

APPENDIX H

Landscape Composition Report

ONTARIO MINISTRY OF TRANSPORTATION – EASTERN REGION
GWP 4054-17-00

LANDSCAPE COMPOSITION REPORT PRELIMINARY DESIGN AND CLASS ENVIRONMENTAL ASSESSMENT, HIGHWAY 401 PLANNING STUDY COLBORNE TO BRIGHTON

AUGUST 2023





LANDSCAPE COMPOSITION REPORT

PRELIMINARY DESIGN AND
CLASS ENVIRONMENTAL
ASSESSMENT, HIGHWAY
401 PLANNING STUDY
COLBORNE TO BRIGHTON


ONTARIO MINISTRY OF TRANSPORTATION –
EASTERN REGION

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1 INTRODUCTION

1.1 REPORT OVERVIEW

WSP Canada Inc. (WSP) has been retained by the Ontario Ministry of Transportation (MTO) to complete Planning, Preliminary Design and Environmental Assessment for the replacement and rehabilitation of bridges and structural culverts, the establishment of 6 interim lanes, and ultimate 8 lanes for the future Highway 401 footprint to address current and future transportation needs and commuter parking lot improvements for Highway 401– Colborne to Brighton. The project limits extend from 0.8 km east of Percy Street to 0.4 km west of Christiani Road (Figure 1 - Map of Study Area Figure 1). The approximately length of the corridor is 16 km.

This Landscape Composition Report (LCR) summarizes the existing landscape composition and assessment of impacts associated with the Preliminary Design of the new Highway 401 within the study area. The report meets the requirements of the MTO Environmental Reference for Design (ERD) Section 3.9 – Landscape Composition, and utilizes and builds on the mitigation and compensation measures outlined by other disciplines.

The LCR includes:

- An examination of the existing landscape conditions, including vegetation in the existing and proposed right-of-way (ROW), vistas, landform and land uses;
- A desktop photographic inventory of the study area – refer to Appendix A;
- Identification of potential effects of the proposed highway works on significant vegetation, vistas and landforms;
- Preliminary Design Plates and a description of the existing landscape composition and potential impacts, where applicable, related to:
 - Landscape vegetation and soil protection;
 - Surface and groundwater flows;
 - The visual environment;
 - The socio-economic environment; and
 - Cultural heritage features.
- Recommendations and mitigation strategies, including key recommendations where removals are recommended and compensation planting;
- Mitigation measures that draw on information from other disciplines related to vegetation, wildlife, cultural heritage, and the socio-economic environment.

Readers are encouraged to view this report in its entirety. Similarly, it is recommended that all Impact Assessment Reports prepared by other disciplines are to be read in tandem with this report, to ensure that

measures and recommendations within each discipline's report are compatible and carried forward where recommended.

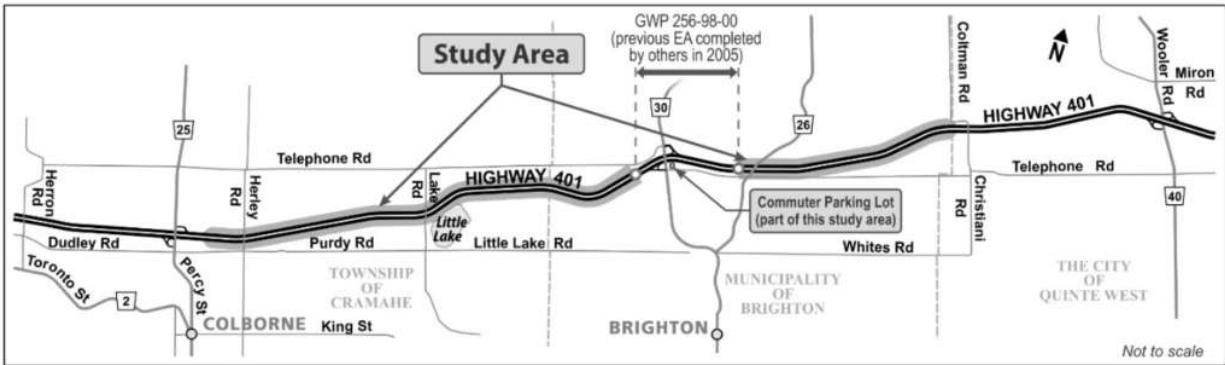


Figure 1 - Map of Study Area

2 METHODOLOGY

Desktop assessments were conducted to support the preparation of this report. Photographs and notes were recorded through examinations of aerial and street-view photography obtained from Google Earth. Background data and field inventory information from other disciplines were then analyzed to identify potential constraints, sensitivities, and related management and mitigation implications in relation to the proposed works. The analysis includes the viewshed from the perspective of the highway users, as well as the existing and potential views of the highway from adjacent lands. The complete desktop photographic inventory of the study area can be found in Appendix B. Plates PN1- PN33, and PS1 – PS33 of Appendix B show the location of collected photographs and vegetation data overlaid on existing aerial photography and the proposed limits of grading. The photographic inventory (Appendix B) is to be read in conjunction with the Inventory Plans (Appendix A).

2.1 BACKGROUND INFORMATION SOURCES

Background information sources reviewed prior to the desktop assessment include:

- MTO Landscape Composition Environmental Reference for Highway (October 2006)
- The Official Plan of the Township of Cramahe (December 2014)
- The Municipality of Brighton Official Plan (September 2020)

The following documents prepared by WSP were reviewed to provide pertinent information about the study area:

- 30% Landscape Design Drawings (WSP, February 2023)
- Draft Terrestrial Ecosystem Existing Conditions Report (WSP, December 2021)
- Fish and Fish Habitat Existing Conditions Report (WSP, December 2020)
- Cultural Heritage Resource Assessment Report (WSP, February 2022)

A full list of references is provided at the end of this report.

2.2 STUDY PROCESS

The process of completing the LCR included the following activities:

- 1 Review technical reports available, including: highway drawings, reporting for aquatic & terrestrial ecosystems, and natural and cultural heritage;
- 2 Review of aerial photography, street-view imagery and all relevant base mapping;
- 3 Identification and description of the landscape composition related to the existing landscape within proposed right-of-way, including a visual review of landscape features, natural geomorphologic landforms, waterscapes, and vistas in the vicinity of the highway;
- 4 Coordinate with other studies underway to collaborate; and
- 5 Identification of potential impacts and mitigation strategies related to the undertaking.

3 EXISTING CONDITIONS

3.1 PHYSIOGRAPHY AND TOPOGRAPHY

The study area is located in southeastern Ontario and lies between the cities of Colborne and Brighton traversing through regions of drumlins, till plains, sand plains, and clay plains. The drumlins consists of a series of north east – south west oriented drumlins (Chapman and Putnam, 2007). The topography is variable ranging from gently rolling to local areas of hills and steeper slopes with the latter occurring just beyond the ROW in some locations.

The landscape adjacent to Highway 401 within the project limits is a mosaic of agricultural, rural residential and natural habitats including forests, wetlands and cultural meadow (WSP, February 2023).

3.2 LAND USES AND SETTLEMENT PATTERNS

The study area extends from the Township of Cramahe to the Municipality of Brighton (from 0.8 km east of Percy Street to 0.4 km west of Christiani Road). The principal intersections within the study area along Highway 401 from west to east include: Durham Rd. overpass, Lake Rd. overpass, County Rd. 26 overpass, and Christiani Rd. overpass.

Adjacent to the Highway 401 ROW, the land use is typically characterized by agricultural uses or woodlots. Quarries, roadways, houses and barns, and other infrastructure are periodically observed. Little Lake (a small oblong lake), and smaller regional roads (Crandall Rd., McDonald Rd., and Telephone Rd.) can be seen from the highway (WSP, February 2022).

3.3 DESIGNATED NATURAL HERITAGE AREAS

Land within the proposed right-of way (ROW) consists of cultural meadow vegetation (field herbs and grasses), tree and shrub cover. The surrounding landscape is a mosaic of natural features such as: woodlands, wetlands, shrub thickets, plantations, and agricultural lands interspersed with residential property. Greater areas of natural vegetation include woodlands and wetlands which form an area of habitat connectivity across the landscape in the following areas: the south side of the highway west of Lake Road to the south side of highway east of Little Lake (WSP, 2022). There are significant natural areas and Areas of Natural and Scientific Interest which may be impacted by the proposed highway including: Brighton Bluff ANSI, Mayhew Creek Significant Natural Area, and Bidy Creek Wetland. Refer to the Terrestrial Existing Conditions Report (WSP, 2022) for more information.

Natural Heritage mapping (NHIC, 2021) shows woodlands along the length of the study area. They include deciduous, coniferous and mixed forest types.

During field investigations these woodlands were found to be of significant size (> 2 ha) were in a rural to low-density residential setting and had a continuous canopy. These attributes are likely to designate the woodlands as significant based on criteria in the MNRF's Natural Heritage Reference Manual (MNRF, 2010) and Municipal and Northumberland County's Official Plans.

Table 1: Designated Natural Heritage Areas within the Study Area

ANSI	SIGNIFICANT WOODLANDS	SIGNIFICANT NATURAL AREAS	WETLANDS
<ul style="list-style-type: none"> — Brighton Bluff — Brighton Provincial Wildlife Area 	<ul style="list-style-type: none"> — Multiple unnamed throughout the study area 	<ul style="list-style-type: none"> — Mayhew Creek Significant Natural Area — Spring Valley Significant Natural Area 	<ul style="list-style-type: none"> — No Provincially significant wetlands were found in or surrounding the adjacent study area — Bidy Creek (evaluated wetland, non PSW)

3.4 SIGNIFICANT VIEWS

For the most part, vistas along the ROW consist of rolling agricultural fields, meadows, plantations, thickets, rural properties, and various kinds of forests. The natural topography of the site is framed and enhanced by vegetated buffers, woodlots, and hedgerows. Views along the Little Lake, and minor roads off the highway are particularly compelling. A photographic record of views along the entire corridor is included in Appendix B.

