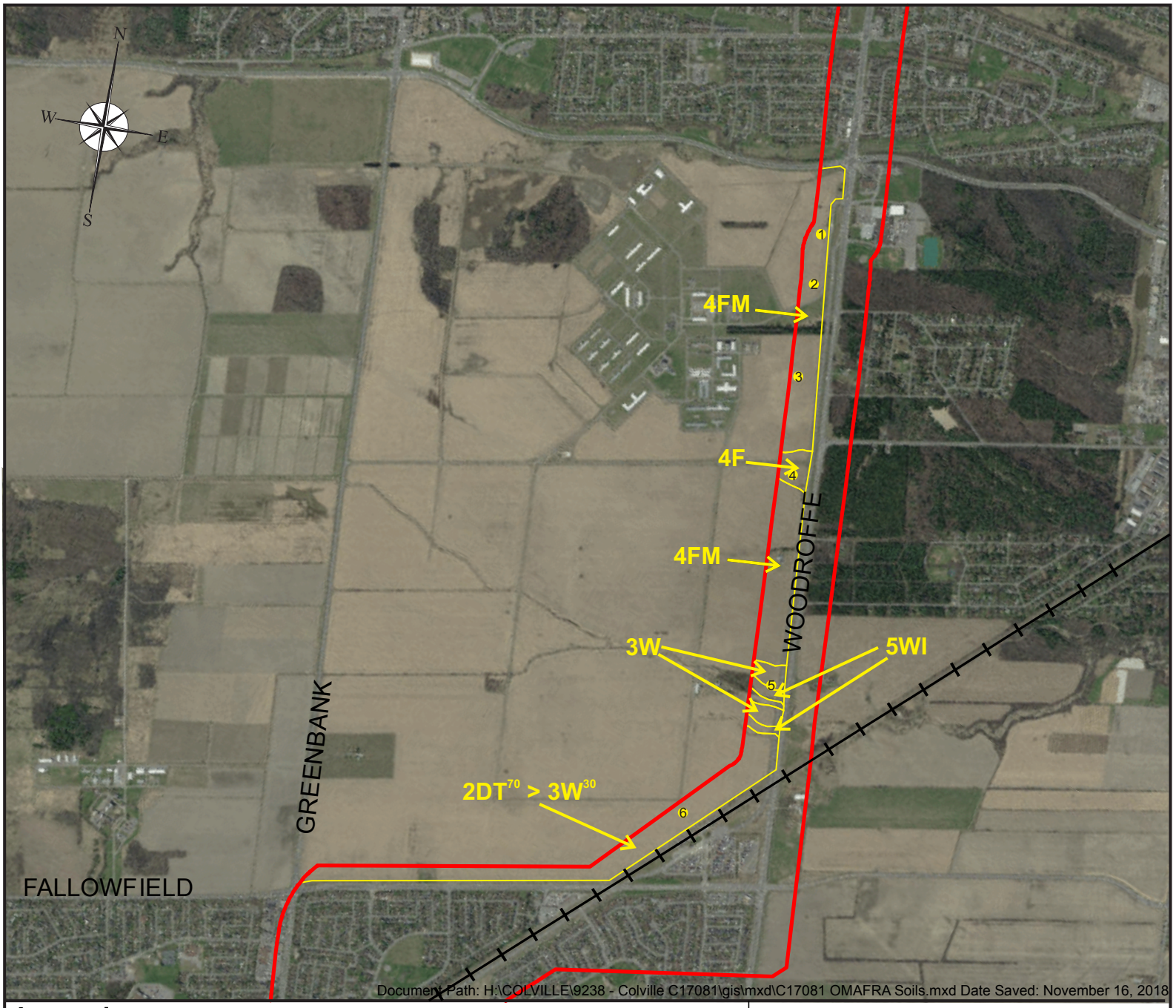
A a Level slopes (0.0 - 0.5%)
B b Nearly level slopes (0.5 - 2.0%)
C c Very Gentle slopes (2.0 - 5.0%)
D d Gentle slopes (5 - 9%)
E e Moderate slopes (9 - 15%)
F f Strong slopes (15 - 30%)
Gg Steep slopes (30 - 45%)

Simple Slopes (uniform, lengths > 50 metres) denoted in upper case
Complex Slopes (short, irregular slopes) denoted in lower case

Prepared for: PARSONS

Prepared by: COLVILLE CONSULTING INC.

Revised: December 4, 2018 FILE: C17081



Legend

Soil Classification

CLI Class 2 - Soils in this class have moderate limitations that restrict the range of crops or require moderate conservation practices.

CLI Class 3 - Soils in this class have moderately severe limitations that restrict the range of crops or require special conservation practices.

CLI Class 4 - Soils in this class have severe limitations that restrict the range of crops or require special conservation practices.

CLI Class 5 - Soils have very severe limitations that restrict their capability in producing perennial forage crops, and improvement practices are feasible.

Soil Classification Subclass

W Excess Water - limitations for agriculture due to poor drainage; improvements not feasible.

T Topography - limitations from both the percent of slope and the pattern or frequency of slopes in different directions.

F Low Fertility - soils having low fertility; limitations may be due to lack of plant nutrients.

M Moisture Limitations - this consists of soils where crops are affected by drought owing to inherent soil characteristics.

D Undesirable soil structure and/or low permeability.

I Inundation by streams or lakes; soils subjected to inundation.

Figure 3-47
Refined Soil Series CLI Mapping

Scale 1:28,000

50 00 280 500 Metres

Soil Symbol

Soil Classification → 4T ← Subclassification

Primary Study Area

Soil Boundary

1 Soil Sample Location

Prepared for: PARSONS

Prepared by: COLVILLE CONSULTING INC.

Revised: December 17, 2018 FILE: C17081

3.5.2 SUBSURFACE CONDITIONS

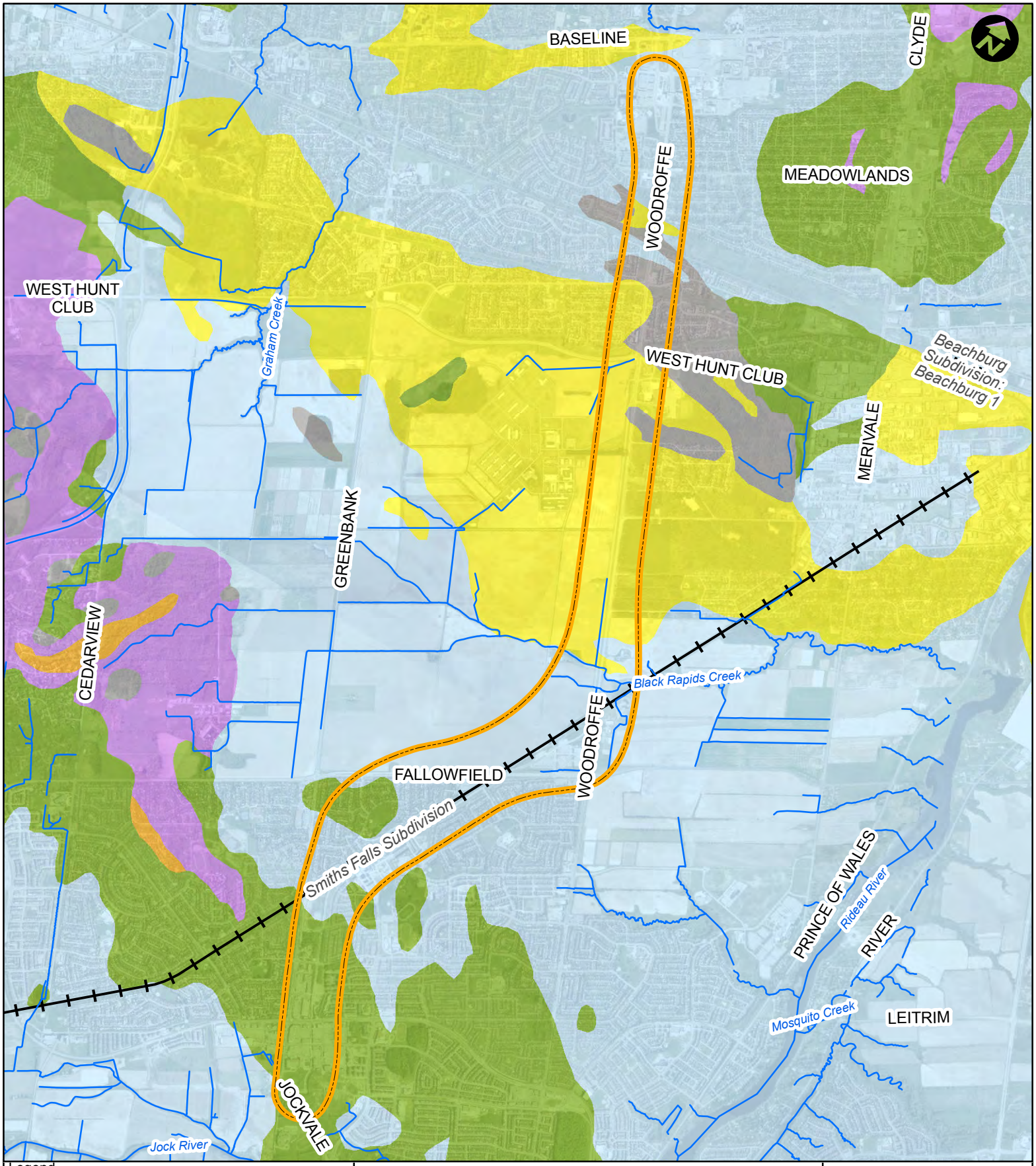
A geotechnical report was undertaken to characterize the subsurface conditions for the Study Area. The full report is included in **Appendix B**. More detailed geotechnical investigations are described in **Section 5.2**.

The general stratigraphic sequence in the Study Area typically consists of fill or topsoil, overlying sensitive marine clays, underlain by sands and silts, glacial till, and bedrock. Not all of these deposits are present at all locations, but all units are mapped within the Study Area.

Surficial geology in the Study Area is shown in **Figure 3-48**. Surficial geology maps indicate the occasional presence of organic deposits, like peat, between Norice Street and Vaan Drive. However, organic deposits have not been encountered in boreholes put down in this area as completed for different projects, with the exception of surficial topsoil or thin layers of topsoil beneath fill. Large portions of the Study Area are also underlain by deposits of offshore marine clay. The upper few metres of the clay deposit is typically weathered to form a stiff to very stiff crust. The underlying unweathered grey clay is typically of firm consistency, but is occasionally soft, very sensitive to disturbance, and is highly compressible. Throughout the Study Area, deposits of glacial till exist beneath the sands, silts, and clays, or near the ground surface between Berrigan Drive and Jockvale Road. The glacial till typically consists of a heterogeneous mixture of gravel, cobbles, and boulders in a matrix of silty sand or sandy silt. Lenses and layers of more permeable sand and gravel outwash deposits can be found within the glacial till. Cobbles and boulders are also frequently encountered within the glacial till deposit.

Bedrock Geology in the Study Area is shown in **Figure 3-49**. The bedrock throughout most of the Study Area consists of sedimentary sequences of sandstone, dolostone, and limestone of Rockcliffe, Oxford, and March Formations.

The thickness of the overburden varies over the Study Area as shown in **Figure 3-50**. The depth to bedrock varies significantly throughout the Study Area. Geological mapping indicates that the bedrock depth varies from about 10 to 25m between Navaho Drive and VIA Rail and decreases to about 3 to 10m between VIA Rail and Strandherd Drive. South of Strandherd Drive, the bedrock depth is indicated to increase again and range from about 10 to 25m. The depth to bedrock encountered in boreholes is generally consistent with the published geological mapping. However, between Elm Park Avenue and Berrigan Drive, completed for a different project, it was learned that auger refusal was encountered as shallow as 0.4m below ground surface, and rock outcrops are visible at ground surface.



Legend

- Study Area
- Watercourse
- Rail Lines
- Paleozoic Bedrock
- Clay
- Diamicton
- Gravel
- Organic deposits
- Sand

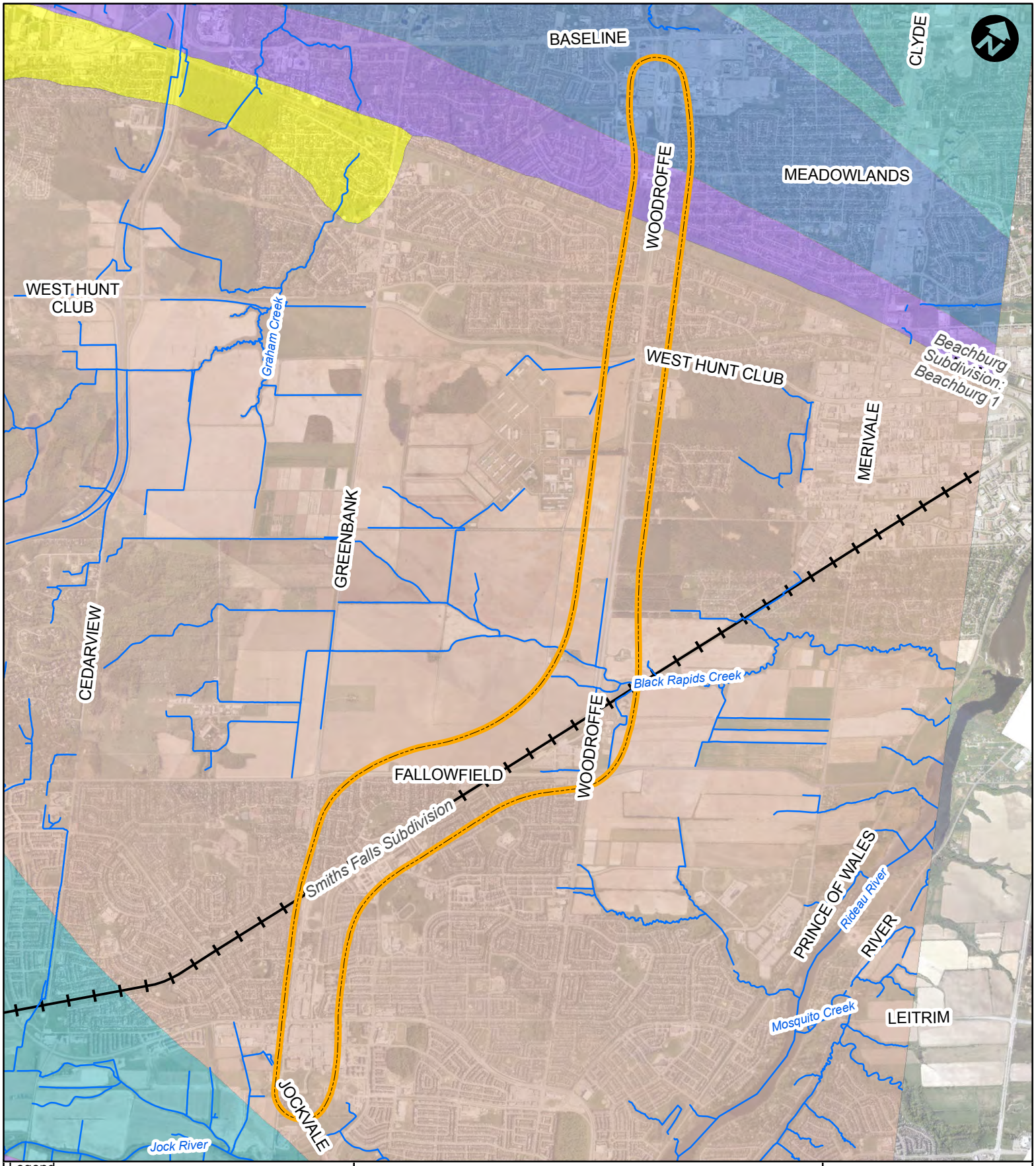
Barrhaven Light Rail Transit
(Baseline Station to Barrhaven Town Centre)

Planning and Environmental Assessment Study

0 0.5 1 2 Km

Surficial Geology

Ottawa PARSONS



Legend

- Study Area
- Watercourse
- Rail Lines
- Dolomite
- Limestone & Dolomite interbeds
- Sandstone
- Sandstone & Dolomite interbeds
- Shale

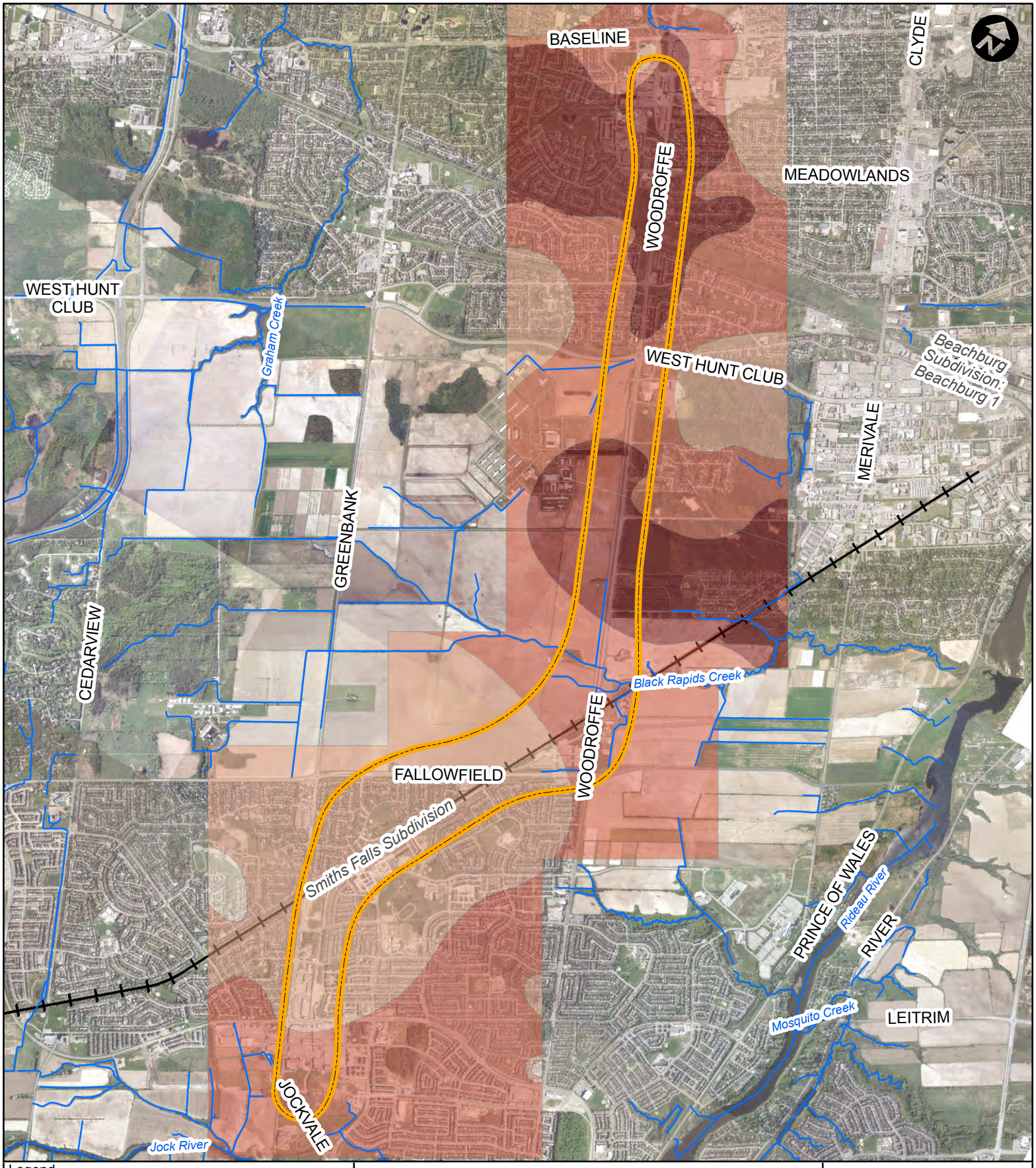
Barrhaven Light Rail Transit
(Baseline Station to Barrhaven Town Centre)

Planning and Environmental Assessment Study

0 0.5 1 2 Km

Bedrock Geology

Ottawa PARSONS



Legend

- Study Area
- Watercourse
- Less than 1 m
- 1 m to 8 m
- 8 m to 15 m
- Greater than 15 m

Barrhaven Light Rail Transit
(Baseline Station to Barrhaven Town Centre)

Planning and Environmental Assessment Study

0 0.5 1 2 Km

Drift Thickness

Ottawa PARSONS

3.5.3 FLUVIAL GEOMORPHOLOGY

Fluvial Geomorphic and Hydrologic existing conditions were characterized for the Study Area. The full report is included in **Appendix B**. More detailed geotechnical investigations are described in **Section 5.3**.