It is anticipated that proposed vegetation removals and the construction of the new roadway and bridges will significantly impact some of these views. Principal consideration should be given to buffering views of the roadway from adjacent land uses, and framing bridges with appropriate vegetation to ensure that new infrastructure fits into the existing landscape harmoniously. Conversely, thought should be given to providing views of the surrounding landscape from the new roadway and bridges where possible, while also maintaining safe driving conditions.



Figure 2 – Eastbound lane (looking west) with view of Telephone Road trail in the distance



Figure 3 - County Road 26 north of Highway 401, looking north



Figure 4 – Eastbound lane (looking west) of Highway 401 with Little Lake in the distance



Figure 5 - Eastbound lane of Highway 401, looking south west



Figure 6 - View of Hwy 401 from Telephone Rd., looking east



Figure 7 - View from Brighton Provincial Park, looking south towards Hwy 401



Figure 8 - View of Highway 401 from Christiani Rd. bridge, looking west



Figure 9 - View of Christiania/ Coltman bridge approach over Hwy 401, looking south



Figure 10 - View from Crandall Rd. with Hwy 401 to south (looking southeast)



Figure 11 - McDonald Rd., north of Little Lake and south of Hwy 401, looking west

4 ANTICIPATED IMPACT ON THE ENVIRONMENT AND MITIGATION MEASURES

4.1 PROPOSED WORKS

The section of Highway 401 that comprises the study area is currently a four-lane divided highway. Specifically, the study area limits include Highway 401 from 0.8 km east of Percy Street in the Town of Colborne to 0.4 km west of Christiani Road in the Municipality of Brighton. The total length of the study area is 16.8 km. The highway carries local, commercial, commuter, tourist, and agricultural traffic and is the primary through route across southern, central, and eastern Ontario. The section below describes the potential impacts and mitigation recommendations for the Preliminary Design and Class EA for the rehabilitation or replacement of seven bridges and culverts, commuter parking lot improvements at County Road 30, along with the widening of Highway 401 to either six (interim) or eight (long-term) lanes of traffic between the Town of Colborne and the Municipality of Brighton.

4.2 POTENTIAL IMPACTS & MITIGATION RECOMMENDATIONS

Direct and indirect impacts to vegetation, wildlife, and species-at risk are anticipated as a result of the proposed works. However, encroachment of the new ROW limits on both sides of the highway will mainly directly impact areas of cultural vegetation of relatively minor ecological value and small isolated groupings of trees. Notably, removals will directly impact the edge of the woodlands and habitat of Butternuts (*Juglans cinerea*; Tree B03), adjacent wetlands and vegetation within the Brighton Provincial Wildlife Area ANSI (WSP, February 2023).

The following table summarizes the anticipated impacts and mitigation measures to protect significant cultural heritage landscapes, and vegetation within the study area. These are based off of anticipated impacts outlined in the Terrestrial Ecosystems Impact Assessment Report (WSP, February 2023), as well as planting restoration best practices to minimize the impacts on habitat during the implementation of the proposed works.

Table 2: Impacts & Mitigation Recommendations

AREA	ANTICIPATED IMPACT	MITIGATION MEASURES
Cultural Heritage Landscapes and Buildings: CHL 3-5, CHL 7, CHL 9, CHL 12, CHL 14, CHL 15, CHL 16, CHL 18, CHL 19, CHL 23, CHL 24, BHR 2, BHR 10.	Potential grading and construction impacts.	Where construction is anticipated to result in grading impacts and tree removals, post-construction landscaping with native tree species should be employed to mitigate visual impacts.
Cultural Roadside Vegetation (ELC's : CUM1-1, CUS, CUT, CUW, CUP)	Potential removals and grading.	<ul style="list-style-type: none"> — Bank stabilization — Topsoil and reseeded — Restore disturbed meadow areas with Native Grass and Forb Mix – Well Drained, to encourage monarch butterfly breeding
Treed Habitat	Approximately 2750m of treed edge habitat anticipated to be removed to facilitate construction. Refer to Terrestrial Existing Conditions and Impact Assessment Report and Highways Removals Plans for additional information	<ul style="list-style-type: none"> — Bank stabilization — Topsoil and reseeded — Replanting with densely spaced native species of trees and shrubs, to prevent encroachment by invasive species and protect wildlife habitat. Minimum of 2 rows of trees
Marsh habitat at Little Lake and Bidy Creek, and various locations along Highway 401 edge	Minor vegetation removal associated with culvert lengthening.	<ul style="list-style-type: none"> — Bank stabilization — Topsoil and reseeded
Brighton Provincial Wildlife Area	Approximately 740m of mature treed habitat anticipated to be removed to facilitate construction.	<ul style="list-style-type: none"> — Bank stabilization — Topsoil and reseeded — Replanting with densely spaced trees and shrubs of woodland edge to prevent encroachment by invasive species and protect wildlife habitat

4.3 MITIGATION MEASURES

This report aims to provide high-level considerations for the study area until such time detail design can be completed. Feature limits, setbacks, and environmental management recommendations should be

reviewed and refined through liaison with the project environmental team and further design of the proposed works. Primary preservation and mitigation should be focused on areas of natural heritage significance and those including SAR (Species at Risk) habitat.

At the time of detailed design, consultation with the Ministry of Environment Conservation and Parks (MECP) and the project Ecologists should be undertaken to determine the requirements for SAR habitat restoration, if any. Construction materials, such as erosion control blankets, and rip rap sizing, should also be reviewed at that time, to ensure there are no negative impacts to SAR species.

4.3.1 GENERAL MITIGATION RECOMMENDATIONS

Construction activities can cause direct and indirect environmental effects. Generally, with the implementation of mitigation measures and best management practices, the effects can be minimized. The following sections describe strategies that can be applied to mitigate potential impacts.

In developing specific actions for individual wetland and woodland areas, the following key mitigation and monitoring measures should be executed:

- A Landscape Architect / Certified Arborist should be consulted during the detailed design and construction phases so that appropriate protection measures can be established for trees to be retained adjacent to the right-of-way.
- Compensation plantings should be designed where deemed necessary and appropriate. Native species should be used for new plantings as a priority with exceptions only executed to fulfill a specific function for which there is not a suitable native species. Select non-native species may be utilized for functional reasons such as salt-tolerant evergreens to mitigate snow drifting, which is difficult to source with native varieties. Invasive species should not be used under any circumstance. Appendix C provides a list of suitable species from which selections can be made for planting designs.
- If mature native specimens are removed for access and clearing purposes, it is recommended that the same species be replanted following proposed works. Compensation planning for tree removals should use an aggregate caliper method. The caliper of the replacement trees should be equal to the sum of trees being removed (i.e. 150mm DBH tree removed = (3) 50mm or (15) 10mm trees to be replaced). The location of such plantings can be adjusted to minimize the potential for future interference with operations (i.e. drainage).
- Monitoring by an Environmental Inspector is recommended to observe, inspect and ensure proper installation and maintenance of mitigation measures during construction and for a specified period of time following the completion of construction.

4.3.2 SEDIMENT CONTROL

- To prevent migration of sediment into watercourses and natural areas, implement erosion and sediment controls prior to construction and monitor regularly to ensure they remain in place and are functioning properly during construction. Ensure sediment control measures (i.e. filter sock product) remain in place until groundcover plantings (i.e. seeded areas) have become established.
- When proposing erosion control barriers (ECB), filter sock products are recommended where appropriate. Filter sock products can be infused with seed and remain on site past site stabilization. These products are not dug in like traditional silt fence and therefore have less impact to existing root system when installed and avoid disturbance at removal.

- Protect existing vegetation that is to be retained per Ontario Provincial Standard Specification (OPSS) 805: Construction Specification for Temporary Erosion and Sediment Control Measures.
- Disturbed areas (i.e. open soil areas created during construction) will be stabilized and re-vegetated with appropriate seed mixes as soon as possible following construction. Where appropriate and feasible side slopes will be vegetated with native plant species to reduce erosion, improve slope stability, increase infiltration and reduce overland flow. Recommended seed mixes include:
 - MTO Modified Native Standard Roadside Mix (OPSS PROV 803)
 - MTO Lowland Mix (OPSS PROV 803)
 - Native Grass and Forb Mix – Well Drained

Specifications for the seed mixtures noted above are recommended in Appendix C and shall be specified.

4.3.3 GRADING

- Existing surface and groundwater flow patterns will be carefully studied so that proposed grading can be designed to maintain these patterns to the greatest extent possible.
 - Where possible, side slopes should not exceed 3:1 (horizontal: vertical) unless there is a strategic reason otherwise. Where conditions require slopes greater than 3:1 the application of bonded fibre matrix (BFM) is required as an additive to hydroseeding slurry of seed application to help maintain a stable slope and minimize erosion until seed becomes established. Inclusion of BFM additive should be considered for slopes less than 3:1 where volumes of overland flow and general run off may warrant additional protection.
-

4.3.4 PROTECTION OF EXISTING VEGETATION

- Limit vegetation clearing beyond the ROW and limit the size of the construction area and clear zone to only what is needed. Typically, vegetation clearing beyond the right-of-way (ROW) is not permitted. If vegetation clearing beyond the ROW is required for access or managements of sightlines, agreements with landowners must be obtained. Any additional vegetation clearing must be assessed by a qualified person (Ecologist, Arborist, etc.) as applicable and permits and mitigation measures determined prior to commencement of work. Keep the size of zones designated for clearing and brushing as small as possible, limiting them to the removal of only what is necessary for establishing clear sight lines. Areas where brushing is required typically contain shrubs such as Sumac, Red Osier Dogwood and invasive Buckthorn, and trees including Trembling Aspen and Green Ash.
- Locate construction access and staging areas in less sensitive areas and facilitate the regeneration of construction access and staging areas through active restoration plans.
- Carefully clear vegetation and trees designated for removal in accordance with OPSS 201 (Construction Specification for Clearing, Close Cut Clearing, Grubbing, and Removal of Surface and Piled Boulders). This includes felling trees into the ROW to minimize unnecessary disturbance beyond the ROW.
- Protect against spills of contaminants, fuels and other potentially harmful materials that may reach natural areas.
- Restrict vehicle maintenance and refueling to designated areas only.
- Establish a Tree Protection Zone (TPZ) through the installation of tree protection fencing which follows standard arboricultural procedures (per OPSS 801).

- The following are basic precautions and procedures related to tree management during construction:
 - Areas within the dripline of trees designated for preservation are not to be used for any type of storage (e.g., storage of debris, construction material, surplus soils, and construction equipment). Trenching or tunneling for underground services shall not take place within the TPZ or dripline of trees designated for preservation within or adjacent to the construction zone.
 - No grade changes shall occur within the TPZ. Where grade changes may occur, either as a cut or fill situation, precautions to preserve the tree may be undertaken prior to the placement of fill or excavation activities.
 - Trees to be preserved shall not have any rigging cables or hardware of any sort attached or wrapped around them. Potential contaminants shall not be dumped or flushed within the TPZ or where they may come into contact with the feeder roots of the trees.
 - Ensure that the Contractor takes every precaution to prevent damage to trees or shrubs. This includes protecting crown and root systems from damage, preventing compaction and contamination resulting from the construction. Any damage to trees such as broken limbs, damage to roots, or wounds to the main trunk or stem systems should be immediately reported to the Contract Administrator so that the damage can be addressed promptly by a Landscape Architect and Certified Arborist where appropriate.
 - In the event that it is necessary during construction to remove limbs, portions of trees or excavate in root zones of trees that are designated for preservation, all operations should be executed carefully and in accordance with proper arboricultural techniques and under the guidance of a Certified Arborist.

4.3.5 WATERCOURSE AND WETLAND CROSSINGS

- Minimize the construction envelope at watercourse and wetland crossings.
- Where enhancement plantings are being introduced at watercourse crossings consider the following strategies:
 - Use native tree and shrub plantings including deciduous tree whips;
 - Stabilize slopes with native seed mix using bonded fibre matrix (BFM) and install native vegetation with suckering/colony forming habits (Appendix C);
 - Assess the feasibility of using bioengineering techniques such as soil and seedbank retention and salvage, live staking etc.;
 - Use native seed mixtures to stabilize open soil areas, prevent future erosion, provide value for wildlife (e.g. food, cover and breeding habitat);
 - Minimize compaction of soils. Where compaction cannot be avoided, employ decompaction techniques prior to planting and seeding as part of the site rehabilitation process.
- Proposed storm water ponds should be designed to appear natural, blending in with the surrounding natural landscape (i.e. natural curved shape, appropriate aquatic and terrestrial native planting).

4.3.6 WILDLIFE

- Implement erosion and sediment control measures as noted in Section 4.3.2.
- Implement recommendations in the (TECIA) Terrestrial Existing Conditions and Impact Assessment Report (WSP, February 2023). Some key recommendations include:

- Ensure no active bird nests will be removed / disturbed during the identified breeding bird window in accordance with the Migratory Birds Convention Act;
- Develop a protocol for wildlife awareness training and encounters (including Species of Conservation Concern) to be implemented by the Contract Administrator during construction; and,
- Consider public education and seasonal or permanent wildlife signs at key wildlife passage corridors to public raise awareness about the increased potential to encounter wildlife in these locations.

4.3.7 INVASIVE SPECIES

4.3.7.1 EUROPEAN COMMON REED

European Common Reed (*Phragmites australis*) is an invasive plant species that is a concern along municipal and provincial highways. They thrive in disturbed, moist soils making ditches the ideal environment for the species to grow. Phragmites are aggressive and can rapidly spread through ditches and swales impacting biodiversity, habitat and hydrological cycles along the highway. Mitigation measures should be implemented to avoid the migration of Phragmites into the MTO right-of-way.

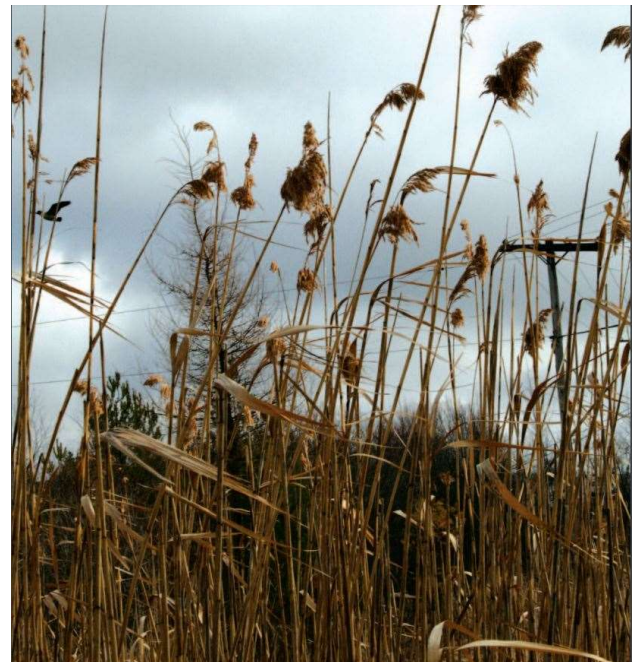


Figure 12: European Common Reed

Spraying the stands of European Common Reed with an herbicide, such as Glyphosate, at least three weeks prior to excavation could be used to kill the majority of the plants. However, even with spraying the excavated soil should be contained to ensure that either seeds or rhizomes do not escape during the process of disposal. If possible, roots, rhizomes, and seed heads should be placed in sturdy plastic bags for disposal at an appropriate sanitary landfill or burned. While it is possible to compost the stems, reproductive portions of

European Common Reed should never be placed into compost. Clothing, footwear, and equipment should be cleaned on-site after handling the plant to avoid further dispersal of European Common Reed.

During detailed design, the consultant must:

- Review areas identified by ecologists in other studies (TECIA Report) or if identified on site.
- Confirm species with project Ecologist.
- Construction documents to include removal procedures and monitoring plan by qualified Ecologist.

Removal and disposal of European Common Weed shall be in in conformance with guidelines and recommendations outlined in the [Invasive Phragmites \(European Common Reed\) – Best Management Practices in Ontario](https://www.ontarioinvasiveplants.ca/resources/best-management-practices/) found on the Ontario Invasive Plant Council website (<https://www.ontarioinvasiveplants.ca/resources/best-management-practices/>).

4.3.7.2 BUCKTHORN

Buckthorn (*Rhamnus cathartica*) is a non-native invasive species that spreads rapidly along roadways, fence lines, woodlot edges, and in fields. This shade and drought tolerant species out-competes native plants while reducing biodiversity, degrading soil qualities and impacting habitats.

In woodlot edges where Buckthorn is present, efforts shall be made to eliminate the species to allow for successful establishment of native woodlot edge species. Efforts to eliminate the species include pulling and cutting. Pulling should take place from mid-October to mid-November when surrounding plants are dormant and soil is moist and pliable. Plants up to 1 metre tall can be removed by pulling. Cutting of larger specimens should take place from late spring to early summer. Herbicide should be applied to the stump immediately after cutting to allow for optimum absorption. Clothing, footwear, and equipment should be cleaned on-site after handling the plant to avoid further dispersal of Buckthorn.



Figure 13: Buckthorn

During detailed design, the consultant must:

- Review areas identified by ecologists in other studies TECIA Report or if identified on site.
- Confirm species with project Ecologist.
- Construction documents to include removal procedures and monitoring plan by qualified Ecologist.

The removal and disposal of Buckthorn shall be in conformance with the guidelines and recommendations outlined in the Invasive Common Buckthorn – Best Management Practices in Ontario found on the Ontario Invasive Plant Council website (<https://www.ontarioinvasiveplants.ca/resources/best-management-practices/>). Further information on pulling and cutting, as well as herbicide application, can be found in the Invasive Common Buckthorn – Best Management Practices in Ontario publication.

4.3.7.3 AUTUMN OLIVE

Autumn Olive (*Elaeagnus umbellata*), also known as the Japanese Silverberry is a non-native invasive species. It's a prolific seed producer and grows rapidly in a wide series of environments including areas with poor nutrients. This species was largely used and promoted in the 1960 – 1970 as a beneficial wildlife species due to its high tolerance for low soil PH, and nitrogen fixing properties making it used of mine and soil reclamations.

While examining sites where Autumn Olives are



Figure 14: Autumn Olive

present, it's important to use a control plan, which integrates pest management principles (IPM) to determine the type of control measure. A detailed inventory of each site is recommended before starting control efforts to minimize negative impacts to surrounding flora and fauna. Mechanical control measures ie: pulling/ digging or mulching are effective in smaller areas <300 sq.m of scattered seedlings or smaller plants with stems up to 9cm in dia.

In plants with medium to large stems <2cm dia., cut stem close to ground and spray herbicide to cover the cambium layer of the cut stump within minutes of cut. Applications of triclopyr, glyphosate or picloram are recommended.