There are six (6) watercourse or drainage features within the Study Area. The channels of four of these features cross the existing Southwest Transitway, while the channels of the two others will traverse in close proximity (referred to as 'proximity watercourses'). The features are described in **Table 3-9** and shown in **Figure 3-51** and **Figure 3-52**.

Figure 3-51 Overview of Watercourse and Drainage Feature Crossings

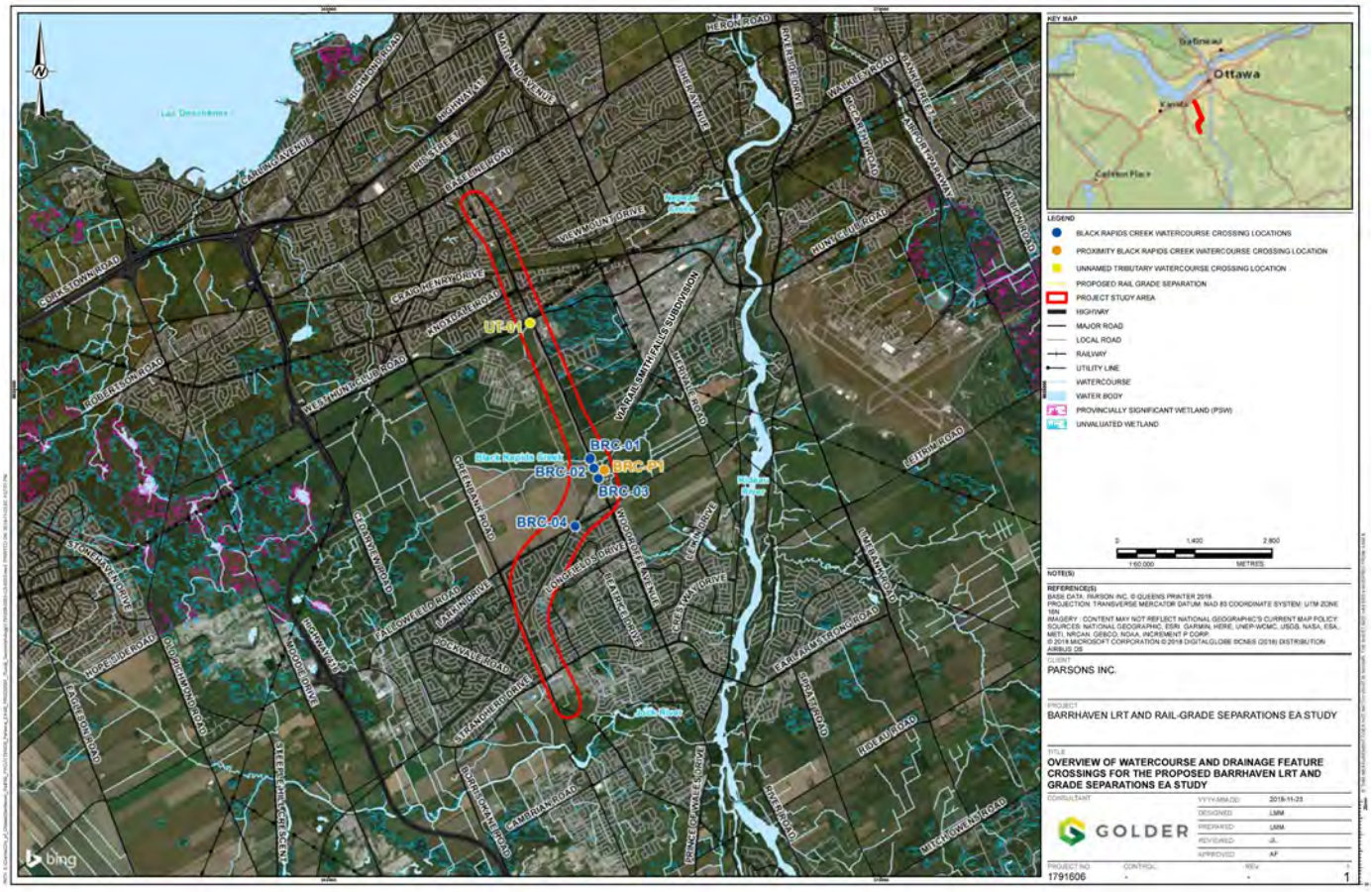


Figure 3-52 Watercourse and Drainage Feature Crossings Near the Intersection of Fallowfield Road and Woodroffe Avenue

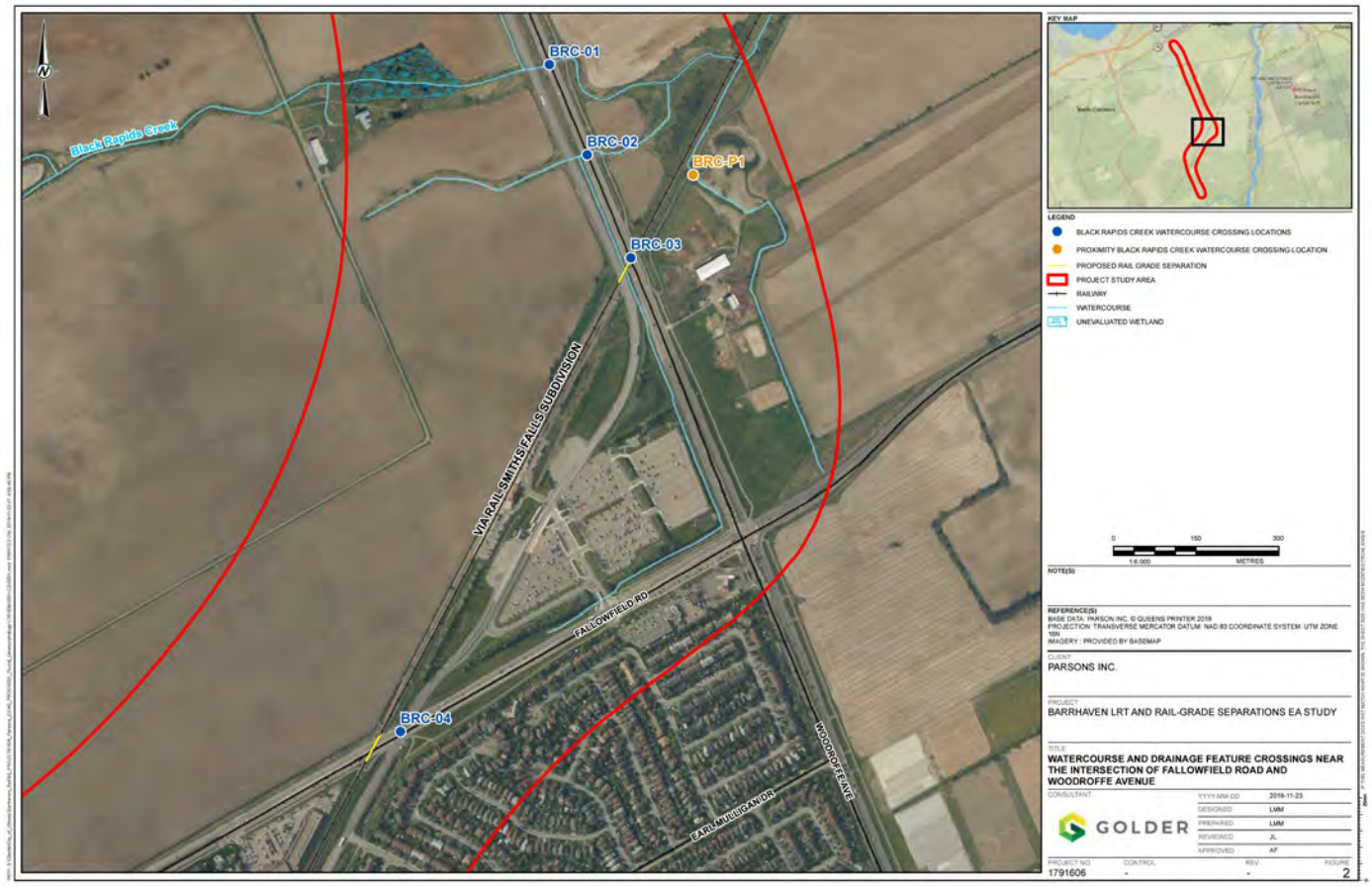


Table 3-9 Summary of Existing Fluvial Geomorphic and Hydrologic Conditions at Watercourse Crossings

General Location	Crossing	General Description of Channel Morphology and/or Water Feature Conditions	Presence or Absence of Crossing Structures Along Channel Reach	*Estimated Bankfull Width (m)	Riparian Conditions	Estimated Drainage Area (hectares)	**Mean Annual Flow (m^3/s)
West Hunt Club & Woodroffe	UT-01	Small unnamed watercourse or drainage feature (potential tributary of Nepean Creek) that supports ephemeral to intermittent flows and altered/engineered channel form (e.g., ditch feature of low sinuosity) Channel inferred to include poorly-defined bed and banks Channel expected to be crossed by the Project Anticipated to drain in a north-easterly direction	Possible Corrugated Steel Pipe (CSP) culvert under roads	2	Dense cover of grasses with instances of shrubs and small trees	60	0.01
Woodroffe Rail Crossing	BRC-01	Black Rapids Creek (tributary of Rideau River) Small to medium sized watercourse that supports perennial flows and a combination of natural and altered/engineered channel form Channel inferred to include well defined bed and banks and alluvial controls Channel expected to be crossed by the Project	Concrete box culverts under Woodroffe Avenue and pedestrian/cycling bridge at Greenbelt Pathway	10	Dense cover of grasses, shrubs and small trees, with instances of riprap armouring	Up to 800	0.098
	BRC-02	Small watercourse or drainage feature (tributary of Black Rapids Creek) that supports perennial flows and a combination of natural and altered/engineered channel form (e.g., agricultural ditch of low sinuosity) Channel inferred to include poor to moderately defined bed and banks and alluvial controls Channel expected to be crossed by the Project	Concrete box culverts under Woodroffe Avenue and pedestrian/cycling bridge at Greenbelt Pathway	10	Dense cover of grasses, shrubs and small trees, with instances of riprap armouring	230	0.027
	BRC-03	Small watercourse or drainage feature (tributary of Black Rapids Creek) that supports intermittent flows and altered/engineered channel form (e.g., roadside ditch of low sinuosity) Channel inferred to include poorly-defined bed and banks Channel is currently crossed by the VIA Rail and is expected to be in close proximity to the Project Anticipated to drain generally south to north	Possible Corrugated Steel Pipe (CSP) culvert under the VIA Rail	2	Dense cover of grasses with instances of gravel and/or paved areas	80	0.01
	BRC-P1	Small watercourse or drainage feature (potential of Black Rapids Creek) that supports intermittent flows and a combination of natural and altered/engineered channel form (i.e., channel upstream of the crossing appears to have been straightened) Channel inferred to include poor to moderately defined bed and banks and alluvial controls Channel expected to be in close proximity to the Project Anticipated to drain generally south to north	CSP culvert under pedestrian/cycling bridge at Greenbelt Pathway	5	Dense cover of grasses, shrubs and small trees, with instances of rip rap armouring	100	0.013

Fallowfield VIA Rail Crossing	BRC-04	Small watercourse or drainage feature (tributary of Black Rapids Creek) that supports intermittent flows and altered/engineered channel form (e.g., ditch feature of low sinuosity) Channel inferred to include poorly-defined bed and banks Channel is currently crossed by the VIA Rail and is expected to be crossed by the Project Anticipated to drain generally south to north	Concrete box culvert under Fallowfield Road	5	Dense cover of grasses with some shrubs and trees at locations upstream of the crossing	Up to 100	Up to 0.013

BRC = Black Rapids Creek; UT = Unnamed Tributary; m^3/s = cubic metres per second.

* Bankfull width estimated based on aerial imagery

** Annual Mean Flow derived using the Ministry of Natural Resources and Forestry (MNRF) Ontario Flow Assessment Tool (OFAT)

3.5.4 HYDROGEOLOGY

Groundwater in the area of the Southwest Transitway and Woodroffe Avenue VIA Rail crossing is approximately 4 to 5m below surface (McCormick Rankin, 1997). Groundwater between Baseline Station and West Hunt Club ranges between 2-6m below ground surface.

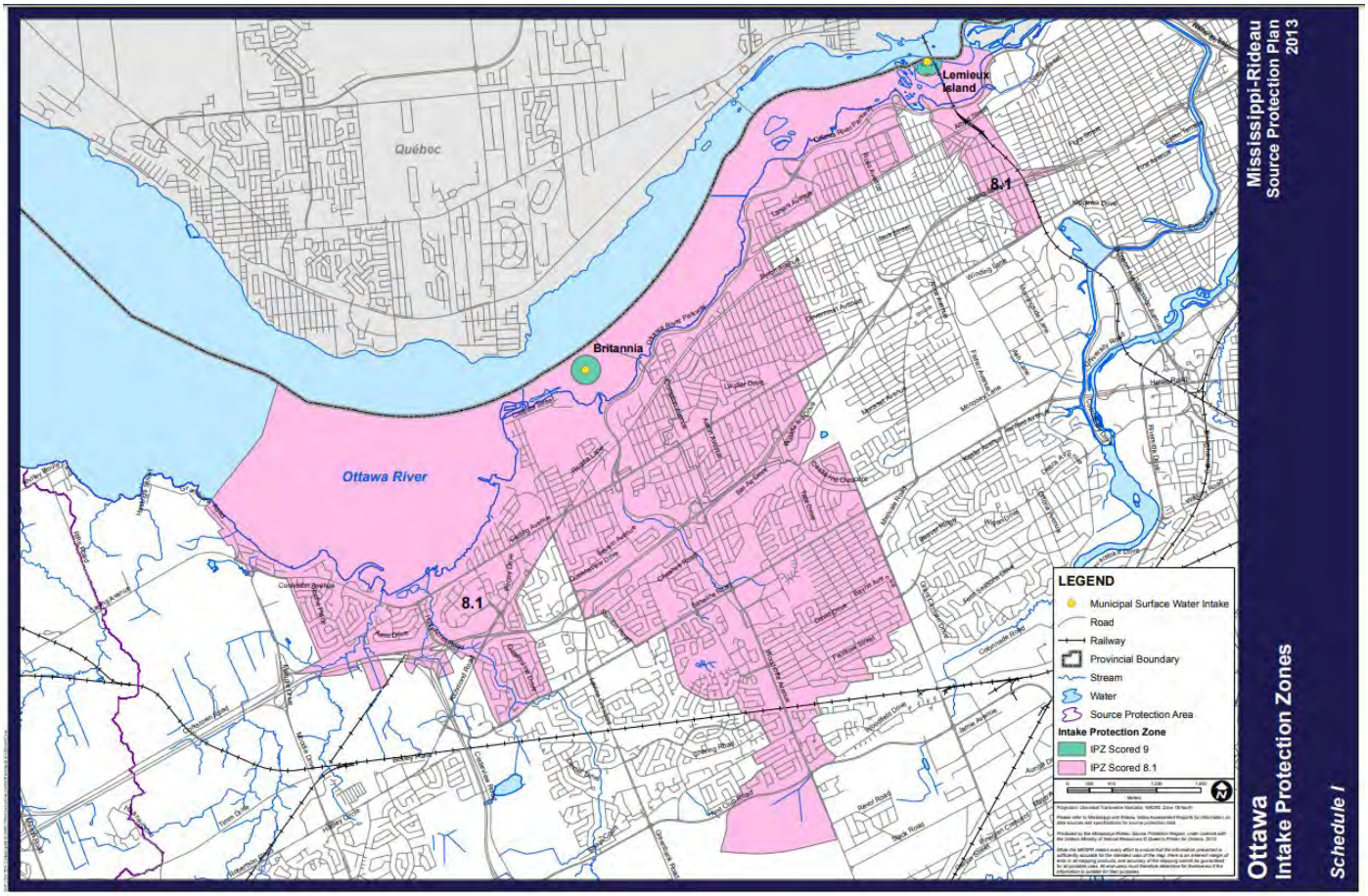
3.5.5 SOURCE PROTECTION AREA

The *Clean Water Act*, 2006 provides the legislative framework for Source Protection in Ontario. The Study Area for the corridor falls within the Rideau Valley Source Protection Area, as described in the Mississippi-Rideau Source Protection Plan (MRSPP) (2020). The Rideau Valley Source Protection Region is 8,500km^2. Source protection plans exist to protect drinking water across municipal boundaries. The Source Protection plan identifies four vulnerable areas: Intake Protection Zones, Wellhead Protection Areas, Highly Vulnerable Aquifers, and Significant Groundwater Recharge Areas.

3.5.5.1 Intake Protection Area

The Study Area intersects with Intake Protection Zones (IPZ) 2 and 3 with a vulnerability score of 8.1. The northern limits of the Study Area to West Hunt Club are within IPZ-2 (**Figure 3-53**). IPZ-2 extends on the west side of Woodroffe Avenue to just south of Vaan Drive. Areas with an IPZ of 1 and 2 are sensitive and contaminants could reach a drinking water intake pipe at the water treatment plant within, or less than two hours. The vulnerability scoring for these areas is above 8 which means that surface waters in the IPZ-2 areas are more vulnerable to contamination than areas scoring less than 8. Activities that pose a risk to sources of drinking water are prescribed as drinking water threats by Ontario Regulation 287/07 made under the *Clean Water Act, 2006* and source protection plan policies may apply. The MRSPP was reviewed to determined what, if any policies apply based on the described project. As per Appendix C2, the City of Ottawa implements the following policies applicable to the project and specifically IPZ-2 scored 8.1 areas: SALT-2-LB-S57, FUEL-1-LB-S58, FUEL-6-LB-S57 and FUEL-6-LB-S58.

Figure 3-53 IPZ-2 Area for Ottawa *(From Mississippi-Rideau Source Protection Plan, 2020)*



3.5.5.2 Wellhead Protection Area

The Study Area is not located in a Wellhead Protection Zone.

3.5.5.3 Groundwater Recharge and Vulnerable Aquifers

Portions of the Study Area contain Significant Groundwater Recharge Areas and Highly Vulnerable Aquifers, which are more vulnerable to surface contaminants. Black Rapids Creek is included in both of these areas. Most of the Rideau Valley region contains aquifers of similar vulnerability. The MRSPP was reviewed to determined what, if any policies apply based on the described project. No policies apply within Significant Groundwater Recharge Areas. There are no applicable policies for Highly Vulnerable Aquifers under the "prohibit" policy code according to Appendix C of the MRSPP. Policies for Highly Vulnerable Aquifers under "encourage" as per Appendix C of the MRSPP include: policy SALT-5-NLB, Salt-6-NLB these provide road salt management plans and smart salt practices for Highly Vulnerable Aquifers. Appendix B of the MRSPP was reviewed to determine drinking water threat circumstances and the following applies for the project: the application of road salt in Highly Vulnerable Aquifers is identified as a "low" threat level to drinking water.

3.5.6 CONTAMINATION AND HAZARDOUS MATERIALS

A limited Phase I ESA was completed to support the study. The full report can be found in **Appendix B**.

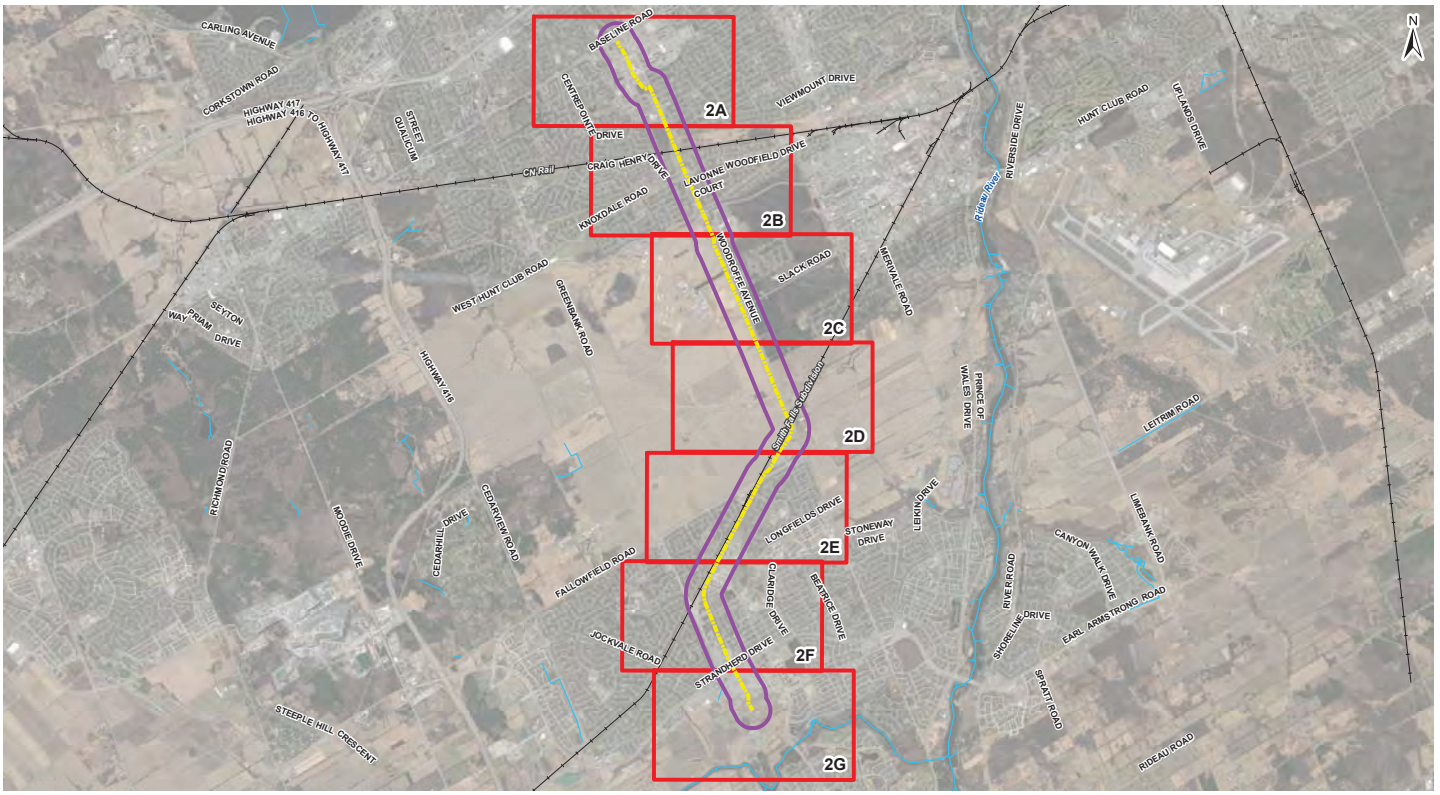
The primary objective of the limited Phase I ESA is to identify, based on available information and without an intrusive investigation, actual or potential issues of environmental concern which may impact the soil and/or groundwater related to former activities within the Study Area and to identify the need for further ESA activities (i.e., Phase II ESA). The ESA consisted of the following tasks:

- provide a general description of the Study Area consisting of legal description, ownership, zoning, and land use;

- conduct a review of various records pertaining to the Site and surrounding properties;
- conduct a site reconnaissance to make specific observations of the Study Area and the surrounding properties from publicly accessible areas;
- review of historical aerial photographs; and,
- a review of the Ecolog Environmental Risk Information Services (ERIS) report.

Based on the information obtained, 28 individual issues of potential environmental concern related to potential impacts to soil and/or groundwater have been identified within the Study Area and are illustrated in **Figure 3-54, Figure 3-55, Figure 3-56 and Figure 3-57**.

Figure 3-54



LEGEND

- Study Area (250m radius)
- Permanent Watercourse
- Railway

NOTE: All features are approximate
REFERENCE: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community; Land Information Ontario - Railways, Roads, Watercourses; Parsons

0 625 1,250 2,500 m
Scale 1:50,000

Barrhaven LRT and Rail Grade Separations
Site Plan and Study Area

City of Ottawa

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Reviewed: LP	File No.: 11083GIS0011	Date: 12/14/2018
PARSONS	Drawing No.:	1

LEGEND

- Study Area (250m radius)
- Site
- Site Reference
- Location of Potentially Contaminating Activities

1. Road and Railway Crossings
   -Fill material
5. Woodroffe Avenue and Meadowlands Drive West
   -Spill
7. 1400 Woodroffe Avenue
   -Multiple spills
12. 1980 Baseline Road
   -Spill, waste generator, fuel storage and PCB inventory
13. Baseline Road and Woodroffe Avenue
   -Waste generator and spill
16. 1425 Woodroffe Avenue
   -Fuel storage
17. 1431 Woodroffe Avenue
   -Spill
21. 155 Meadowlands Drive West
   -Waste generator
24. 1427 Woodroffe Avenue
   -Chemical use and storage
26. Woodroffe Ave, Fallowfield Rd and Greenbank Rd
   -Pole mounted transformers

NOTE: All features are approximate
REFERENCE: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community; Land Information Ontario - Railways, Roads, Watercourses; Parsons

0 90 180 360 m
Scale 1:7,000

Barrhaven LRT and Rail Grade Separations
Site Plan and Potential Environmental Concern

City of Ottawa

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Reviewed: LP	File No.: 11083GIS0012	Date: 12/14/2018
PARSONS	Drawing No.:	2A

Figure 3-55

LEGEND

- Study Area (250m radius)
- Site

- Location of Potentially Contaminating Activities
- 1. Road and Railway Crossings -Fill material
- 3. Woodroffe Avenue and Hunt Club Road -Spill
- 6. Norice Street and Woodroffe Avenue -Spill and waste generator
- 9. Norice Street and Woodroffe Avenue -Spill and waste generator
- 14. 1545 Woodroffe Avenue -Fuel storage, spills, waste generator and TSSA incident
- 15. 1457 Woodroffe Avenue -Fuel storage
- 18. 5 Majestic Drive -Spill
- 23. 1645 Woodroffe Avenue -Contaminated site on federal land
- 26. Woodroffe Ave, Fallowfield Rd and Greenbank Rd -Pole mounted transformer

NOTE: All features are approximate
REFERENCE: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community; Land Information Ontario - Railways, Roads, Watercourses; Parsons

0 90 180 360 m
Scale 1:7,000

Barrhaven LRT and Rail Grade Separations
Site Plan and Potential Environmental Concern
City of Ottawa

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Reviewed: LP	File No.: 11083GIS0013	Date: 12/14/2018
PARSONS		Drawing No.: 2B

LEGEND

- Study Area (250m radius)
- Railway
- Site
- Site Reference

- Location of Potentially Contaminating Activities
- 1. Road and Railway Crossings -Fill material
- 8. Vaan Drive and Woodroffe Avenue -Spill
- 10. Slack Road and Woodroffe Avenue -Waste generator, fuel storage and PCB inventory
- 11. 1740 Woodroffe Avenue -Waste generator, fuel storage and PCB inventory
- 25. Woodroffe Avenue -Possible septic tanks
- 26. Woodroffe Ave, Fallowfield Rd and Greenbank Rd -Pole mounted transformer

NOTE: All features are approximate
REFERENCE: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community; Land Information Ontario - Railways, Roads, Watercourses; Parsons

0 90 180 360 m
Scale 1:7,000

Barrhaven LRT and Rail Grade Separations
Site Plan and Potential Environmental Concern
City of Ottawa

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Reviewed: LP	File No.: 11083GIS0014	Date: 12/14/2018
PARSONS		Drawing No.: 2C

Figure 3-56

LEGEND

- Study Area (250m radius)
- Railway
- Site
- ★ Site Reference
- ▲ Location of Potentially Contaminating Activities
- ▲ 1. Road and Railway Crossings -Fill material
- ▲ 2. Site -Potential spill and railway
- ▲ 22.3355 Fallowfield Road -Waste generator
- ▲ 25. Woodroffe Avenue -Possible septic tanks
- ▲ 26. Woodroffe Ave, Fallowfield Rd and Greenbank Rd -Pole mounted transformer
- ▲ 27. Woodroffe Avenue and Fallowfield Road railway crossing -Agricultural properties and pesticides

NOTE: All features are approximate
REFERENCE: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community; Land Information Ontario - Railways, Roads, Watercourses; Parsons

0 90 180 360 m
Scale 1:7,000

Barrhaven LRT and Rail Grade Separations
Site Plan and Potential Environmental Concern

City of Ottawa

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Reviewed: LP	File No.: 11083GIS0015	Date: 12/14/2018

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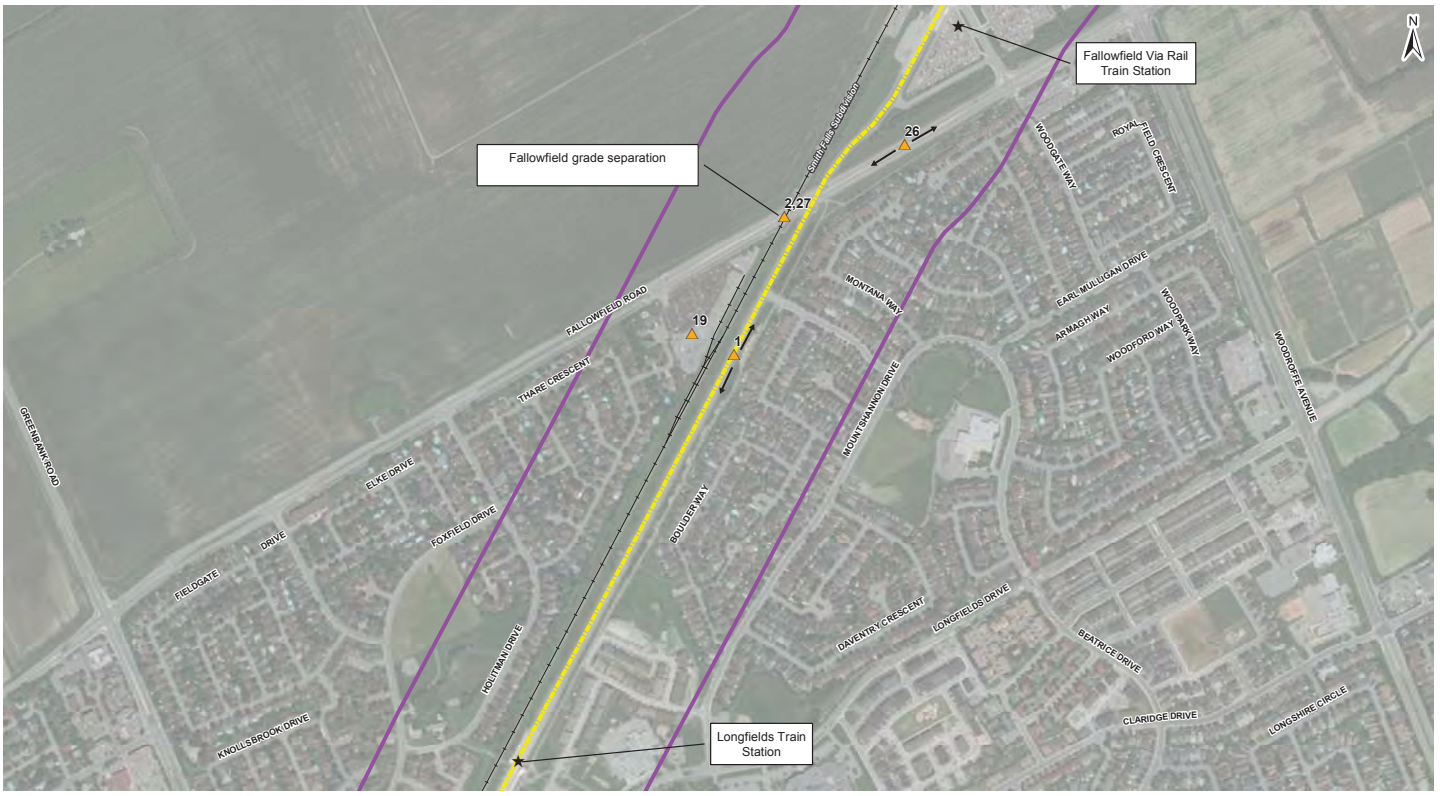

LEGEND

- Study Area (250m radius)
- Railway
- Site
- ★ Site Reference
- ▲ Location of Potentially Contaminating Activities
- ▲ 1. Road and Railway Crossings -Fill material
- ▲ 2. Railway Tracks -Potential spill
- ▲ 19. 3500 Fallowfield Road -Spill
- ▲ 26. Woodroffe Ave, Fallowfield Rd and Greenbank Rd -Pole mounted transformers
- ▲ 27. Woodroffe Avenue and Fallowfield Road railway crossing -Pad mounted transformers

NOTE: All features are approximate
REFERENCE: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community; Land Information Ontario - Railways, Roads, Watercourses; Parsons

0 90 180 360 m
Scale 1:7,000

Barrhaven LRT and Rail Grade Separations
Site Plan and Potential Environmental Concern

City of Ottawa

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Reviewed: LP	File No.: 11083GIS0016	Date: 12/14/2018

PARSONS Drawing No.: 2E

Figure 3-57

LEGEND

- Study Area (250m radius)
- Railway
- Site
- ★ Site Reference
- ▲ Location of Potentially Contaminating Activities
- ▲ 1. Road and Railway Crossings
  -Fill material
- ▲ 20. 2501 Greenbank Road
  -Fuel storage, waste generator, spill
- ▲ 26. Woodroffe Ave, Fallowfield Rd and Greenbank Rd
  -Pole mounted transformers

NOTE: All features are approximate
REFERENCE: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community; Land Information Ontario - Railways, Roads, Watercourses; Parsons

0 90 180 360 m
Scale 1:7,000

Barrhaven LRT and Rail Grade Separations
Site Plan and Potential Environmental Concern
City of Ottawa

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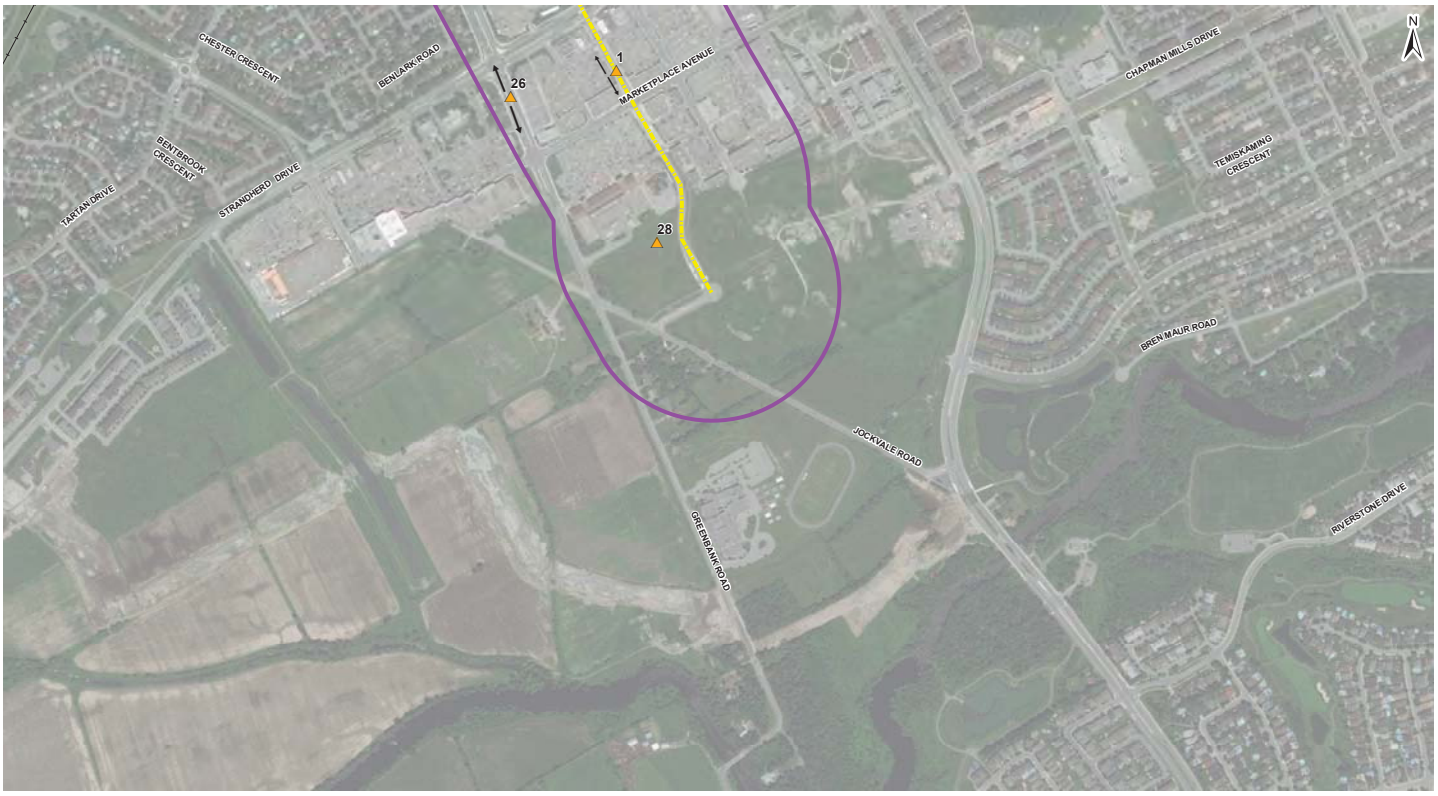
Reviewed: LP	File No.: 11083GIS0017	Date: 12/14/2018

PARSONS — Drawing No.: 2F



LEGEND

- Study Area (250m radius)
- Railway
- Site
- ▲ Location of Potentially Contaminating Activities
- ▲ 1. Road and Railway Crossings
  -Fill material
- ▲ 26. Woodroffe Ave, Fallowfield Rd and Greenbank Rd
  -Pole mounted transformers
- ▲ 28. South of Marketplace bus station
  -Mounds of soil

NOTE: All features are approximate
REFERENCE: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community; Land Information Ontario - Railways, Roads, Watercourses; Parsons

0 90 180 360 m
Scale 1:7,000

Barrhaven LRT and Rail Grade Separations
Site Plan and Potential Environmental Concern
City of Ottawa

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Reviewed: LP	File No.: 11083GIS0018	Date: 12/14/2018

PARSONS — Drawing No.: 2G

3.5.7 INFRASTRUCTURE AND UTILITIES

This section summarizes the existing municipal infrastructure and utilities within the Study Area. The documents reviewed to summarize the existing conditions include the City of Ottawa *Utility Coordinating Committee drawings* (UCC) and the 2013 *Infrastructure Master Plan* (IMP). The UCC drawings provide the location and description of existing infrastructure (sanitary sewers, storm sewers, culverts, watermains) and of existing utilities (gas, hydro, telecommunications). The 2013 IMP provides information on future infrastructure works planned within the Study Area.

During the course of finalizing this study the City of Ottawa has begun developing a new IMP. The information provided in this section remains the basis for subsequent evaluation and development of the Recommended Plan therefore, it remains unchanged. Discussion of the new IMP and its influence on the project or process is documented in **Section 6.8**.