For more information or a wider variety of methods and treatment, please refer to the Autumn Olive Best Management Practice in Ontario Guide

During detailed design, the consultant must:

- Review areas identified by ecologists in other studies (TECIA Report) or if identified on site.
- Confirm species with project Ecologist.
- Construction documents to include removal procedures and monitoring plan by qualified Ecologist.

The removal and disposal of Autumn Olive shall be in conformance with the guidelines and recommendations outlined in the Autumn Olive Best Management Practice in Ontario Guide found on the Ontario Invasive Plant Council website (<https://www.ontarioinvasiveplants.ca/resources/best-management-practices/>). Further information on pulling and cutting, as well as herbicide application, can be found in the Autumn Olive Best Management Practice in Ontario Guide Ontario publication.

4.3.8 OTHER CONSIDERATIONS

Potential indirect effects to adjacent vegetation features that may occur following the construction period can include the following:

- Damage from excessive or improper application of herbicides and pesticides for ROW maintenance requirements.
- Damage to bordering natural vegetation from roadway maintenance activities such as salting and sanding, structure/culvert repairs, ditch cleanout. The application of salt on roadways for safety reasons is in accordance with Best Management Practices (BMPs). Salt runoff and salt spray drift into vegetated areas may result in the loss of vegetation vigor and in extreme cases, vegetation dieback, and spread of salt tolerant flora (halophytes).
- In locations where there are considerable spread of grapevines, monitor new plantings to make sure they are not over taken by river bank grape.

5 RESTORATION AND ENHANCEMENT FEATURES

5.1 NATURAL HERITAGE

A series of habitat areas including forest, meadows and marshes all have the potential to support wildlife that are tolerant of human landscapes. Areas directly adjacent to the ROW may provide greater opportunities for more sensitive wildlife which can include interior bird species and other wildlife species.

An assessment of wildlife movement was carried out, and through this research, it was noted that there are some concentrations of wildlife in the vicinity of the Brighton Provincial Wildlife Area at the east end of the project site. The natural heritage character of the region, especially CHL and BHR impacted by the Highway 401 ROW should be restored back as close to existing conditions as possible.

A 30% Planting Plan was developed by WSP (February 2023) specifying planting and seeding options to restore areas impacted by the scope of this project. Outlined in Appendix C are custom seed mixes and specialized planting palettes recommended for the various ecosystems present in project ROW.

For more information, refer to the TECIA Report (WSP, February 2023), Wildlife Movement Existing Conditions and Opportunities Report (WSP, March 2022), and 30% Landscape Design Drawings (WSP, Feb 2023).

5.2 SNOWDRIFT BUFFERS

Snowdrift buffers can be a mitigation strategy to reduce snowdrift onto the highway. At the time of this report writing, no snowdrift assessment has been prepared for the highway works. A study would need to be performed to outline where tree lined buffers are most effective at reducing the snowdrift. Typically this would include rows of staggered trees and dense rows of undercover shrubs placed at a distance of 15m x the height of the vegetative barrier from the pavement edge.

5.3 FOREST EDGE MANAGEMENT

- Maximize the retention of vegetation to the greatest extent possible and use protective fencing as noted in section 4.3.4 to minimize disturbance during construction.
- Nesting migratory birds are protected under the Migratory Birds Conservation Act, MBCA (1994) and Regulations. In general, it is recommended that activities which could result in an MBCA contravention be conducted outside of the area-specific “Regional Nesting Period”; for the subject area, the Regional Nesting Period is from the end of March to end of August (approximately). See nesting period and calendars here:
 - <http://www.ec.gc.ca/paom-itmb/default.asp?lang=En&n=1B16EAFB-1>.
- Where new forest edges need to be established consider the opportunity to retain a narrow zone where no root grubbing will occur. Flush cut trees and shrubs in this zone promote regrowth and stimulate

suckering from cut stumps and roots. During detailed design, flush cutting zones and methods should be implemented at all woodlot edge rehabilitation areas shown in Appendix D (Conceptual Planting Plans).

- Retain the native soil and seedbank wherever possible in areas where clearing is proposed.
- Where applicable establish buffer plantings with groups of native trees and shrubs along the new edges to increase shade, reduce wind and the effects of other contaminants such as salt spray. Species selection should also be based on desirable existing vegetation and consider factors such as salt tolerance, longevity and hardiness of plant material, and seasonal interest. Invasive or exotic species should not be utilized in any circumstance.
- To help preserve the natural integrity of the existing vegetation colonies, proposed plant species should be selected based plant list provided in Appendix C and ensure species selected are based on those remaining the area being planted.
- In sloped areas select colony forming/suckering and deep-rooted plant species to assist with slope stabilization and organize plantings in large masses to promote dense colony formation and enhance visual quality.

6 MONITORING AND COMMITMENTS FOR THE UNDERTAKING

In order to ensure that the mitigation measures identified in Section 4 are implemented as envisioned, a strategy will be developed for monitoring impacts to the existing landscape and compensation / enhancement plantings. Further, commitments have also been proposed for ensuring that they are carried out as part of the construction, operation, and maintenance of the undertaking. All monitoring requirements associated with other disciplines (or terrestrial, aquatic, etc.) are described further in their respective reports.

MONITORING PROPOSED DURING THE CONSTRUCTION PHASE INCLUDES:

- Tree protection;
- Erosion and sediment control;
- Management of construction access, delivery and removal of materials;
- Maintenance of wildlife protection features according to recommendations from the terrestrial biology team;
- Management of active recreation routes where detours have been implemented.

MONITORING PROPOSED DURING THE OPERATIONAL PHASE INCLUDES:

- Maintenance and monitoring of any new plant materials for a minimum 2-year warranty period to ensure the establishment of healthy, vigorous plantings at the end of the warranty period. This should include an action plan to replace any plantings that are deemed unacceptable.
- Monitoring of groundcover plantings (i.e. seeded areas) to ensure soils exposed during construction have been adequately covered and erosion / sedimentation is not occurring. This should include an action plan for any areas requiring remediation.
- Monitoring for the incidental impacts of maintenance and operations such as salt damage, and routine maintenance of drainage features. This should include an action plan for operational practices that are resulting in negative impacts on the environment.

7 SUMMARY

This project involves the replacement and rehabilitation of bridges and structural culverts and establishing the future footprint of Highway 401 for an interim 6 lane to ultimate 8 lane highway. The project scope is a 16.8 km stretch of highway between the Township of Colborne to the Town of Brighton. The study area limits include Highway 401 from 0.8km east of Percy Street in the Town of Colborne to 0.4km west of Christiani Road. The highway passes through natural landscapes that have been subject to historical and recent disturbances such as agriculture and commercial development.

The construction of the highway will cause indirect and direct environmental effects; however, these can be managed through implementation of a variety of mitigation measures. The mitigation measures outlined in this report should minimize potential environmental impacts of the highway implementation, however, these measures are preliminary in nature as exact limits of grading and associated clearing may require some modification as the design is finalized and as construction proceeds.

BIBLIOGRAPHY

Chapman, L.J. and Putnam, D.F. 2007. Physiography of Southern Ontario; Ontario Geological Survey, Miscellaneous Release--Data 228 ISBN 978-1-4249-5158-1

Ecoplans Ltd, Oct 2006. Landscape Composition Technical Requirements for Environmental Impact Study and Environmental Protection/Mitigation. Prepared for the Ministry of Transportation.

WSP Canada Inc, February 2023. 30% Landscape Design Drawings. Prepared for the Ministry of Transportation.

WSP Canada Inc, February 2023. Terrestrial Ecosystems Existing Conditions and Impact Assessment Report. Prepared for the Ministry of Transportation.

WSP Canada Inc, December 2020. Fish and Fish Habitat Existing Conditions Report. Prepared for the Ministry of Transportation.

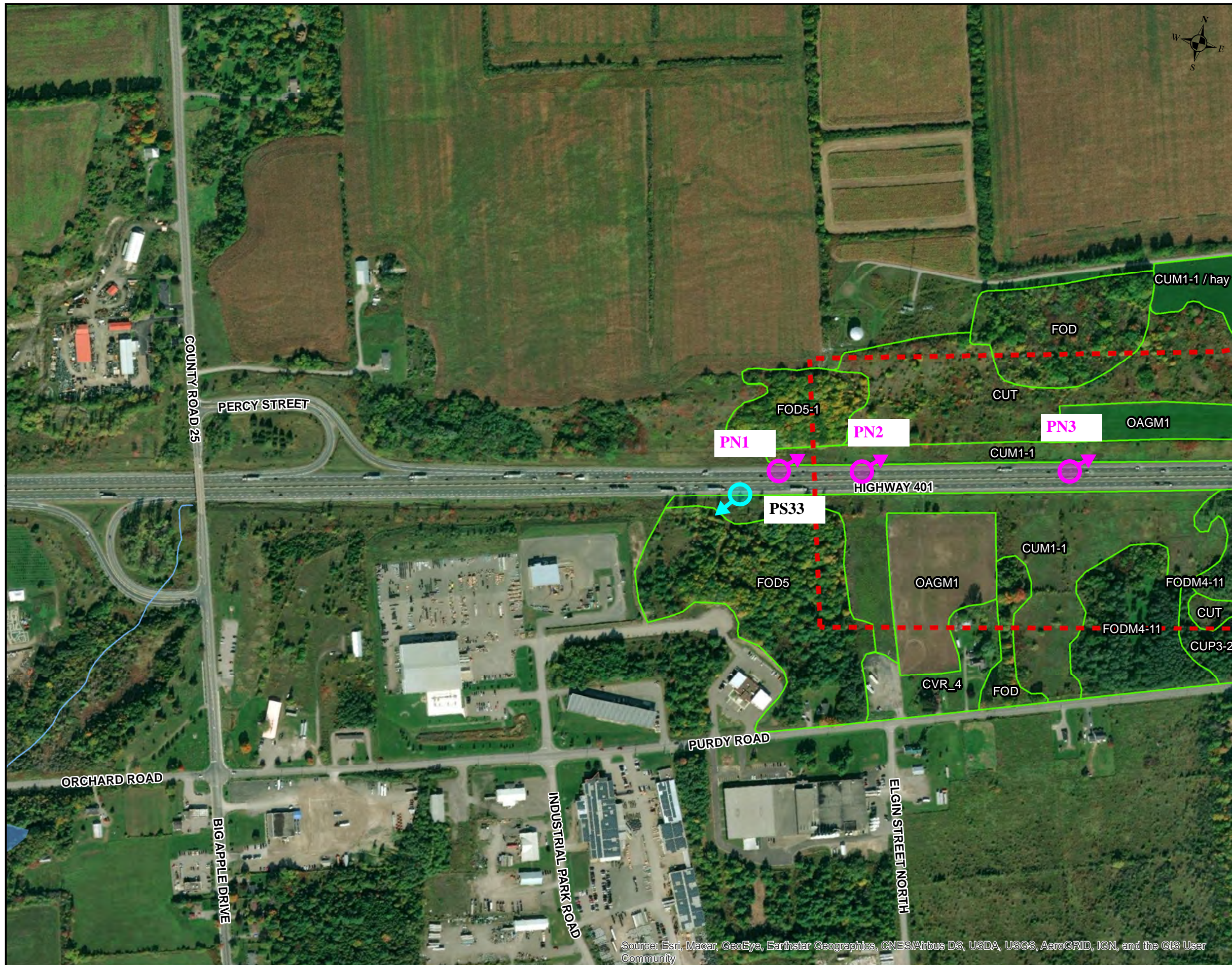
WSP Canada Inc, February 2022. Cultural Heritage Resource Assessment Report. Prepared for the Ministry of Transportation.