The Study Area is divided in three sections with respect to infrastructures and utilities. Two of these sections are fully serviced by sewer/water infrastructure and public utilities. The first is located between Baseline Road and West Hunt Club Road; the second is located between Fallowfield Road to Jockvale Road. The third section, the Greenbelt located between West Hunt Club Road and Fallowfield Road, is partially serviced.

3.5.7.1 Water Distribution Network

3.5.7.1.1 Existing Water Distribution Network

The water distribution network in the Study Area includes backbone watermains, feeder mains, and local distribution watermains. The Study Area is divided in two pressure zones named 2W2C (formerly 2W) and 3SW (formerly named BARR). The Study Area is fully supplied by the municipal water distribution network except for the Greenbelt area between Pineland Avenue and Fallowfield Road. This includes the communities of Grenfell Glen and Merivale Gardens which are located on private well service.

The backbone watermains are the primary suppliers of water within a pressure zone. In the Study Area, they vary in sizes from 406mm diameter up to 1220mm diameter. They are listed in **Table 3-10** and shown on **Figure 3-58, Figure 3-59** and **Figure 3-60** below.

Table 3-10 Backbone Watermains in the Study Area

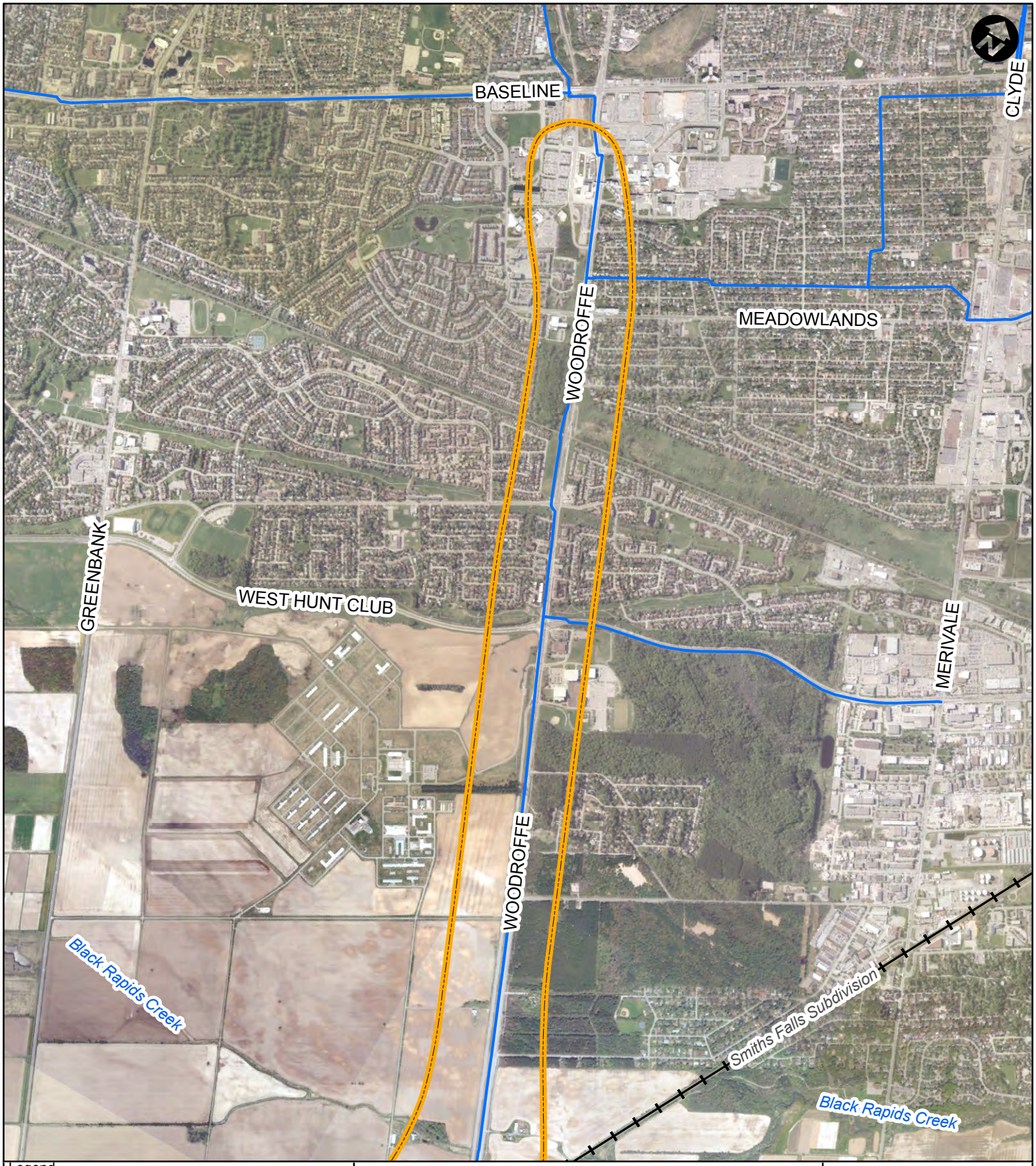
Location/Intersection	Parallel/Perpendicular	Diameter (mm)	Material	Year Installed
Woodroffe Avenue, from Baseline Road to South of Fallowfield Road	Parallel (perpendicular in some areas)	1220	Concrete	1978
Woodroffe Avenue/David Street	Perpendicular	600	Concrete	1974
Woodroffe Avenue/West Hunt Club Road	Perpendicular	600	Concrete	2011
Transitway/ Fallowfield Road	Perpendicular	762	Concrete	1978
Fallowfield Road, from Woodroffe Avenue to Greenbank Road	Parallel	762	Concrete	1978
Transitway/South of Longfields Station	Perpendicular	600	Concrete	2014
Jockvale Road/Transitway (1)	Perpendicular	406	Concrete	1993
Jockvale Road/Transitway (2)	Perpendicular	406	Concrete	2001

3.5.7.1.2 Future Water Distribution Projects

The 2013 IMP has identified one growth-related water project in the Study Area: Greenbank Road Watermain (Project ID S-04). This project involves the construction of a 610mm watermain along Greenbank Road from North of Jockvale to South of the Jock River to replace the twin 406mm diameter watermains on Jockvale Road (numbered 1 and 2 in the above table). The project is pending funding; it is not expected to start construction in the near future unless developers front end the cost of the works.

Feeder Main (watermain) Relocation

Currently, there is a large 1220mm feeder main (watermain) that runs in the Woodroffe Avenue corridor from Baseline Road to Fallowfield Road, generally under the southbound lanes. This is a vital water distribution line to the Barrhaven community. As proposed in the 2015 preliminary feeder main replacement design option, the watermain is planned to be relocated to the northbound lanes to allow the watermain to be constructed while leaving the existing watermain in working condition during construction.



Legend

Study Area

Pipe Diamter

>600mm

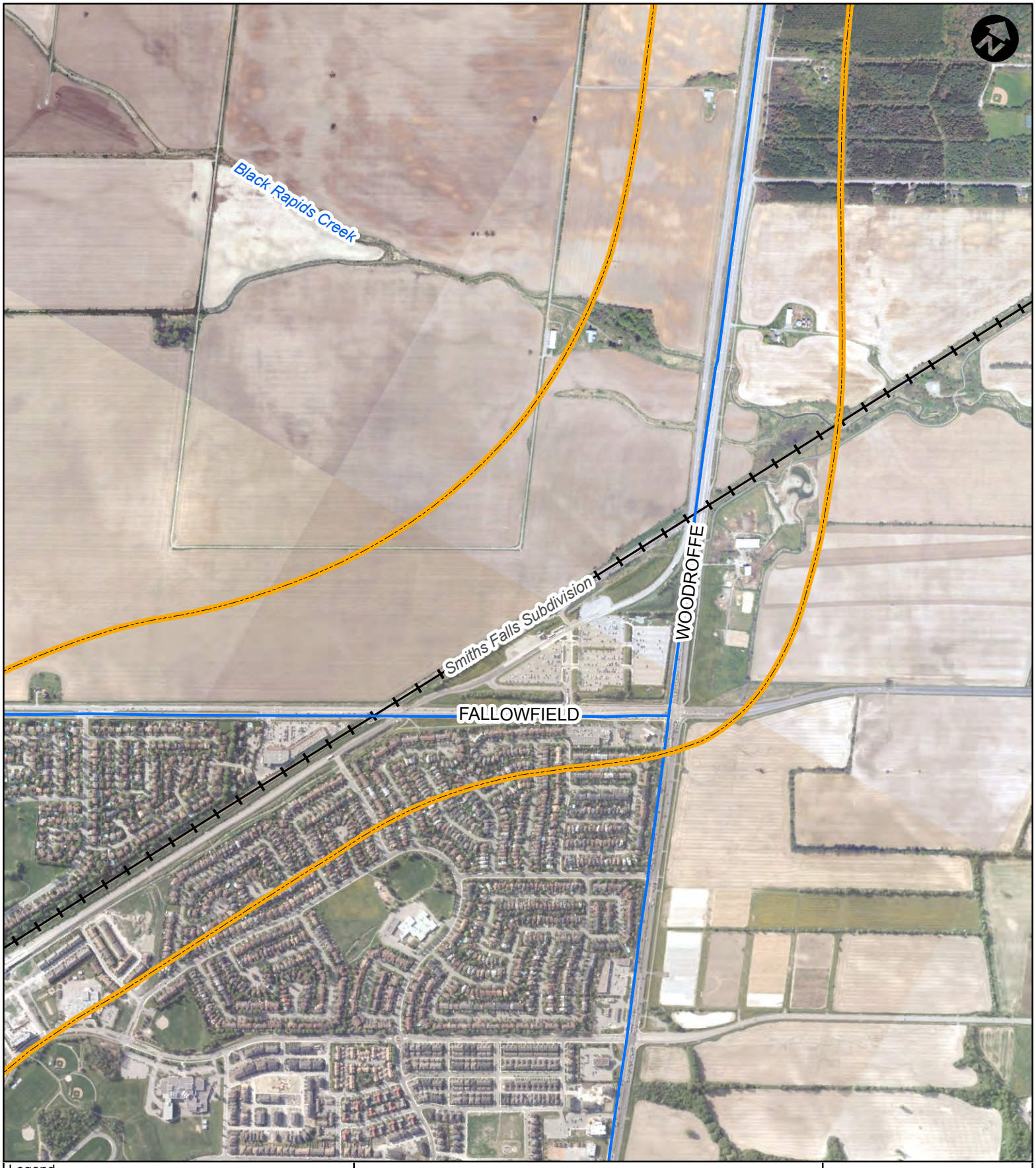
Barrhaven Light Rail Transit
(Baseline Station to Barrhaven Town Centre)

Planning and Environmental Assessment Study

0 0.325 0.65 1.3 Km

Watermain

Ottawa PARSONS



Legend

Study Area

Pipe Diameter

>600mm

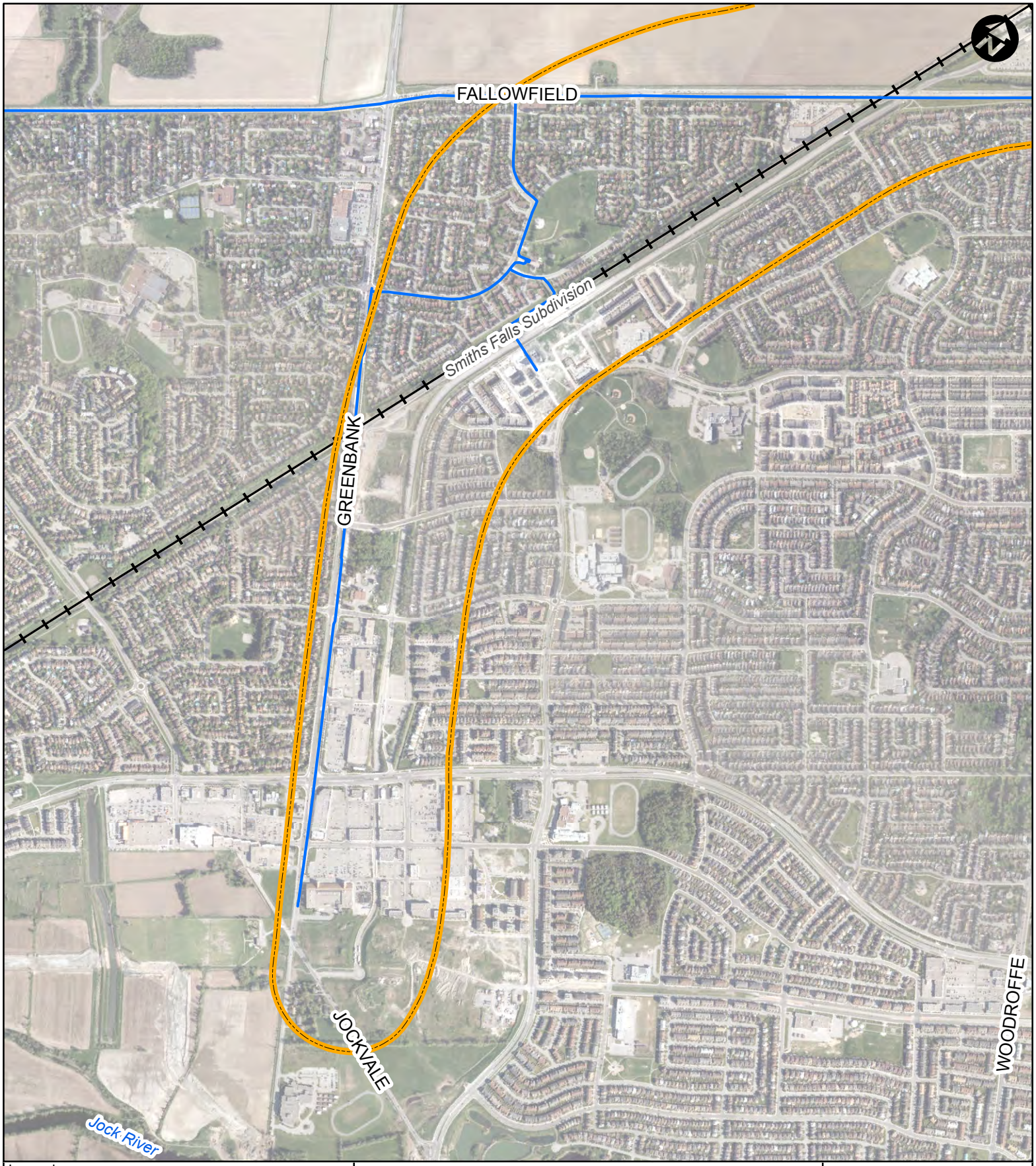
Barrhaven Light Rail Transit
(Baseline Station to Barrhaven Town Centre)

Planning and Environmental Assessment Study

0 0.15 0.3 0.6 Km

Watermain

Ottawa PARSONS



Legend

Study Area

Pipe Diameter

>600mm

Barrhaven Light Rail Transit
(Baseline Station to Barrhaven Town Centre)

Planning and Environmental Assessment Study

0 0.2 0.4 0.8 Km

Watermain

Ottawa PARSONS

3.5.7.2 Wastewater Collection System

3.5.7.2.1 Existing Wastewater Collection System

The wastewater collection system includes collector (trunk) sanitary sewers, a forcemain and local sanitary sewers. The Study Area is fully serviced by the municipal wastewater collection system except for the Greenbelt area between Nepean Sportsplex and Fallowfield Road. This includes the communities of Grenfell Glen and Merivale Gardens, which are located on private septic services.

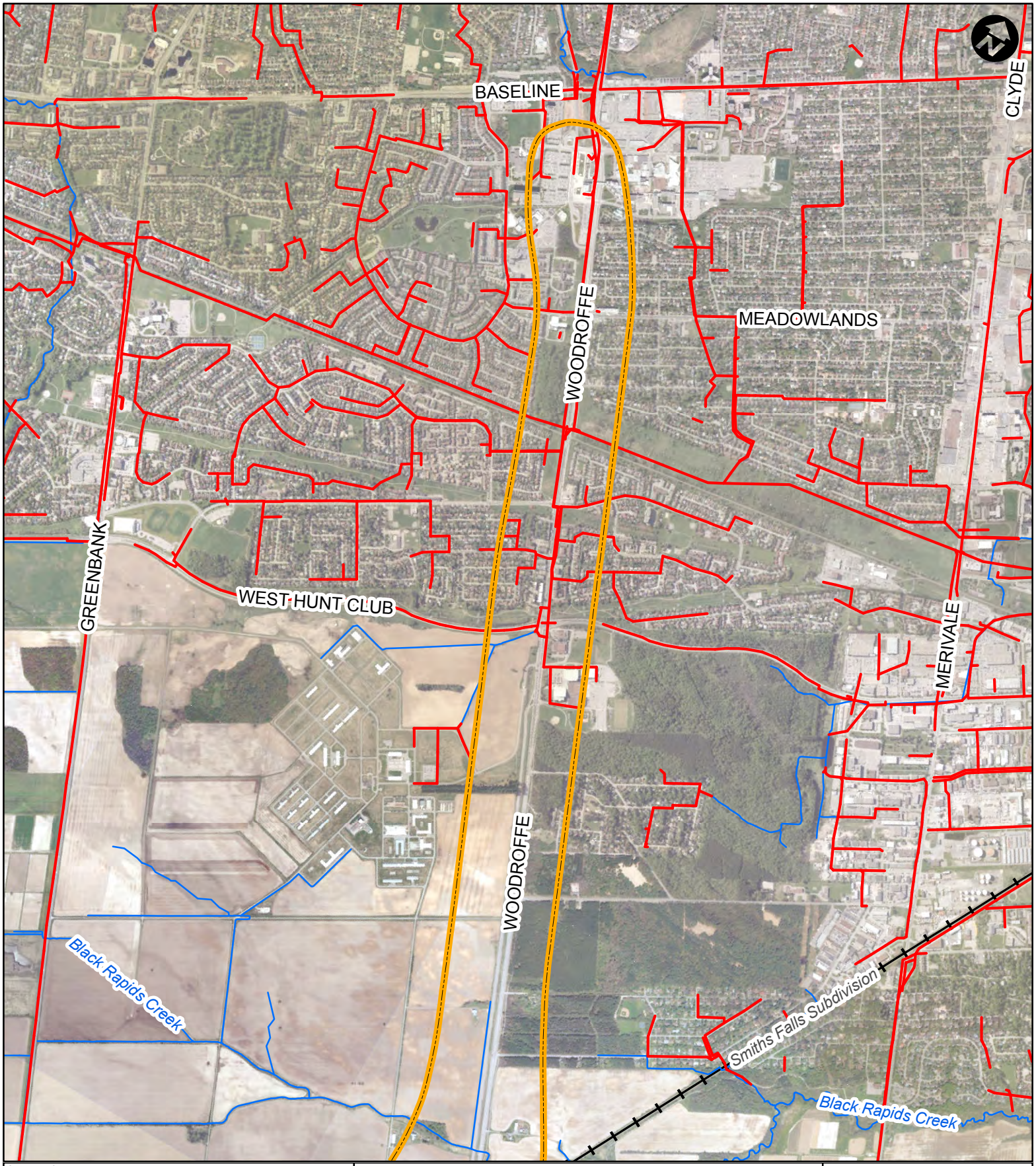
The collector sanitary sewers vary in size from 600mm diameter to 2250mm. The collectors and the forcemain are listed in **Table 3-11** and shown in **Figure 3-61**, **Figure 3-62** and **Figure 3-63** below.

Table 3-11 Sanitary Collectors and Forcemain in the Study Area

Location/Intersection	Collector/Forcemain Name	Parallel/Perpendicular	Diameter (mm)	Material	Year Installed
Woodroffe Avenue, from north of Baseline Road to Norice Street	Woodroffe Diversion Forcemain	Parallel	600	Polyvinyl Chloride	1999
Woodroffe Avenue, from Norice Street to CN Railway	Woodroffe Diversion Sewer	Parallel	675	Concrete	1999
Woodroffe Avenue/CN Rail	Lynwood Collector	Perpendicular	2250	Reinforced Concrete	1981
Woodroffe Avenue, from CN Rail to north of West Hunt Club Road	South Woodroffe Trunk	Parallel	750	Concrete	1974
Woodroffe Avenue/Knoxdale Dr.		Perpendicular	750	Concrete	1974
Woodroffe Avenue/Knoxdale Dr.		Perpendicular	600	Polyvinyl Chloride	1999
Woodroffe Avenue/260m south of Knoxdale Dr.		Perpendicular	525	Concrete	1973
Transitway / Henfield Avenue to Via Verona Avenue	Barrhaven Trunk	Perpendicular	750	Concrete Pressure Pipe	1975

3.5.7.2.2 Future Wastewater Collection Projects

The 2013 IMP has not identified any expansion or replacement projects for major sanitary sewers within the Study Area. Local sewer system extensions are anticipated as development intensifies.



Legend

Study Area

Pipe Diameter

>525 mm

Watercourse

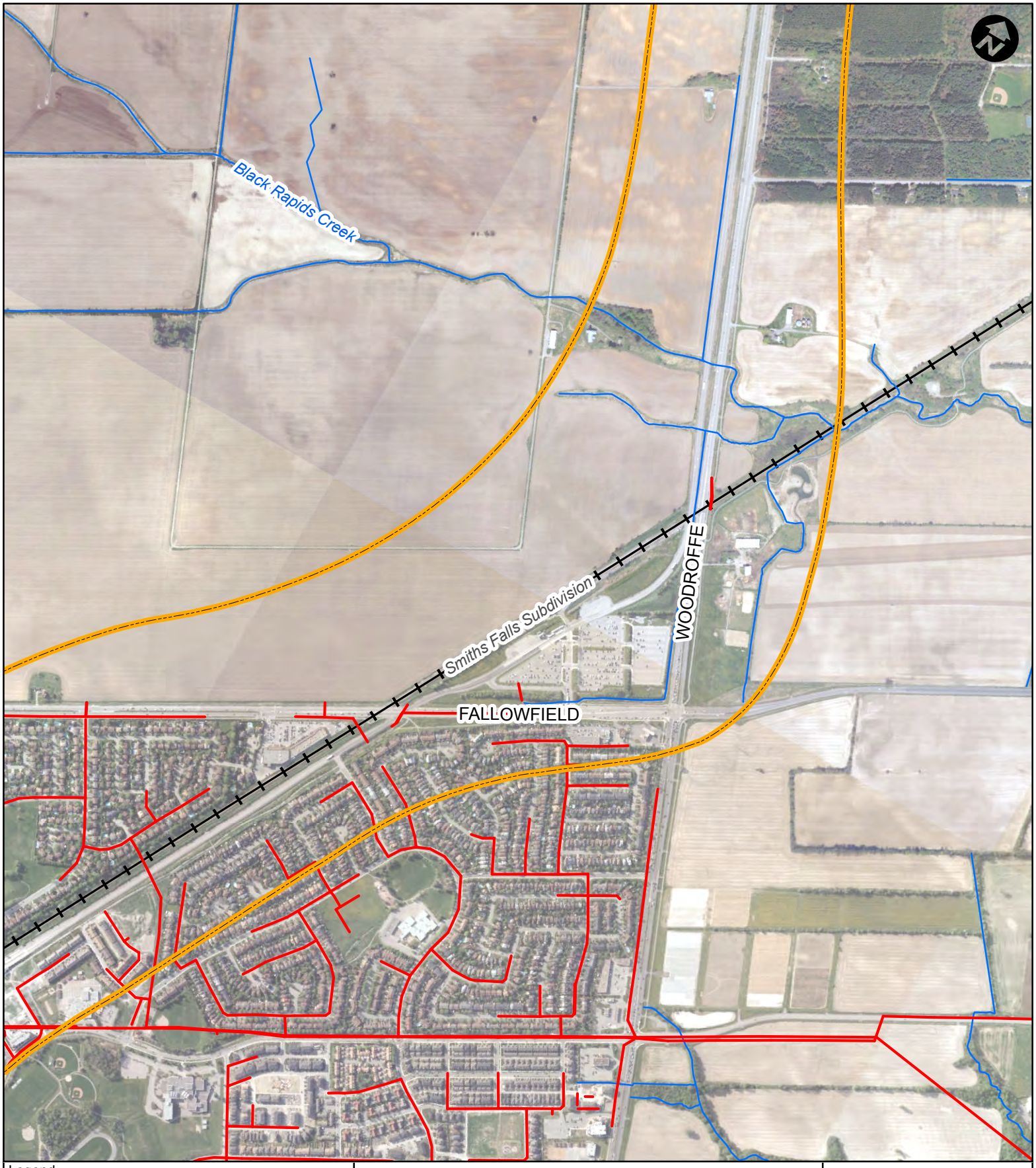
Barrhaven Light Rail Transit
(Baseline Station to Barrhaven Town Centre)

Planning and Environmental Assessment Study

0 0.325 0.65 1.3 Km

Sanitary Pipes

Ottawa PARSONS



Legend

Study Area

Pipe Diameter

>525 mm

Watercourse

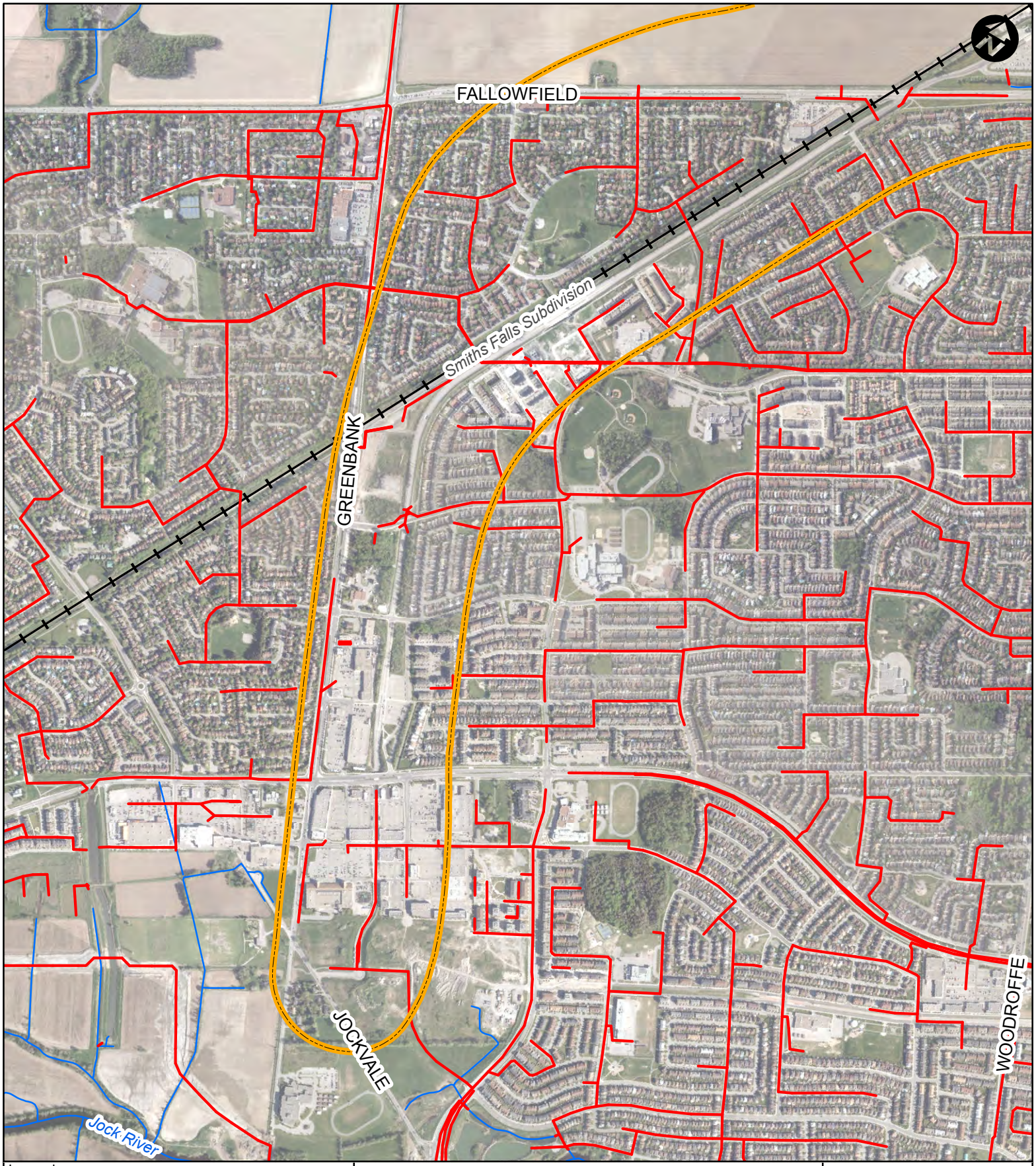
Barrhaven Light Rail Transit
(Baseline Station to Barrhaven Town Centre)

Planning and Environmental Assessment Study

0 0.15 0.3 0.6 Km

Sanitary Pipes

Ottawa PARSONS



Legend

Study Area

Pipe Diameter

>525 mm

Watercourse

Barrhaven Light Rail Transit
(Baseline Station to Barrhaven Town Centre)

Planning and Environmental Assessment Study

0 0.2 0.4 0.8 Km

Sanitary Pipes

Ottawa PARSONS

3.5.7.3 Stormwater Collection System

The stormwater collection system in the Study Area includes collector storm sewers, local storm sewers, a stormwater management pond (SWM pond), box culverts and culverts. The Study Area is fully serviced by the municipal stormwater collection system except for the Greenbelt area between south of Nepean Sportsplex and Fallowfield Road. This includes the communities of Grenfell Glen and Merivale Gardens which contain rural stormwater management including ditches.

Black Rapids Creek crosses the existing Southwest Transitway with a series of box culverts ranging in sizes from 1800mm x 3600mm to 2400mm x 3600mm.

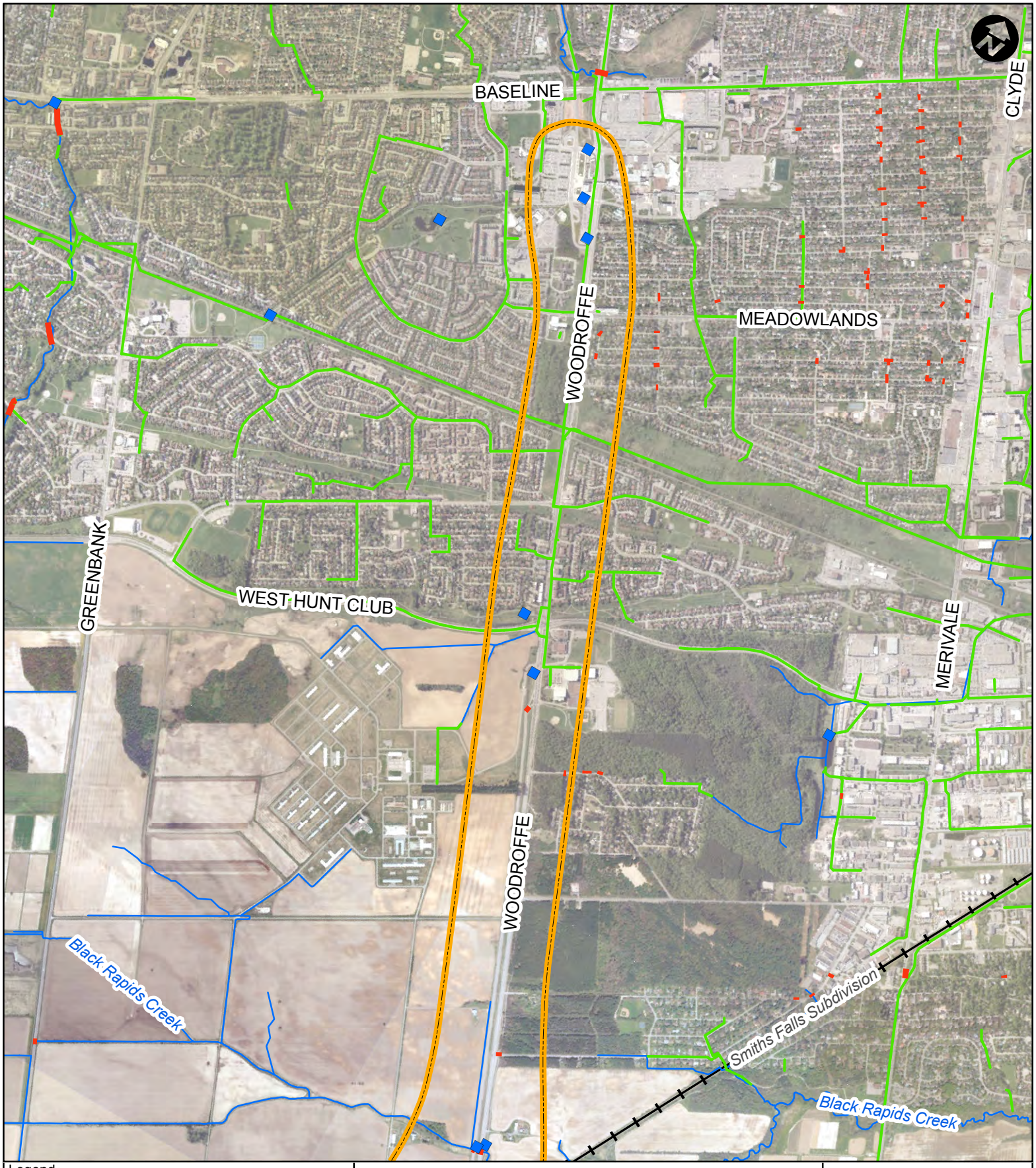
The collector storm sewers through the serviced areas vary in sizes from 750mm diameter up to 2400mm diameter. The local roadways are serviced with smaller storm sewers (300mm-600mm) and runoff is captured through a series of catch basins and maintenance holes. The collectors are listed in **Table 3-12** and shown in **Figure 3-64**, **Figure 3-65** and **Figure 3-66** below.

Table 3-12 Stormwater Collectors in the Study Area

Location/Intersection	Parallel/Perpendicular	Diameter (mm)	Material	Year Installed
Woodroffe Avenue, from Knoxdale Road to Pinecrest Creek (north of Baseline Rd)	Parallel	2400	Concrete	1974
Woodroffe Avenue/Tallwood Dr.	Perpendicular	2100	Concrete	1985
Woodroffe Avenue, from Crestlea Crescent to Knoxdale Road	Parallel	1800	Concrete	1974
Woodroffe Avenue, from Nepean Sportsplex to Crestlea Crescent	Parallel	1200	Concrete	1974
Woodroffe Avenue/260m south of Knoxdale Dr.	Perpendicular	1800	Concrete	1973
Woodroffe Avenue/Majestic Drive	Perpendicular	900	Concrete	1972
Woodroffe Avenue/75m north of Hunt Club Road	Perpendicular	1800 (1200 lined)	Concrete	1974
Woodroffe Avenue/70m south of West Hunt Club Road	Perpendicular	900 (twin)	Concrete	1993
Transitway/Blacks Creek north crossing	Perpendicular	2400 x 3600	Concrete	-
Woodroffe Avenue/Blacks Creek north crossing	Perpendicular	2400 x 3600	Concrete	-
Transitway /Blacks Creek south crossing	Perpendicular	1800 x 3600	Concrete	-
Woodroffe Avenue /Blacks Creek south crossing	Perpendicular	1800 x 3600	Concrete	-
Transitway/Fallowfield Road	Perpendicular	525 (twin)	Polyvinyl Chloride	2005
Transitway/between Cobb Court and Mountshannon Drive	Perpendicular	1350	Concrete	1974
Transitway/between Foxhill Way and Via Verona Avenue	Perpendicular	2250	Concrete	1975
Transitway, from SWM pond to between Foxhill Way and Via Verona Avenue	Parallel	750	Concrete	2014
Transitway, from Strandherd Drive to Jockvale Road	Parallel	Varies from 975 to 1350	Concrete	2010
Transitway/Marketplace Avenue	Perpendicular	1050	Concrete	2002
Transitway, from Jockvale Road to east of transitway	Parallel	Varies from 1500 to 1650	Concrete	2010

3.5.7.3.1 Future Stormwater/Drainage Projects

The 2013 IMP does not identify any expansion or replacement projects for major storm sewers or stormwater management facilities within the Study Area. Local sewer system extensions are anticipated as development intensifies.



Legend

SWM Facilities

Culvert

Study Area

Pipe Diameter

>750mm

Watercourse

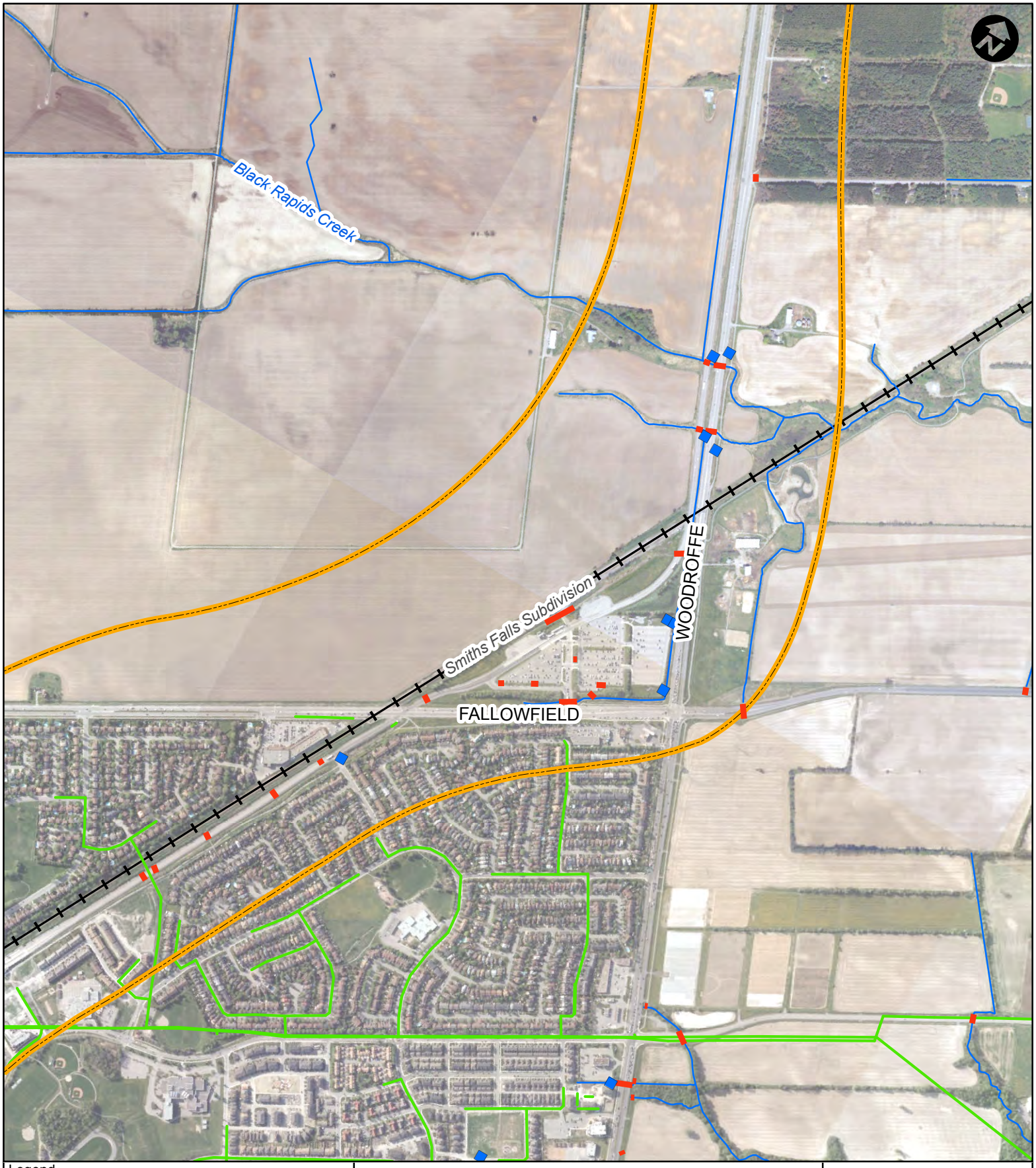
Barrhaven Light Rail Transit
(Baseline Station to Barrhaven Town Centre)