WSP Canada Inc, March 2022. Wildlife Movement Existing Conditions and Opportunities. Prepared for Ministry of Transportation.

APPENDIX

A INVENTORY PLANS







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Legend

- Study Area
- Watercourse (LIO)
- ELC

CUM1-1: Dry - Moist Old Field Meadow
 CUP3-2: White Pine Coniferous Plantation
 CUT: Cultural Thicket
 CVR_4: Rural Property
 FOD: Deciduous Forest
 FOD5: Dry - Fresh Sugar Maple Deciduous Forest
 FOD5-1: Dry - Fresh Sugar Maple Deciduous Forest
 FODM4-11: Dry - Fresh Black Locust Deciduous Forest
 OAGM1: Annual Row Crops

Data Source: Ministry of Natural Resources, Ontario Base Mapping, October 2016.

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ONTARIO MINISTRY OF TRANSPORTATION

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HIGHWAY 401
COLBORNE TO BRIGHTON

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FIGURE NO: Plate 1	SCALE: 1:5,000

TITLE:
VEGETATION COMMUNITIES

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Legend

- Study Area
- Watercourse (LIO)
- ELC
- CUM1-1: Dry - Moist Old Field Meadow
- CUP3-2: White Pine Coniferous Plantation
- CUT: Cultural Thicket
- CUW: Cultural Woodland
- CVC_2: Light Industry
- CVR_1: Low Density Residential
- CVR_4: Rural Property
- FOC4: Fresh - Moist White Cedar Coniferous Forest
- FOD: Deciduous Forest
- FOD3-1: Dry - Fresh Poplar Deciduous Forest
- FODM4-11: Dry - Fresh Black Locust Deciduous Forest
- FOM: Mixed Forest
- HR: Hedgerow
- MAS2-1: Cattail Mineral Shallow Marsh
- OAGM1: Annual Row Crops

Data Source: Ministry of Natural Resources, Ontario Base Mapping, October 2016.

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Legend

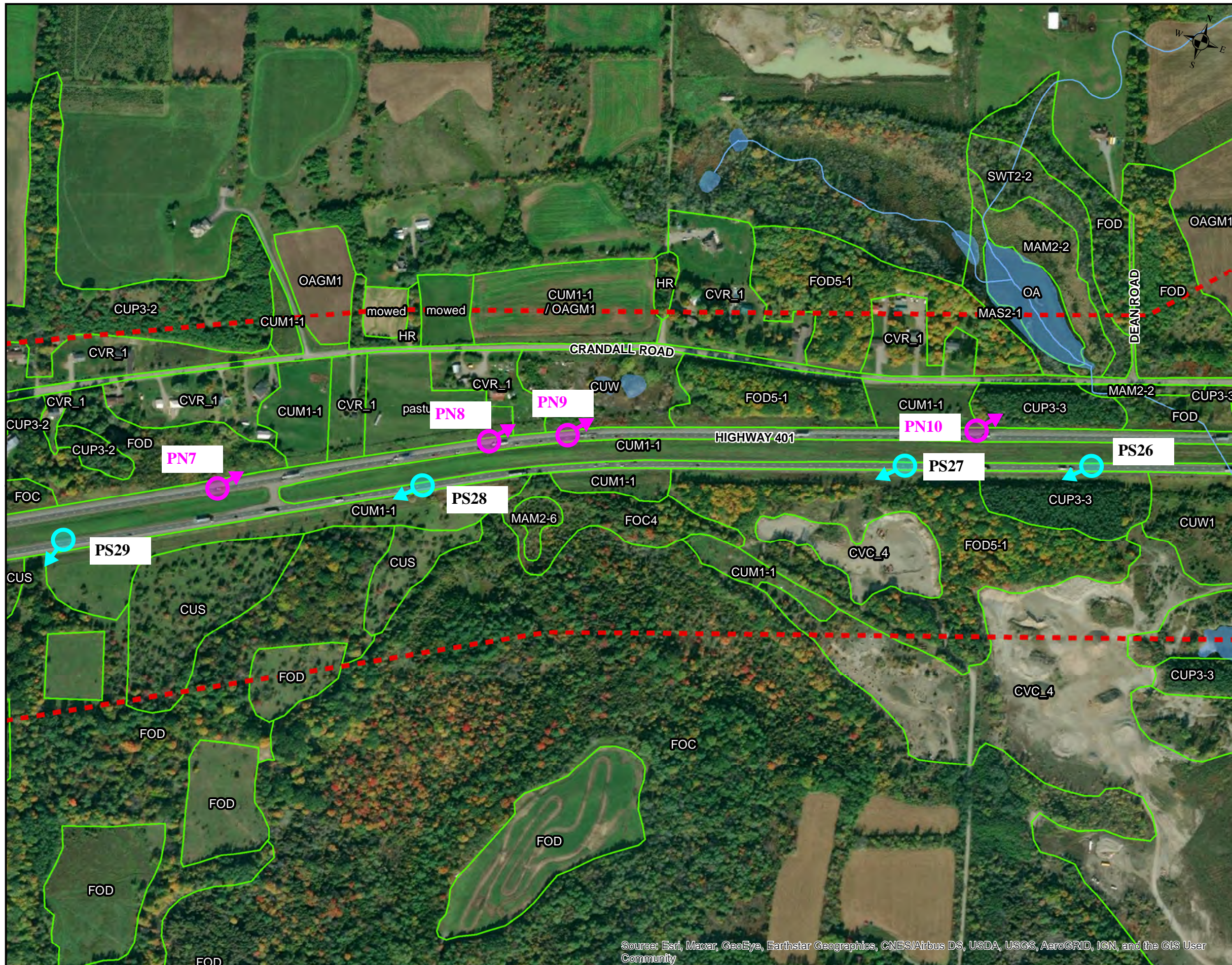
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- - - Study Area
- Watercourse (LIO)
- ELC
- CUM1-1: Dry - Moist Old Field Meadow
- CUP: Cultural Plantation
- CUP3-2: White Pine Coniferous Plantation
- CUS: Cultural Savannah
- CVR_1: Low Density Residential
- CVR_4: Rural Property
- FOC: Coniferous Forest
- FOD: Deciduous Forest
- FODM4-11: Dry - Fresh Black Locust Deciduous Forest
- FOM: Mixed Forest
- FOM5: Dry - Fresh White Birch - Poplar - Conifer Mixed Forest
- HR: Hedgerow
- OAGM1: Annual Row Crops

50 25 0 50 Metres

Data Source: Ministry of Natural Resources, Ontario Base Mapping, October 2016.

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Legend

- Study Area
- Watercourse (LIO)
- ELC
- CUM1-1: Dry - Moist Old Field Meadow
- CUP3-2: White Pine Coniferous Plantation
- CUP3-3: Scotch Pine Coniferous Plantation
- CUS: Cultural Savannah
- CUW: Cultural Woodland
- CUW1: Mineral Cultural Woodland
- CVC_4: Extraction
- CVR_1: Low Density Residential
- FOC: Coniferous Forest
- FOC4: Fresh - Moist White Cedar Coniferous Forest
- FOD: Deciduous Forest
- FOD5-1: Dry - Fresh Sugar Maple Deciduous Forest
- HR: Hedgerow
- MAM2-2: Reed-canary Grass Mineral Meadow Marsh
- MAM2-6: Broad-leaved Sedge Mineral Meadow Marsh
- MAS2-1: Cattail Mineral Shallow Marsh
- OA: Open Aquatic
- OAGM1: Annual Row Crops
- SWT2-2: Willow Mineral Thicket Swamp

Data Source: Ministry of Natural Resources, Ontario Base Mapping, October 2016.

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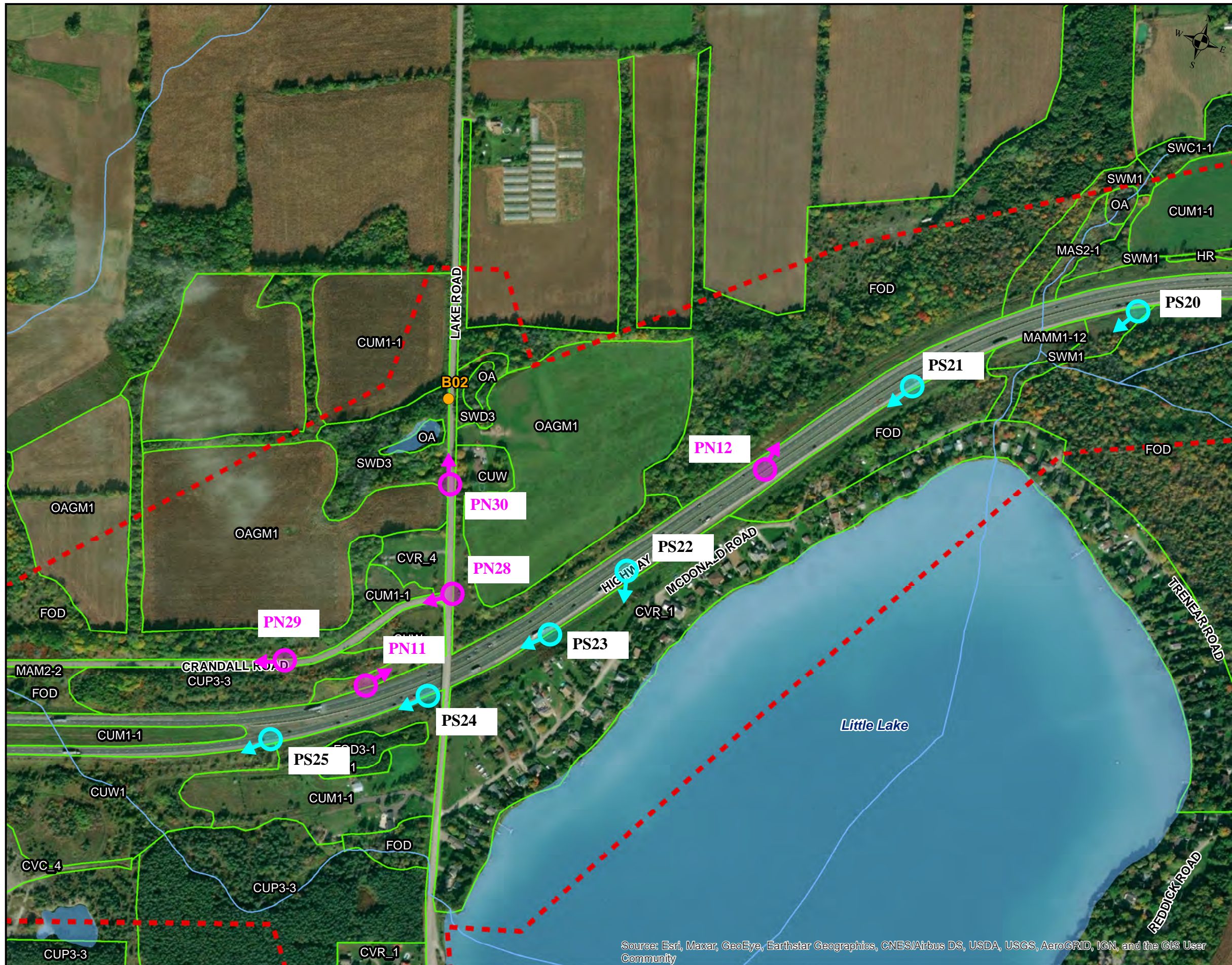
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Legend

- Butternut Location
- - - Study Area
- Watercourse (LIO)
- ELC
- CUM1-1: Dry - Moist Old Field Meadow
- CUP3-1: Red Pine Coniferous Plantation
- CUP3-3: Scotch Pine Coniferous Plantation
- CUW: Cultural Woodland
- CUW1: Mineral Cultural Woodland
- CVC_4: Extraction
- CVR_1: Low Density Residential
- CVR_4: Rural Property
- FOD: Deciduous Forest
- FOD3-1: Dry - Fresh Poplar Deciduous Forest
- HR: Hedgerow
- MAM2-2: Reed-canary Grass Mineral Meadow Marsh
- MAMM1-12: Common Reed Graminoid Mineral Meadow Marsh
- MAS2-1: Cattail Mineral Shallow Marsh
- OA: Open Aquatic
- OAGM1: Annual Row Crops
- SWC1-1: White Cedar Mineral Coniferous Swamp
- SWD3: Maple Mineral Deciduous Swamp
- SWM1: White Cedar Mineral Mixed Swamp

50 25 0 50 Metres
 Data Source: Ministry of Natural Resources, Ontario Base Mapping, October 2016.

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Legend

- Study Area
- Watercourse (LIO)
- ELC
- CUM1-1: Dry - Moist Old Field Meadow
- CUP3-3: Scotch Pine Coniferous Plantation
- CVR_1: Low Density Residential
- CVR_4: Rural Property
- FOC1-2: Dry - Fresh White Pine - Red Pine Coniferous Forest
- FOC2-1: Dry - Fresh Red Cedar Coniferous Forest
- FOD: Deciduous Forest
- FOD3-1: Dry - Fresh Poplar Deciduous Forest
- FOD5-1: Dry - Fresh Sugar Maple Deciduous Forest
- HR: Hedgerow
- MAM2-2: Reed-canary Grass Mineral Meadow Marsh
- MAS2-1: Cattail Mineral Shallow Marsh
- SWC1-1: White Cedar Mineral Coniferous Swamp

50 25 0 50 Metres

Data Source: Ministry of Natural Resources, Ontario Base Mapping, October 2016.

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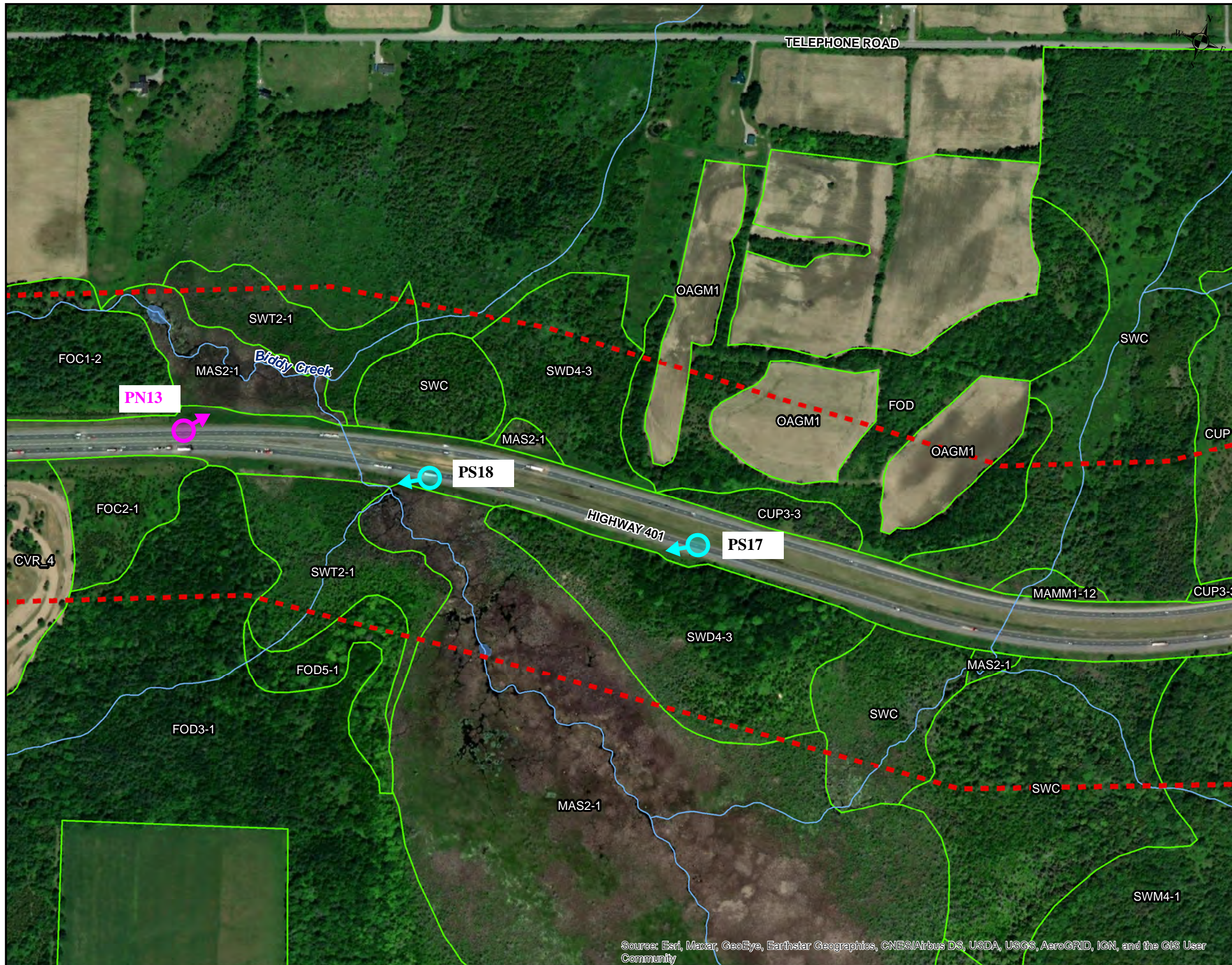
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Legend

- Study Area
- Watercourse (LIO)
- ELC
- CUP: Cultural Plantation
- CUP3-3: Scotch Pine Coniferous Plantation
- CVR_4: Rural Property
- FOC1-2: Dry - Fresh White Pine - Red Pine Coniferous Forest
- FOC2-1: Dry - Fresh Red Cedar Coniferous Forest
- FOD: Deciduous Forest
- FOD3-1: Dry - Fresh Poplar Deciduous Forest
- FOD5-1: Dry - Fresh Sugar Maple Deciduous Forest
- MAMM1-12: Common Reed Graminoid Mineral Meadow Marsh
- MAS2-1: Cattail Mineral Shallow Marsh
- OAGM1: Annual Row Crops
- SWC: Coniferous Swamp
- SWD4-3: White Birch - Poplar Mineral Deciduous Swamp
- SWM4-1: White Cedar - Hardwood Organic Mixed Swamp
- SWT2-1: Alder Mineral Thicket Swamp

Data Source: Ministry of Natural Resources, Ontario Base Mapping, October 2016.