Planning and Environmental Assessment Study

0 0.325 0.65 1.3 Km

Storm Pipes

Ottawa PARSONS



Legend

SWM Facilities
Culvert
Study Area

Pipe Diameter

>750mm
Watercourse

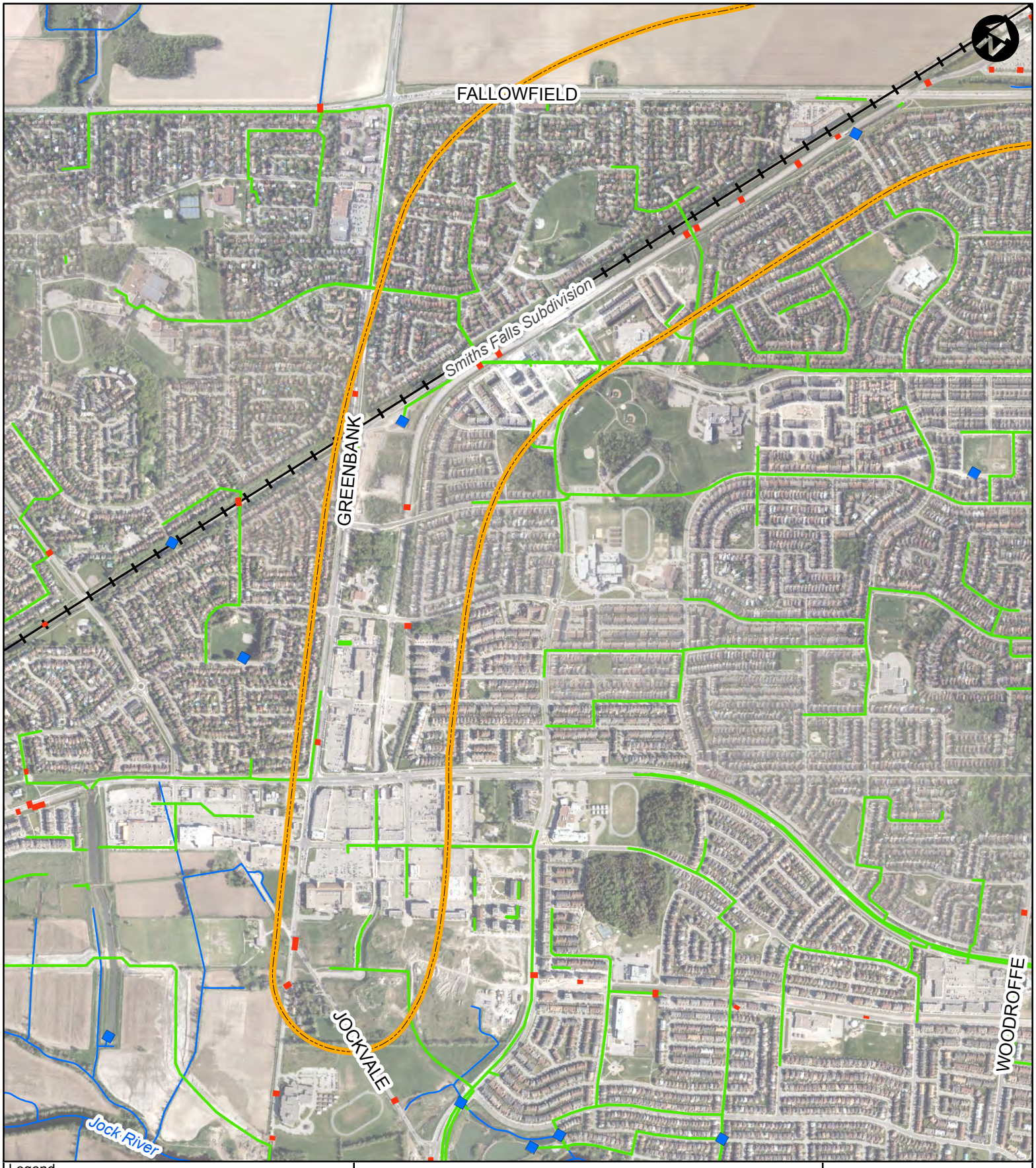
Barrhaven Light Rail Transit
(Baseline Station to Barrhaven Town Centre)

Planning and Environmental Assessment Study

0 0.15 0.3 0.6 Km

Storm Pipes

Ottawa PARSONS



Legend

- Study Area
- SWM Facilities
- Culvert
- Watercourse

Pipe Diameter

- >750mm

Barrhaven Light Rail Transit
(Baseline Station to Barrhaven Town Centre)

Planning and Environmental Assessment Study

0 0.2 0.4 0.8 Km

Storm Pipes

Ottawa PARSONS

3.5.7.4 Gas Distribution

Enbridge Gas distributes gas in the Study Area except in the Greenbelt (where no service is provided) between West Hunt Club Road and Fallowfield Road. The gas pipes vary in size from 35mm diameter to 300mm diameter. A 300mm diameter vital gas main is located within Fallowfield Road Right-of-Way under the westbound lanes. Vital gas mains are critical to the gas distribution system. These gas mains are typically more costly to relocate due to their size and operating pressure. There are plans for the extension of a 20"-24" (50 - 60cm) extra high-pressure vital gas main along the north side of West Hunt Club from Greenbank Road to Prince of Wales Drive which will cross Woodroffe Avenue. This work is planned for in the 2020-2025 timeframe.

3.5.7.5 Electricity Distribution

In the Study Area, electricity is distributed either underground through duct banks, conduits, and cables or overhead on poles. The UCC drawings identify the size of duct banks which vary in size from 400mm to 1370mm wide (**Table 3-13**).

A Hydro Ottawa overhead major distribution line runs north-south along the east side of Woodroffe Avenue from north of Knoxdale Road/Medhurst Drive to West Hunt Club Road. Approximately 200m south of West Hunt Club it crosses over to the west side of Woodroffe Avenue and continues south past Fallowfield Road; this overhead line branches out on Fallowfield Road.

Table 3-13 Hydro Duct Banks in the Study Area

Location/Intersection	Parallel/Perpendicular	Width (mm)
Woodroffe Avenue/ Navaho Dr.	Perpendicular	1370
Woodroffe Avenue/College Avenue	Perpendicular	1370
Woodroffe Avenue, from 30m north of College Avenue to 68m north of Parkglen Drive	Parallel	542
Woodroffe Avenue, from Meadowland Drive to 44m south	Parallel	542
Woodroffe Avenue/5m south of Nepean Sportsplex entrance	Perpendicular	404
Woodroffe Avenue, 225m north of Fallowfield	Parallel	400
Fallowfield Road/east of Via Park Place	Perpendicular	400
Fallowfield Road/west of Via Park Place	Perpendicular	400
Transitway/Highbury Park	Perpendicular	542
Transitway/Strandherd Drive	Perpendicular	818
Transitway/Marketplace Avenue	Perpendicular	818

3.5.7.5.1 Hydro One Electricity Transmission

Hydro One transmission lines in the Study Area include two separate corridors:

The first one is running east-west, crossing Woodroffe Avenue immediately south of Knoxdale Road and contains the following lines:

- a 115 kV circuit (C7BM) twin wood pole line.
- a 230 kV transmission line (M32S) supported by steel towers.

The second corridor also runs east-west, crossing Woodroffe Avenue on the north side of West Hunt Club, and contains four transmission lines on two sets of steel towers. The voltages of the transmission lines vary from 115 kV to 500 kV as follows:

- The northernmost line (S7M) is operated at 115 kV.
- The two middle lines (X522A and X523A) are operated at 500 kV.
- The southernmost line (E34M) is operated at 230 kV.

3.5.7.6 Telecommunications Distribution Systems

Telecommunication utilities are distributed throughout the Study Area either underground through duct banks, conduits and cables, or overhead on poles.

Rogers cable runs along Woodroffe Avenue between Knoxdale/Medhurst Drive and Majestic Drive and along VIA Rail from Woodroffe Avenue to Greenbank Road. Atria crosses VIA Rail at Woodroffe Avenue.

4 Evaluation of Alternative Solutions

The conclusions set out in **Section 2** of this report demonstrate the need to extend rapid transit from Baseline Station to Barrhaven Town Centre and provide for rail grade-separation at the Woodroffe Avenue, Southwest Transitway and Fallowfield Road crossings of the VIA Rail line. This section summarizes the development and evaluation of alternative solutions to best meet the established needs of the project. While the City of Ottawa's TMP (2013) identifies extending LRT to Barrhaven as the preferred ultimate solution for this rapid transit corridor, the City of Ottawa, as part of pre-planning work for major transit infrastructure projects, reconfirms the preferred solution as a general practice regardless of the EA process followed.

4.1 Planning and Design Objectives for the Project

As presented in the 2013 TMP, "*Ottawa's Transportation system [in 2031] will enhance our quality of life by supporting social, environmental, and economic sustainability in an accountable and responsive manner*." This vision for transportation in the City is supported by several elements and coinciding principles. This EA uses these elements to provide a basis for developing planning and design objectives for the Project and the subsequent evaluation of alternative solutions based on these objectives. Elements identified in the TMP and the ensuing six (6) objectives as developed for this EA are presented in **Table 4-1**.

Table 4-1 Planning and Design Objectives for the Project

Element	Planning and Design Objectives for the Project
Reduce automobile dependence	1. Improve travel time, reliability, efficiency of rapid transit
Meet mobility needs	2. Improve universal accessibility and connectivity of the active transportation networks
Integrate transportation and land use	3. Provide for safety, efficiency, resiliency (a system that can tolerate unexpected events by implementation of pocket tracks, cross-overs, elevator redundancy, parallel pathway etc.) and mobility on the area transportation network
Protect public health and safety	4. Eliminate the risk of a near-miss or collision between roadway and pathway users and trains
Enhance the economy	5. Improve connectivity with the VIA Rail Fallowfield Station
Deliver cost-effective services; protect public health and safety and protect the environment	6. Regard for social, natural, physical and economic environmental aspects, and life-cycle cost

4.2 Description of Alternative Solutions

There are three distinct components of the project that require a review and confirmation of alternative solutions. These include the:

1. Extension of LRT from Baseline Station to Barrhaven Town Centre;
2. Grade-separation of Woodroffe Avenue and the Southwest Transitway from the VIA Rail line; and,
3. Grade-separation of Fallowfield Road from the VIA Rail line.

A range of alternative solutions were developed for the LRT extension and the rail grade-separations and subsequently evaluated for their suitability to address the above-noted planning and design objectives. The range of alternative solutions for the Woodroffe Avenue/Southwest Transitway and Fallowfield Road rail grade-separations are the same, however, the evaluation for each component was completed separately. The alternative solutions are described in **Table 4-2** and **Table 4-3**.

Table 4-2 Description of Alternative Solutions - LRT Extension

Alternative Solution		Description
1	Do Nothing	Used as a baseline for comparison, includes regular on-going maintenance of the corridor in its present BRT configuration. Does not include modifications or enhancements to the pedestrian and cycling environment.
2	Implement Transportation Demand Management measures	Transportation Demand Management includes measures aimed at influencing demand to reduce the need or delay timing of infrastructure projects by making more efficient use of existing capacity. Measures such as high-occupancy vehicle lanes (which would require re-designation and roadway modifications), carpooling and encouraging telework/working from home are included as part of this solution. This solution would not include enhancements to the pedestrian and cycling environment.
3	Improve pedestrian and cycling infrastructure	Under this scenario, significant investment would be made in pedestrian and cycling infrastructure to reduce the need for additional road and transit investments. This solution could involve potential widening to enhance corridor pedestrian and cycling facilities only.
4	Improve roadway infrastructure	This solution would involve reconstruction and widening of arterial roadways and other potential measures on the existing road network within the Study Area to address future capacity requirements if rapid transit service is not improved. This would include roadways already identified for future widening in the City's TMP as well as other widenings not currently being considered. Transit would continue to operate in existing dedicated bus lanes. Enhancements to the pedestrian and cycling environment would also be included in this solution.
5	Complete the SW Transitway as BRT	Under this scenario, the transitway would be completed as a fully exclusive and grade-separated BRT facility between Baseline Station and Barrhaven Town Centre, as currently envisaged in the 2013 TMP (2031 RTTP Network Concept). This would involve building new BRT infrastructure, primarily between Baseline Station and the Nepean Sportsplex to replace the existing on-street dedicated bus lanes with an exclusive and grade-separated transitway. Enhancements to the pedestrian and cycling environment would also be included in this solution.
6	Convert and complete the SW Transitway as LRT	Under this scenario, the completion of the transitway as a BRT facility would not take place and would instead be implemented as a fully segregated grade-separated electrically powered LRT facility from Baseline Station to Barrhaven Town Centre, as envisaged in the 2013 TMP (Ultimate RTTP Network). Enhancements to the pedestrian and cycling infrastructure would also be considered as part of this solution.

Table 4-3 Description of Alternative Solutions -Rail Grade-Separation

Alternative Solution		Description
1	Do Nothing	Used as a baseline for comparison, includes regular on-going maintenance of the corridor in its present configuration. Does not include modifications or enhancements to the pedestrian and cycling environment.
2	Close the road/transitway at the VIA Rail crossing location	The existing roads and transitway would be closed at the VIA Rail line crossing until such time they could be grade-separated. Existing roads, transitway traffic, pedestrian and cycling facilities would be redirected to an existing and alternative grade-separated crossing.
3	Improve the existing at-grade road/SW Transitway crossing	The existing roads and transitway crossing of the VIA Rail line would remain but with infrastructure improvements reflective of current best practices. This could include changing the angle to which the roads and transitway cross the VIA Rail line, upgrades to the railway gates, signalization, flashing lights, pavement markings amongst others. This solution would include enhancements to pedestrian and cycling facilities isolated to the crossing area.
4	Realignment of roads/SW Transitway that avoids crossing the VIA Rail line	A realignment of Woodroffe Avenue, Fallowfield Road and the transitway could be constructed that avoids crossing of the VIA Rail line in this area. The original alignments would be closed off and connection across the VIA Rail line would no longer be possible so as to remove at-grade rail crossings. Pedestrian and cycling enhancements would be part of this solution.
5	Grade-separation	A grade-separation of roads and transitway including pedestrian and cycling facilities would be implemented.

4.3 Evaluation of Alternative Solutions

The full range of alternative solutions were subjected to an evaluation process that compared the outcome of each solution to the planning and design objectives listed in Section 4.1. The results are presented individually in the following tables for

each of: the LRT extension (Table 4-4), grade-separation of Woodroffe Avenue and the Southwest Transitway (Table 4-5) and of Fallowfield Road (Table 4-6) from the VIA Rail line.

Table 4-4 Evaluation of Alternative Solutions Results - LRT Extension

Alternative Solution		Description	Preferred Solution
1	Do Nothing	Does not deliver a multi-modal system as this solution maintains the status quo. As rapid transit service would continue to operate in dedicated lanes within the Woodroffe Avenue corridor with no changes, there would be no opportunity to improve travel time, reliability, or efficiency. With no changes being implemented, this solution does not provide the opportunity to result in a modal shift. There would be no opportunity to improve universal accessibility or connectivity for the active transportation network. This solution does not provide resiliency and mobility on the area transportation network. There would be no opportunity to improve connectivity with the VIA Rail Fallowfield Station. There would be no impact to the physical or natural environment as additional Right-of-Way would not be required, however, there would be little to no opportunity to improve these environments either. No capital cost involved.	Not Recommended ✗
2	Implement Transportation Demand Management measures	Does not deliver a cost-effective multi-modal system. This solution may improve the area transportation network slightly. However, this solution implemented on its own does not meet transit ridership projections or required capacity, therefore, would limit the opportunity to improve travel time, reliability, or efficiency to meet future needs. As such, this solution does not provide the opportunity to result in a modal shift. This solution does not provide the opportunity to improve connectivity with the VIA Rail Fallowfield Station. This solution may include only re-designation of the existing road surface, therefore there would be little opportunity to improve universal accessibility and connectivity of the active transportation network. No additional Right-of-Way would be acquired. This solution does not provide resiliency and mobility on the area transportation network. There would be little to no impact to the physical or natural environment as no additional Right-of-Way would be required, however, there would be little to no opportunity to improve these environments either.	Not Recommended ✗
3	Improve pedestrian and cycling infrastructure	Does not deliver a cost-effective multi-modal system as this solution maintains existing travel lanes and implemented on its own does not meet transit ridership projections or required capacity. This solution would not address long-term needs as it would result in little to no improvements to transit operations and therefore there would be no opportunity to improve travel time, reliability, efficiency or provide resiliency. This solution does not address long distance travel demand for many people in a practical fashion but offers significant opportunity to address local trips within the Study Area, safety, including access to rapid transit stations and VIA Rail Fallowfield Station for only the active modes. This solution provides the opportunity to improve universal accessibility and connectivity of the active transportation network and may result in a modal shift only for pedestrians and cyclists. During winter months, use of pedestrian and cycling facilities may be impacted while snow removal activities are underway. Close to stations and main networks are typically cleared first leaving local routes more difficult to navigate until cleared. To accommodate this solution within the existing Right-of-Way there would be impacts to the natural environment and would offer limited opportunity for new landscaping unless additional Right-of-Way is acquired.	Not Recommended ✗
4	Improve roadway infrastructure	Does not deliver a cost-effective multi-modal system. This solution would identify some road widenings in/near the Study Area; but is not consistent with the direction of the TMP which seeks to encourage increased transit use, particularly for trips to/from downtown Ottawa. It also does not address future transit needs and objectives within the Study Area. This solution does not support the objective to improve transit travel time, reliability, or efficiency. The solution provides the opportunity to improve the universal accessibility, safety, and connectivity of the active transportation network. Ultimately this solution would not result in a modal-shift as it enhances the road network which does not support a reduction in automobile dependence. This solution does not provide the opportunity to improve connectivity with the VIA Rail Fallowfield Station for transit. Considerable additional Right-of-Way would be required which will impact the natural environment. However, there would be opportunity to improve corridor landscaping with the additional space.	Not Recommended ✗

Alternative Solution		Description	Preferred Solution
5	Complete SW Transitway as BRT	Does not deliver a cost-effective solution given the cost involved. If a BRT facility is pursued it would likely need to remain as a BRT facility for a substantial period to justify the capital investment required and reduce opportunity cost/throwaway costs associated with future conversion to LRT. This period is likely to be decades given the investment required to construct a grade-separated transitway from Baseline Station to West Hunt Club Road. The removal of dedicated on-street transit on Woodroffe Avenue would provide the opportunity to redevelop the corridor and enhance existing facilities. This solution supports the 2031 RTTP Network identified in the City's TMP, which envisions completion of the Southwest Transitway as an exclusive BRT facility prior to long-term conversion to LRT technology as identified in the TMP Ultimate RTTP Network. This solution would improve travel time, reliability, and efficiency of rapid transit to some degree. However, it would still require riders travelling beyond Baseline Station to transfer to LRT, which may discourage future ridership growth or a modal shift. This solution meets transit ridership projections or required capacity. This solution provides a limited opportunity to improve universal accessibility and connectivity of the active transportation network (reconstructing existing stations and facilities would not be practical) as it could not be constructed the entire length of the corridor. A dedicated BRT facility would improve connectivity with the VIA Rail Fallowfield Station. Considerable additional Right-of-Way would be required which will impact the natural environment. However, there would be opportunity to improve corridor landscaping with the additional space.	Not Recommended ✗
6	Convert and complete SW Transitway as LRT	This solution supports the Ultimate RTTP Network identified in the City's TMP but changes the implementation phasing of the City's RTTP network, which currently identifies completion of the SW Transitway as a BRT facility prior to eventual conversion to LRT technology. This solution provides a cost-effective multi-modal system. This solution meets transit ridership projections or required capacity. By developing as LRT, it avoids potential throw-away costs of constructing an interim BRT facility first. Based on the Project Need and Opportunities identified (Section 2) and the City's long-term plan for rapid transit, this solution best addresses the planning objectives with respect to improving travel time, reliability, safety, and efficiency of rapid transit. The solution provides a dedicated and consistent connection (via LRT) not only to the VIA Rail Fallowfield Station but the entire LRT network. It also increases transit capacity, improves reliability and user experience, and addresses issues around conversion from BRT to LRT technology. This solution provides the best opportunity for enhancing the active transportation network by improving universal accessibility and connectivity. TOD policies and other City planning polices support making connections and implementing higher order active transportation facilities in the Study Area associated with LRT throughout the entire corridor. Additional Right-of-Way would result in impacts to the natural environment. However, this solution provides the opportunity to define spaces for new corridor landscaping.	Recommended Preferred Solution ✓