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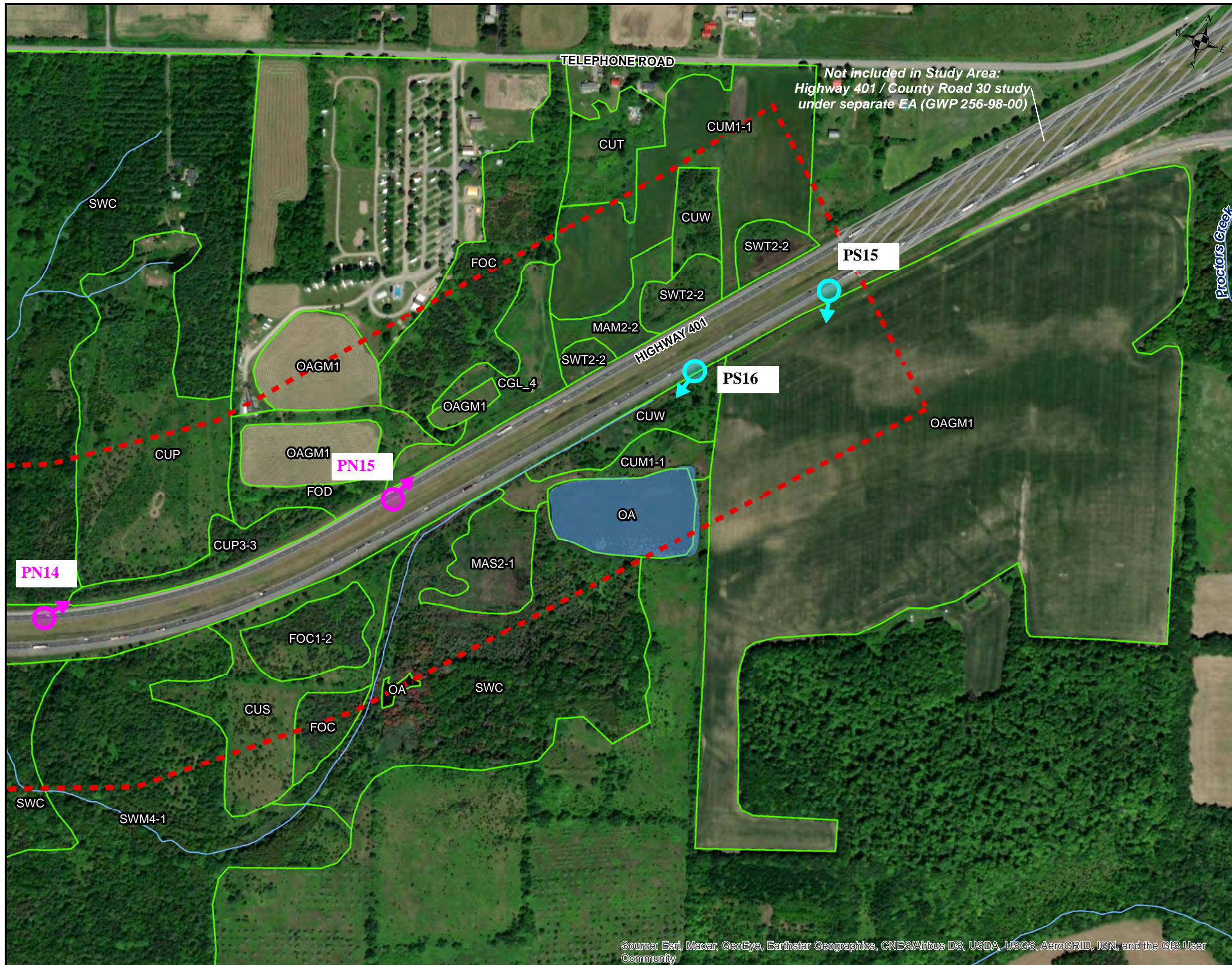
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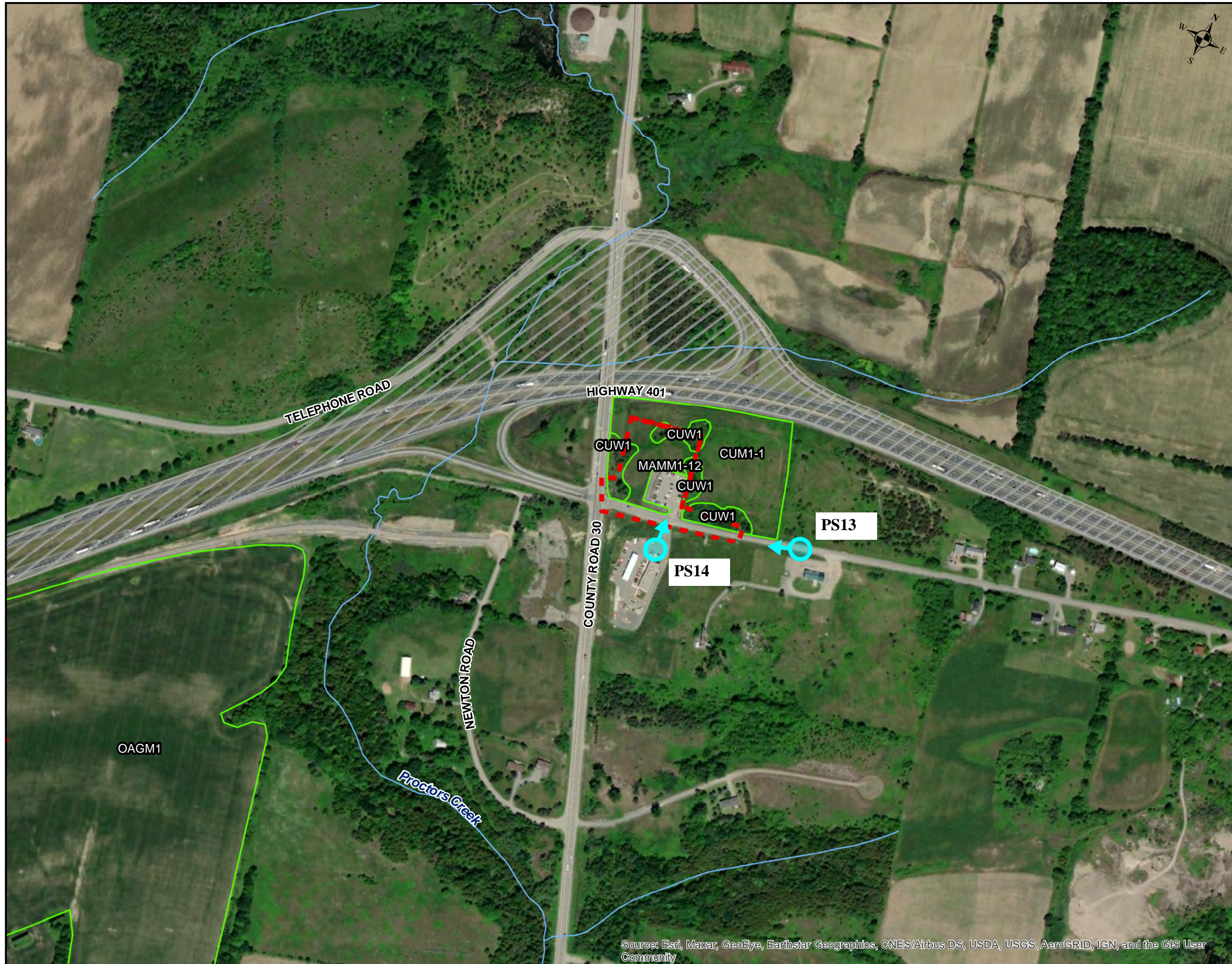
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- Study Area
- ▨ Area Not Included In Study Area
- Watercourse (LIO)
- ELC
- CGL_4: Recreational
- CUM1-1: Dry - Moist Old Field Meadow
- CUP: Cultural Plantation
- CUP3-3: Scotch Pine Coniferous Plantation
- CUS: Cultural Savannah
- CUT: Cultural Thicket
- CUW: Cultural Woodland
- FOC: Coniferous Forest
- FOC1-2: Dry - Fresh White Pine - Red Pine Coniferous Forest
- FOD: Deciduous Forest
- MAM2-2: Reed-canary Grass Mineral Meadow Marsh
- MAS2-1: Cattail Mineral Shallow Marsh
- OA: Open Aquatic
- OAGM1: Annual Row Crops
- SWC: Coniferous Swamp
- SWM4-1: White Cedar - Hardwood Organic Mixed Swamp
- SWT2-2: Willow Mineral Thicket Swamp

Data Source: Ministry of Natural Resources, Ontario Base Mapping, October 2016.