Table 4-5 Evaluation of Alternative Solutions Results – Rail Grade-Separation: Woodroffe Avenue and Southwest Transitway

Alternative Solution		Description	Preferred Solution
1	Do Nothing	This solution does not eliminate the risk of a near-miss or collision between all users and trains. This solution does not address the Project Need and Opportunities established for the Study Area. There would be no capital cost involved to implement this solution. It does not provide the opportunity to improve universal accessibility, safety, and connectivity of the active transportation network. This solution does not provide resiliency and mobility on the area transportation network. There would be no opportunity to improve connectivity with the VIA Rail Fallowfield Station. There would be no impact to the physical or natural environment as additional Right-of-Way would not be required, however, there would be little to no opportunity to improve these environments either.	Not Recommended ✗
2	Close the road/transitway at the VIA Rail crossing location	This solution eliminates the risk of a near-miss or collision between all users and trains. This solution also eliminates the need for rail-crossing infrastructure maintenance and inspection as it removes the crossing altogether. However, this solution performs poorly in consideration of the planning objectives, as it removes accessibility across the tracks, removes connectivity for all modes and does not contribute towards enhancing the natural or social environments. All modes would be forced to re-route out of their way which would	Not Recommended ✗

Alternative Solution		Description	Preferred Solution
		severely affect travel time, reliability, or efficiency. Pedestrian and cycling facilities would be redirected to an existing and alternative grade-separated crossing. Transit would be rerouted long distances to connect to Fallowfield Station adding travel time, decreasing resiliency, and preventing connectivity. Further, this solution does not address the Project Need and Opportunities established for the Study Area.	
3	Improve the existing at-grade road/transitway crossing	This solution partially addresses the project objectives but does not fully eliminate the risk of a near-miss or collision between all users and trains. Upgrading the rail infrastructure equipment or improving the angle of crossing partially improves the safety and leads to a better-quality environment for users and better accessibility. Improving travel times and efficiency for all modes will ultimately be limited by the frequency of train crossings. This solution may have impacts to the natural environment depending on the improvement(s) implemented. This solution does not address the Project Need and Opportunities established for the Study Area.	Not Recommended ✗
4	Realignment of Woodroffe Avenue and the Southwest Transitway that avoids crossing the VIA Rail line	This solution would eliminate the risk of a near-miss or collision between all users and trains. However, this solution performs poorly in consideration of the planning objectives, as it would remove accessibility and connectivity across the tracks for all modes on the networks where the roads would be closed to prevent the rail crossing. The closure of the existing roads to remove crossing of the rail line would force all modes to re-route to the realignment to make connections which would not improve travel time, reliability, or efficiency. This solution does not contribute towards enhancing the natural or social environments or address the Project Need and Opportunities established for the Study Area. This solution would require substantial land acquisition. The land impacts would be almost entirely Greenbelt lands that are actively farmed. As such, this solution results in social, natural, and economic environmental impacts and is not consistent with established planning policy.	Not Recommended ✗
5	Grade-separation	This solution eliminates the risk of a near-miss or collision between roadway and pathway users and trains. This solution also eliminates the need for rail-crossing infrastructure maintenance and inspection as it removes the crossing altogether. This solution provides the best opportunity to provide efficiency, resiliency, and mobility on the area transportation network. All modes would result in improved travel time, reliability, and efficiency as there would be no crossing where waits are experienced to let trains pass. Connectivity with the VIA Rail Fallowfield Station would be direct. This solution is consistent with addressing the Project Need and Opportunities. This solution results in impacts to the natural environment. However, there would be opportunity to improve corridor landscaping with implementation.	Recommended Preferred Solution ✓

Table 4-6 Evaluation of Alternative Solutions Results – Rail Grade-Separation: Fallowfield Road

Alternative Solution		Description	Preferred Solution
1	Do Nothing	This solution does not eliminate the risk of a near-miss or collision between all users and trains. This solution does not address the Project Need and Opportunities established for the Study Area. There would be no capital cost involved to implement this solution. It does not provide the opportunity to improve universal accessibility, safety, and connectivity of the active transportation network. This solution does not provide resiliency and mobility on the area transportation network. There would be no opportunity to improve connectivity with the VIA Rail Fallowfield Station. There would be no impact to the physical or natural environment as additional Right-of-Way would not be required. However, there would be little to no opportunity to improve these environments either.	Not Recommended ✗
2	Close the road at the VIA Rail crossing location	This solution eliminates the risk of a near-miss or collision between all users and trains. This solution also eliminates the need for rail-crossing infrastructure maintenance and inspection as it removes the crossing altogether. However, this solution performs poorly in consideration of the planning objectives, as it removes accessibility across the tracks, removes connectivity for all modes and does not contribute towards enhancing the natural or social environments. All modes would be forced to re-route out of their way which would severely affect travel time, reliability, or efficiency. Pedestrian and cycling facilities would be redirected to an existing and alternative grade-separated crossing. Transit would be rerouted long distances to connect to Fallowfield Station adding travel time, decreasing resiliency,	Not Recommended ✗

Alternative Solution		Description	Preferred Solution
		and preventing connectivity. Further, this solution does not address the Project Need and Opportunities established for the Study Area.	
3	Improve the existing at-grade road crossing	This solution partially addresses the project objectives but does not fully eliminate the risk of a near-miss or collision between all users and trains. Upgrading the rail infrastructure equipment or improving the angle of crossing partially improves the safety and leads to a better-quality environment for users and better accessibility. Improving travel times and efficiency for all modes will ultimately be limited by the frequency of train crossings. This solution may have impacts to the natural environment depending on the improvement(s) implemented. This solution does not address the Project Need and Opportunities established for the Study Area.	Not Recommended ✗
4	Realignment of Fallowfield Road that avoids crossing the VIA Rail line	This solution would eliminate the risk of a near-miss or collision between all users and trains. However, this solution performs poorly in consideration of the planning objectives, as it would remove accessibility and connectivity across the tracks for all modes on the networks where the roads would be closed to prevent the rail crossing. The closure of the existing roads to remove crossing of the rail line would force all modes to re-route to the realignment to make connections which would not improve travel time, reliability, or efficiency. This solution does not contribute towards enhancing the natural or social environments or address the Project Need and Opportunities established for the Study Area. This solution would require substantial land acquisition. The land impacts would be almost entirely Greenbelt lands that are actively farmed. As such, this solution results in social, natural, and economic environmental impacts and is not consistent with established planning policy.	Not Recommended ✗
5	Grade-separation	This solution eliminates the risk of a near-miss or collision between roadway and pathway users and trains. This solution also eliminates the need for rail-crossing infrastructure maintenance and inspection as it removes the crossing altogether. This solution provides the best opportunity to provide efficiency, resiliency, and mobility on the area transportation network. All modes would result in improved travel time, reliability, and efficiency as there would be no crossing where waits are experienced to let trains pass. Connectivity with the VIA Rail Fallowfield Station would be direct. This solution is consistent with addressing the Project Need and Opportunities. This solution results in impacts to the natural environment. However, there would be opportunity to improve corridor landscaping with implementation.	Recommended Preferred Solution ✓

4.4 Preliminary Preferred Solution

Based on the preceding evaluation the Preliminary Preferred Solution is to extend rapid transit from Baseline Station to Barrhaven Town Centre using LRT (including converting the Southwest Transitway from BRT to an LRT facility) and grade-separate the Southwest Transitway/Barrhaven LRT, Woodroffe Avenue and Fallowfield Road from the VIA Rail line.

4.5 Stakeholder Consultation

4.5.1 FIRST ROUND OF CONSULTATION GROUP MEETINGS

The first round of Study Consultation group meetings (Agency, Business and Public) were held on November 27 and 28, 2018. The Study Team, including members from the City of Ottawa and the consultant team, were available to discuss the study and answer questions in a round table forum. Consultation group members were identified and invited to participate via email correspondence. At these meetings, participants were presented information including: confirmation of project need and opportunities, an overview of existing conditions, evaluation of alternative solutions criteria, methodology and results, and the preliminary preferred solutions.

The first POH was held on October 30, 2019 and is discussed in Section 6.3.2. Information presented included the needs and opportunities, existing conditions, evaluation of alternative solutions and preliminary preferred solutions. Feedback received from stakeholders in these consultation meetings included the following:

- General support for the preliminary preferred solution to extend LRT from Baseline Station to Barrhaven Town Centre;
- General support for the preliminary preferred solution for grade-separating the Southwest Transitway/Barrhaven LRT, Woodroffe Avenue and Fallowfield Road from the VIA Rail line;
- Redevelopment plans for Barrhaven Town Centre;
- Consideration for staging/phasing plans to improve the area transportation network sooner; and,
- Consideration for extending the southerly limit of the study to serve to quickly growing communities south of the Jock River.

For a full account of discussion from these consultation group meetings and the first POH, refer to **Appendix A**.

4.6 Preferred Solution

The Study Team also took into consideration additional feedback received including opportunities to implement phasing options to improve the area transportation network sooner. The potential southerly extension beyond Barrhaven Town Centre was not included as part of this study but further considered by the City.

Based on the comments received the preferred solution was confirmed as an extension of rapid transit from Baseline Station to Barrhaven Town Centre as LRT (including converting the Southwest Transitway from BRT to an LRT facility) and grade-separating the Southwest Transitway/Barrhaven LRT, Woodroffe Avenue and Fallowfield Road from the VIA Rail line.

5 Update to Existing Environmental Conditions

Following the establishment of existing conditions for the Study Area and a preferred solution, more detailed analyses were conducted to further inform and develop the subsequent evaluation criteria and evaluation of alternative designs discussed in **Section 6**. These updated studies were completed during 2019-2020.

Additional analysis of existing conditions as it pertains to the modification to the Preferred Design is described in **Section 6.7** and **Annex 18 of Appendix B**.

5.1 Natural Environment Focused Field Studies

An extensive natural environment focused field study program was undertaken. The complete report can be found in **Appendix B.** Natural environment field surveys were conducted as part of this update to existing conditions and included:

- Ecological Land Classification (ELC);
- Significant Wildlife Habitat (SWH) assessment;
  - Amphibian breeding surveys;
  - Breeding bird surveys;
  - Bat maternity colony habitat assessment;
- Significant Woodlands assessment;
- Canadian Wetland Classification;
- Aquatic features assessment; and,
- Species at Risk (SAR) habitat suitability analysis.

Conduct of these surveys was limited to areas where consent to enter public/private lands was obtained during the appropriate timing window for each field survey.

5.1.1 ECOLOGICAL LAND CLASSIFICATION

Twenty-five natural vegetation communities were documented within the Study Area following the established methodology as per the *ELC system for southern Ontario* (Lee et. al., 1998) with updates from the 2008 catalogue. No ELC vegetation communities were found to be provincially at risk or of conservation concern as per the Natural Heritage Information Centre (NHIC). A total of 93 vascular plant species were recorded and most plants inventoried are common to widespread throughout Ontario. Vegetation SAR observed included the City of Ottawa's compensation plantings of Butternut (*Juglans cinerea*) specimens (listed as Endangered both federally and provincially) within the existing Transitway corridor, north and south of Berrigan Drive, and in the Black Rapids Creek corridor (not considered compensation plantings). Detailed ELC mapping is found in **Appendix B.**

5.1.2 SIGNIFICANT WILDLIFE HABITAT

There are four categories of SWH: seasonal concentration areas, migration corridors, rare or specialized habitats and Species of Conservation Concern. Species and their habitats that are already protected as Endangered or Threatened under the ESA are not considered in the assessment of SWH.

Three candidate SWH features and three confirmed SWH features were identified within the Study Area (**Table 5-1**). There are no candidate or confirmed migration corridors for the Study Area. Candidate SWH refers to those natural features that are potentially significant based on the presence of suitable habitat in the criteria outlined in MNRF's SWH guidance document (2015).

All candidate and confirmed SWH features were identified based on ELC, wildlife habitat assessments, and targeted surveys.

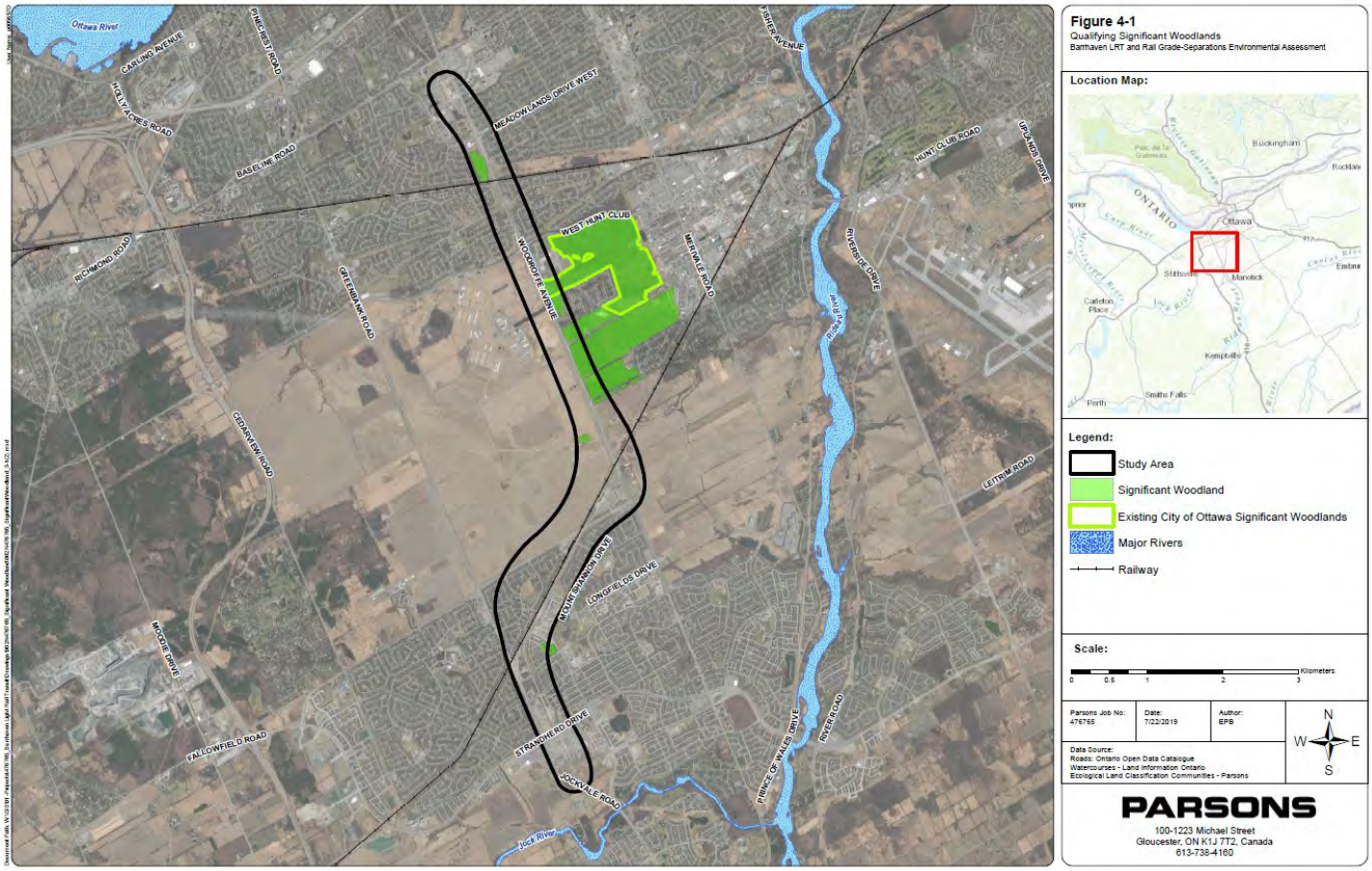
Table 5-1 Summary of Candidate and Confirmed SWH for the Study Area

SWH Category	Wildlife Habitat	Determination
Seasonal Concentration Areas	Waterfowl stopover and staging areas (terrestrial)	Candidate
	Bat Maternity Colonies	Candidate
Rare Habitats	Sand Barren	Confirmed; natural feature SBOB1
Specialized Habitats	Woodland raptor nesting habitat	Confirmed; a breeding pair of Cooper's Hawk observed in the forest communities of Pinhey Forest
	Amphibian breeding habitat (wetlands)	Candidate
Habitats for Species of Conservation Concern	Special Concern and Rare Wildlife Species	Confirmed; breeding pairs of Eastern Wood-pewee were observed within the forest communities comprising Pinhey Forest

5.1.3 SIGNIFICANT WOODLANDS

An assessment was conducted to determine if there were additional qualifying areas within the Study Area that meet the criteria for significant woodlands. Existing and qualifying significant woodland areas were identified as illustrated in **Figure 5-1**.

Figure 5-1 Significant Woodland Assessment Results



5.1.4 SPECIES AT RISK

Following additional field surveys including targeted surveys, the following is applicable to the Study Area:

- Four Threatened/Endangered species under the ESA and/or SARA were confirmed present within the Study Area, these include: Butternut, Barn Swallow*, Bobolink and Eastern Meadowlark.

- One species, Eastern Wood-pewee, listed as special concern species under the ESA and SARA was confirmed present within the Study Area.
- Seven Threatened/Endangered species under the ESA and/or SARA have a high potential to occur within the Study Area, these include: Bank Swallow, Chimney Swift, Common Nighthawk, Wood Thrush, Little Brown Myotis, Northern Myotis and Tricolored Bat.
- Seven species listed as Special Concern under the ESA and/or SARA have potential to occur within the Study Area, these include: Monarch, Yellow-banded Bumble Bee, Snapping Turtle, Eastern Milksnake, Evening Grosbeak, Grasshopper Sparrow and Northern Brook Lamprey.

* Species downlisted prior to finalizing EPR. Special Concern under provincial ESA as of January 25, 2023

5.1.5 CANADIAN WETLAND CLASSIFICATION

Classification keys outlined in the Canadian Wetland Classification System were used to determine wetlands within the Study Area (NWWG 1997). Wetlands are classified based on three levels: class, form, and type.

In total, five wetlands were identified within the Study Area according to the ELC system. These vegetation units have been further evaluated based on federal wetland guidelines. Wetland classification, description and locations of the evaluated wetlands identified based on their associated ELC code are provided (**Table 5-2**). The wetland communities observed within the Study Area are common throughout Ontario and have been heavily influenced by adjacent land uses such as active agriculture, transportation corridors, or pine plantations.

Table 5-2 Canadian Wetland Classification for the Study Area

ELC Vegetation Type	Wetland Class	Wetland Form	Wetland Type
SWDM3-2 Silver Maple Mineral Deciduous Swamp	Mineral Swamp1	Discharge Seepage Swamp3	Hardwood Treed6
SWDM4 Mineral Deciduous Swamp (Black Rapids Creek)	Mineral Swamp1	Riverine Swamp4	Hardwood Treed6
SWTM5 Mineral Deciduous Thicket Swamp (Black Rapids Creek, shown as MAMM1/SWTM5)	Mineral Swamp1	Riverine Swamp4	Mixed Shrub7
MAMM1 Graminoid Mineral Meadow Marsh (Black Rapids Creek, shown as MAMM1/SWTM5)	Mineral Marsh2	Riparian Stream Marsh5	Graminoid (Grass and Tall Rush)8
MAMM1-12 Common Reed Graminoid Mineral Meadow Marsh	Mineral Marsh2	Riparian Stream Marsh5	Graminoid (Reed – dominated by reed species (Phragmites spp.)

[1] periodically standing surface water and gently moving, nutrient-rich groundwater, with vegetation dominated by woody plants > 1 m high.

[2] wetland ecosystem characterized by minimal or no peat accumulation (although thin layers of muck and a mix of mineral and organic muck may be present), periodic or persistent standing water or slow-moving surface water which is circumneutral to alkaline and generally nutrient-rich, and vegetation dominated by graminoids, shrubs, forbs, or emergent plants.

[3] topographically flat and develop around and along the outflow of groundwater seepage. There are no distinct springs on the surface.

[4] occur along the banks of rivers and permanent/intermittent streams. Water table maintained by the level of water in the adjacent stream. Situated adjacent to streams and subject to flooding.

[5] situated on channels, streams, or rivers, on watercourses with continuous or intermittent flow.

[6] dominated by broadleaf species in the canopy layer. Most common species are maple species (*Acer spp.*), black ash (*Fraxinus nigra*), American elm (*Ulmus americana*), birch species (*Betula spp.*), and balsam poplar (*Populus balsamifera*).

[7] tall shrubs (> 1.5 m), medium shrubs (0.5 to 1.5 m), and low shrubs (0.1 to 0.5 m).

[8] dominated by low, tall, or mixed grass species and cattail species.

5.2 Geotechnical Investigation

To assist with the evaluation of alternative designs a focused geotechnical program was undertaken, which included drilling two boreholes at strategic points, along with analysis of extensive historical borehole data to provide more detail regarding the subsurface existing conditions and potential constraints. The investigation was completed November 19 and 27, 2018. The full report can be found in **Appendix B**. The results confirm the soil and groundwater challenges identified during previous planning studies in the vicinity of the proposed rail grade-separations for Woodroffe Avenue, Southwest Transitway and Fallowfield Road. The results from these investigations also identify that the same subsurface challenges that exist in the vicinity of the rail grade-separations exist in the north section of the Study Area between Baseline Station and West Hunt Club Road. The subsurface conditions in the southern section of the Study Area were also investigated between Fallowfield Road and Barrhaven Town Centre.

5.2.1 NORTH SECTION - LRT ALTERNATIVES

The north section of the Study Area is underlain by compressible silty clay (up to about 13m thick), over sand, silt, glacial till and bedrock. An extensive deposit of sand underlies the silty clay, increasing in thickness as the thickness of the silty clay decreases to the south.

The silty clay deposit, where present, has limited capacity to support additional loading without undergoing potentially significant compression, which could in turn lead to settlement of overlying structures. If excessive foundation settlements are to be avoided, the net change in stress on the underlying silty clay must be limited so that the stress level in the silty clay would not approach or exceed the deposit's precondition pressure (i.e., its 'yield' stress). The additional potential stress on the silty clay could result from a combination of new foundations loads, the weight of any material used for filling around the structures and any potential future groundwater level lowering.

5.2.1.1 Elevated Alternatives

Based on the anticipated subsurface conditions encountered between Baseline Station and Knoxdale Road, it is expected that elevated/overpass structures (including Tallwood Station), if considered along this segment of the LRT alignment, would likely need to be supported on deep foundations supported on the underlying glacial till or bedrock, in order to minimize the additional stress on the silty clay due to the foundation loads or filling. Based on the previous boreholes advanced along this section of the alignment, the depth to the bedrock surface is expected to be in the range of about 12 to 17m, generally decreasing towards south. The use of embankments is not recommended as they would require preloading and generally more technically complicated construction methods. No hydrogeological constraints are anticipated associated with the elevated/overpass structure alternative.

5.2.1.2 Below-Grade Alternatives

Conceptually, construction of the LRT within an open trench or tunnel (either cut and cover or underground tunnelling) is feasible from a geotechnical standpoint but the ground conditions present would result in significant risks, mainly related to control of groundwater.

Hydrogeological Considerations

Following on the November 2018 geotechnical investigations, a hydrogeological desktop analysis was carried out for the below-grade alternatives to assess the potential inflows and impacts. Assuming open excavations would extend to about 1m below the underside of the rail structure (tunnel or trench bottom), this would be between 5 to 7m below the measured groundwater level. Groundwater inflows from the sandy deposits will be very high and have significant construction impacts with respect to the excavation and structure. Based on the results of the previous hydrogeological investigations, and depending on the final LRT grades, temporary and permanent groundwater lowering in this area could lead to an unacceptable risk of settlement for those structures, facilities and utilities founded on shallow foundations. The predicted drawdown radius of influence could extend to approximately 250m located in or near the vicinity of the excavation due to the presence of thick compressible silty clay. The settlement impacts will not necessarily be limited to the areas immediately adjacent to the trench or tunnel.

The steady-state dewatering rate would need to be maintained for the life of the structure, assuming it would remain drained. Alternatively, the structure could be made entirely waterproof such that the groundwater levels could return to their current levels following construction. This would, however, significantly complicate the construction of any underground structure and potentially long-term maintenance (because of the need to maintain extensive waterproofing, liners, seals, etc.).

Open Cut Trench or Tunnel Considerations

The clay settlement mechanism described above is currently well understood in the geotechnical engineering community in the Ottawa area. Historically, however, it was not always understood and there have been instances where dewatering has resulted in significant settlements of structures.

In the case of the LRT tunnel/trench, the groundwater levels would need to be lowered permanently, as well as during construction, in order to maintain a dry facility. Typically, where that is required but the risks of dewatering are very high (as in this case) the approach is to carry out the excavation within a watertight shoring system and to design the permanent structure to be watertight, such that permanent pumping of groundwater is not required. This typically requires extremely robust shoring systems, such as interlocking secant pile walls or slurry walls that extend at least a few metres below the bedrock surface to completely cut off water inflows. Construction of a watertight base slab, tied into the watertight shoring on either side is also required.

Construction of watertight shoring and permanent structures is difficult, very costly and is not always successful. There are a number of construction challenges that must be overcome. The secant pile or slurry walls must be constructed in such a manner that the individual piles or slurry wall panels are completely interlocked (i.e., joined without gaps, or 'windows') over the full depth of installation. This can be difficult to achieve in practice but has been done successfully on many projects. However, the projects where complete sealing of the shoring has been achieved typically involve relatively limited lengths of shoring or construction areas (such as a building footprint), and typically require significant amounts of localized repairing as excavation proceeds). In the case of the Barrhaven LRT tunnel/trench, the watertight shoring walls and base slab would need to be constructed on both sides and base of a more than 2km long cut. Achieving the required shoring integrity over that length would be a significant challenge. Where the shoring installation does result in gaps or leakage, the corrective measures are difficult, costly, time-consuming and may not be entirely successful. Those measures typically involve grouting to seal the gaps (which can be very difficult to successfully complete), jet grouting, ground freezing (as a temporary solution), or the installation of recharge systems (which may be required to operate for the life of the facility).

It should also be noted that even small leaks in the permanent structure, especially if there are a number of them, can result in groundwater lowering that may take place over a number of years, resulting in third party claims many years after construction.

Tunnelling (TBM) Considerations

As an alternative to cut and cover construction, a tunnel or twin tunnels could be constructed using tunneling or trenchless methods along the entire alignment from Baseline Station to West Hunt Club Road. The total length of the alignment is about 2.3 km and a Tunnel Boring Machine (TBM) drive (or drives for twin tunnels) of this length may be economically feasible, although still costly, in comparison to the challenges noted above for open cut construction and the potential disruption associated with open cut construction.

TBM tunnelling is not without risk in the ground conditions present along this alignment. The ground conditions change from till to sands and clays along the alignment. These 'mixed face' conditions can be challenging from a tunnelling perspective since it is difficult to appropriately condition the tunnel spoils (excavated material) for muck removal and tunnel advancement as the composition of the soil changes. This can lead to clogging that significantly slows the rate of advancement (resulting increased cost or schedule delays), or, of more concern if support cannot be maintained in the running sands, over excavation and loss of ground can lead to sinkholes that result in damage to structures and utilities and threats to public safety.

In addition, although the risks of settlement of structures founded on compressible clay would likely be minimal for construction of the tunnel, the construction of the stations would still require watertight shoring, as described above for the open cut trench or tunnel. Permanently watertight structures would also be required for the stations and the resulting risks associated with groundwater control as described above for the open cut option, although of lesser magnitude, would still

apply for those excavations and the completed structures. Any leakage over time in the tunnel lining (due to construction issues of degradation of the gaskets or liner) could result in groundwater lowering over the long term that could lead to settlement and damage of structures or utilities along the alignment.

5.2.2 RAIL GRADE-SEPARATIONS

The subsurface conditions between West Hunt Club Road and Slack Road generally consist of sandy deposits but the total thickness of the deposits is not known. South of Slack Road, the sandy deposits tend to thin out and compressible silty clay is present with the thickness of the deposit increasing towards the south. Near the VIA Rail crossing, the LRT alignment is generally underlain by compressible silty clay, over very loose to loose silty and sandy soils, above glacial till and bedrock. The surface of bedrock was encountered in the range of 9 to 10m depth at the rail crossing.

It is not considered feasible to support an overpass in this location on shallow foundations given the limited capacity of the compressible silty clay. An overpass structure will therefore have to be founded on deep foundations. There are no significant geotechnical concerns with supporting bridge structures on deep foundations (such as driven steel H-piles end bearing on rock or drilled cast-in-place caissons end bearing on, or socketed in, the bedrock), recognizing that some of the piles could have difficulty penetrating to the bedrock surface and could 'hang up' on cobbles and boulders within the glacial till which overlies the bedrock, if driven steel H-piles are considered.

The significant issue with respect to excavations is groundwater control. Excavations below the groundwater level, which penetrate the overburden soils and are near/in the bedrock surface will experience significant groundwater inflow. Based on a previous pumping test carried out at the Fallowfield Road crossing, the water table in the very permeable bedrock will need to be lowered significantly to complete construction. In addition, based on the results of the previous investigations, the excavations may encounter basal heave and/or soil boiling when the base of excavation is within about 3 or 4m of the bedrock.

Water drawdown in the bedrock would also potentially cause consolidation of the overlying soil due to water depletion in the silty clay and very loose and loose silt material, resulting in settlement of adjacent structures supported on and within the overburden in the area. The magnitude of the consolidation settlement as a result of groundwater lowering is difficult to predict but it is likely greater than what structures can typically tolerate (i.e., greater than 25mm), which would be in addition to any settlement previously experienced by the structures.

Depressurizing the groundwater in the bedrock could prevent basal heave / soil boiling. This option would require continuous pumping of groundwater inflows from the bedrock to recharge wells even after the construction period. In the long-term, however, unless the water table in the bedrock is returned to pre-construction levels, pumping in the bedrock could lower the water in the bedrock regionally resulting in settlements of structures supported on and within the overburden in the area. Furthermore, any excavation that reaches or penetrates bedrock would require placement of low hydraulic conductivity material such as concrete and/or weathered clay to prevent hydraulic connection between the structure base materials and the bedrock.

Based on the above, an overpass bridge structure is considered to be the preferred grade-separation alternative from a geotechnical and hydrogeological perspective.

5.2.3 SOUTH SECTION - BRT TO LRT CONVERSION

The subsurface conditions moving southwards generally consist of silty clay and glacial till. The thickness of silty clay tends to decrease towards Barrhaven Town Centre and is limited or absent between Highbury Park Drive and Jockvale Road. Shallow bedrock was encountered between Highbury Park Drive and Berrigan Drive. The bedrock consists of sandstone underlain by dolostone or limestone.

Near Berrigan Drive, in view of the shallow bedrock conditions (within about 1m depth), a bridge structure, if considered, could be founded on spread footings supported directly on the bedrock. Since the embankments will essentially be supported on bedrock, settlement of the approach embankments will only occur due to compression of the embankment fill itself; settlement of the subgrade should be negligible.

South of Berrigan Drive, the bedrock surface is at deeper depths. Although technically feasible, it would not be practical to support the foundations of the new station on bedrock. The new station could instead be founded on shallow foundations placed directly on glacial till.

Shoring will likely be required due to the space constraints within the Barrhaven Town Centre. The type of shoring will depend on the proximity to existing structures and may require the use of relatively inflexible shoring (e.g., secant piles).

Some groundwater inflow into the excavations should be expected. However, if the floor of excavations will approach or extend into the bedrock surface, inflow from the bedrock would be significant. Some form of active dewatering will be required (such as pumping from a series of wells drilled into the bedrock) and the groundwater level will need to be lowered in advance of excavation; otherwise, the rate of groundwater inflow to the excavation would be excessive.

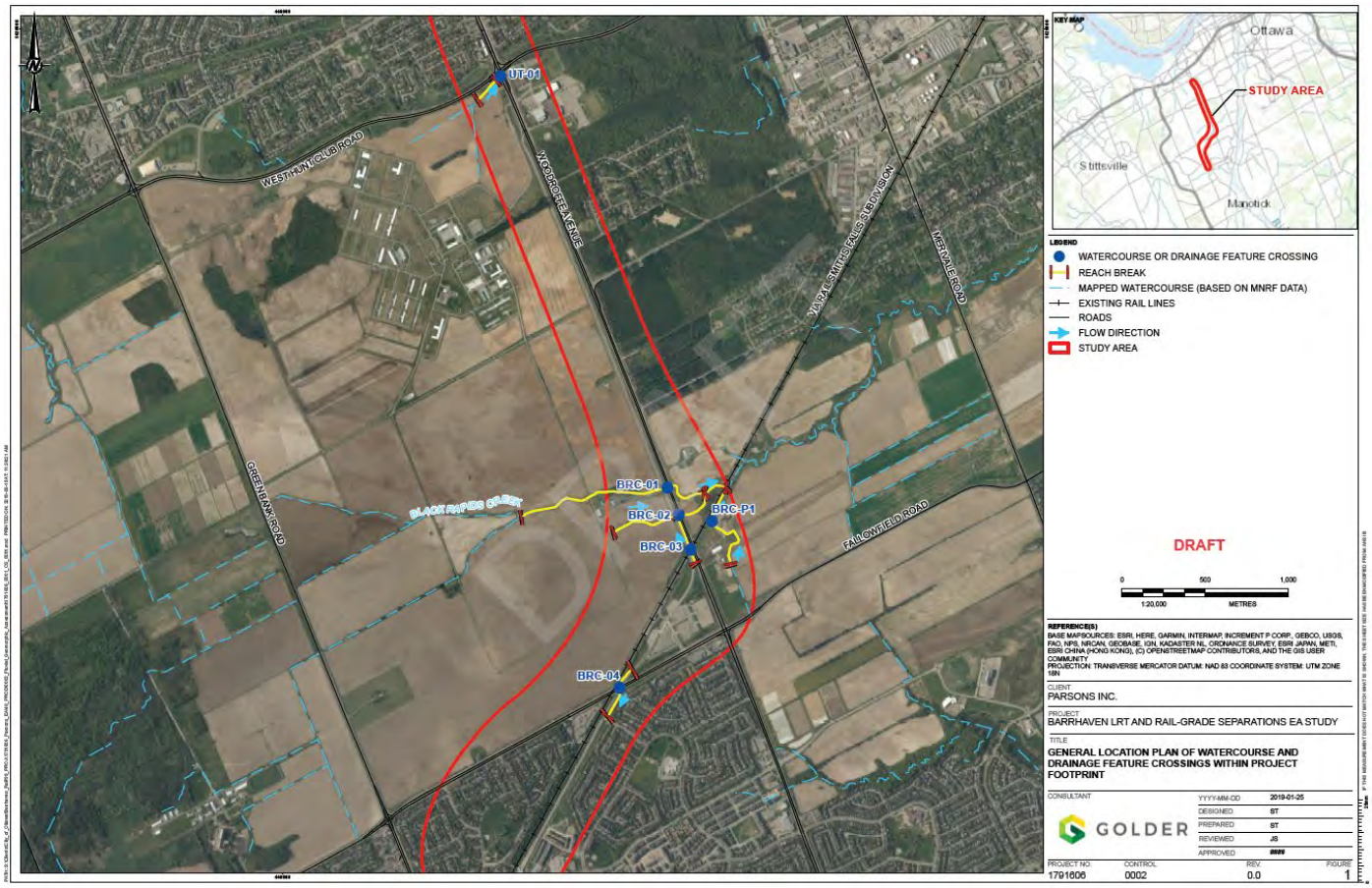
Short-term groundwater level lowering can be expected in the area around the new bridge and/or station due to the groundwater control requirement during construction. Longer-term groundwater level lowering may also be expected if a drainage system beneath and around the below-grade stations and running track is required. The silty clay soils in this area are potentially sensitive to changes in the ground water level. The potential for impacts on surrounding structures and utilities will therefore need to be evaluated.

It is expected that some groundwater lowering has already occurred due to drainage system of the existing underpass structures, which is likely at a similar level to the planned drainage system. The additional drawdown resulting from construction will therefore likely be fairly modest. Further, silty clay is not present on the southern section of the alignment. Where present, due to the low hydraulic conductivity of the silty clay (and the underlying glacial till), the drawdown is expected to be fairly localized to the area of construction. It is therefore expected that the potential groundwater level lowering would not cause excessive settlement of existing structures; however, this would need to be confirmed during subsequent geotechnical investigations during preliminary and detailed design.

5.3 Fluvial Geomorphic Assessment

A fluvial geomorphic assessment was conducted on relevant watercourse crossings in the Study Area to determine the extent of the 100-year erosion limit for each channel and thereby inform the functional design of upgraded crossing structures (**Figure 5-2**). Fieldwork to support this work was conducted on December 12, 2018 and January 11, 2019. The reaches of BRC-01 (Black Rapids Creek), BRC-02 (tributary to Black Rapids Creek) and BRC-P1 (tributary to Black Rapids Creek) are generally characterized by straightened/realigned channel patterns (altered before 1965 to accommodate agriculture or other land use practices) and have shown limited evidence of natural planform adjustment over the duration of the historical air photograph record. These reaches were shown to include no particular channel characteristics that would merit specific crossing structure sizes from the perspective of fluvial geomorphology. It is expected that the minimum span recommendations for the study reaches of BRC-03 (engineered ditch that conveys flows north-south located between the Southwest Transitway and Woodroffe Avenue), BRC-04 (engineered ditch that conveys flows to/from a stormwater management facility) and UTC-01 (tributary to Nepean Creek) will be based on hydraulics alone (i.e., conveyance of the design flood).

Figure 5-2 Location of Watercourse Crossings within the Study Area



5.4 Headwater Drainage Assessment

A headwater drainage assessment was conducted for the Study Area where four sites were observed (**Figure 5-3**). Fieldwork to support this work was conducted July 10, 2018 and April 17, 2019, the complete assessment can be found in **Appendix B**. Based on the management recommendations (TRCA, 2014), it was determined that BRC1-ST1, BRC1-ST2, BRC2-ST2, and BRC3-ST1 will require protection. This involves ensuring that the reach remains open and that the hydroperiod is maintained and is directly connected downstream. Relocation of any kind is not permitted and groundwater or wetlands must be maintained.

Conservation was recommended for BRC2-ST1. This involves maintaining or replacing the existing surrounding features, including on-site and external flows and vegetation within the riparian zone corridor. Natural design techniques to maintain or enhance the reach are to be used.

No management is required for both the GRFD1-ST1 site, due to the lack of flow, natural vegetation and connection downstream.

Figure 5-3 Headwater Drainage Feature Assessment Locations and Management Recommendation