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FIGURE NO: Plate 8	SCALE: 1:5,000
TITLE: VEGETATION COMMUNITIES	
DISCIPLINE: ENVIRONMENT	
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Legend

- Study Area
- Area Not Included In Study Area
- Watercourse (LIO)
- ELC
- CUM1-1: Dry - Moist Old Field Meadow
- CUW1: Mineral Cultural Woodland
- MAMM1-12: Common Reed Graminoid Mineral Meadow Marsh
- OAGM1: Annual Row Crops

50 25 0 50 Metres

Data Source: Ministry of Natural Resources, Ontario Base Mapping, October 2016.

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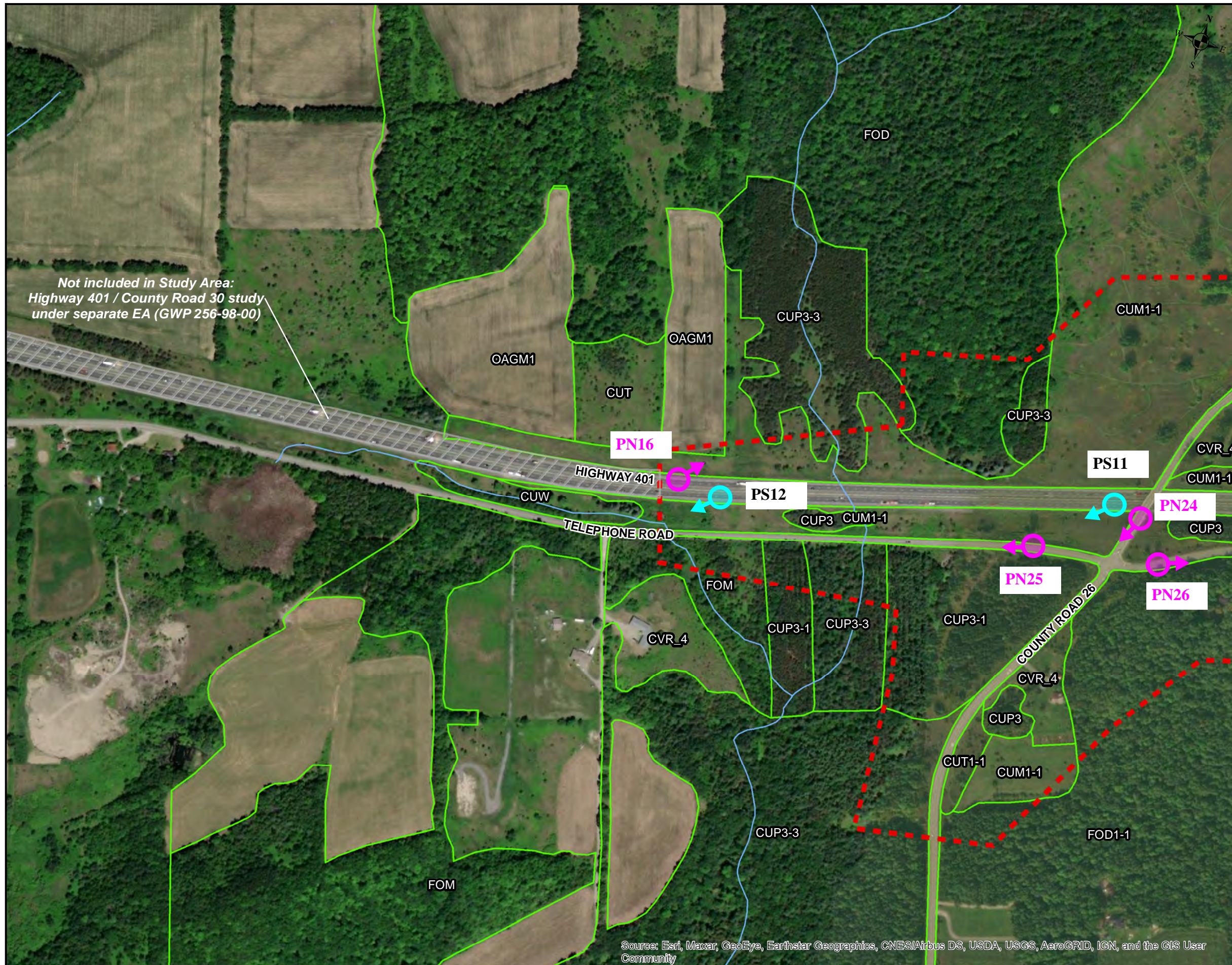
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Not included in Study Area:
Highway 401 / County Road 30 study
under separate EA (GWP 256-98-00)



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Legend

- Study Area
- Area Not Included In Study Area
- Watercourse (LIO)
- ELC
- CUM1-1: Dry - Moist Old Field Meadow
- CUP3: Coniferous Plantation
- CUP3-1: Red Pine Coniferous Plantation
- CUP3-3: Scotch Pine Coniferous Plantation
- CUT: Cultural Thicket
- CUT1-1: Sumac Cultural Thicket
- CUW: Cultural Woodland
- CVR_4: Rural Property
- FOD: Deciduous Forest
- FOD1-1: Dry - Fresh Red Oak Deciduous Forest
- FOM: Mixed Forest
- OAGM1: Annual Row Crops

Data Source: Ministry of Natural Resources, Ontario Base Mapping, October 2016.

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PROJECT NO: 17M-01712-11	DATE: November 2021
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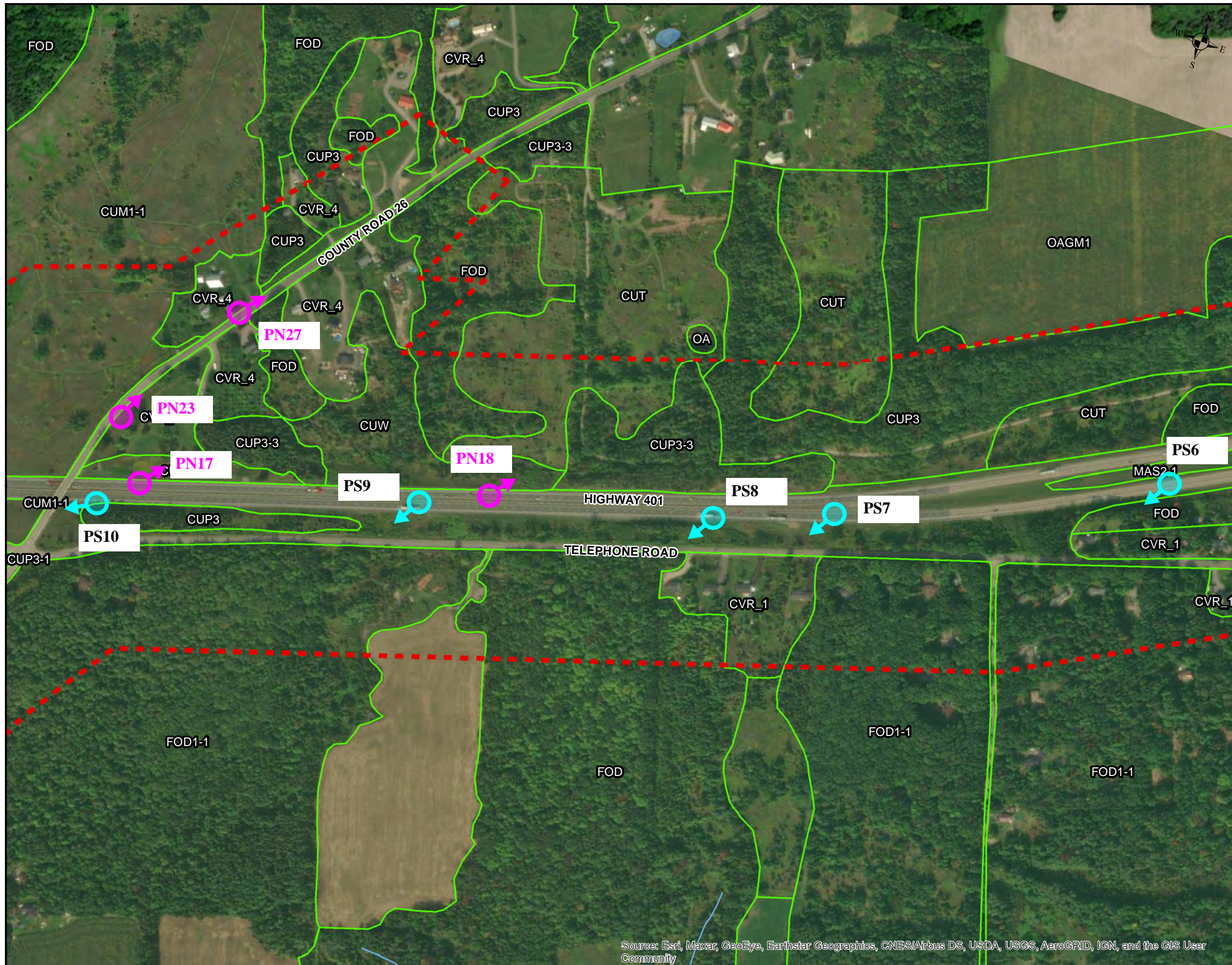
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Legend

- Study Area
- Watercourse (LIO)
- ELC
- CUM1-1: Dry - Moist Old Field Meadow
- CUP3: Coniferous Plantation
- CUP3-1: Red Pine Coniferous Plantation
- CUP3-3: Scotch Pine Coniferous Plantation
- CUT: Cultural Thicket
- CUW: Cultural Woodland
- CVR_1: Low Density Residential
- CVR_4: Rural Property
- FOD: Deciduous Forest
- FOD1-1: Dry - Fresh Red Oak Deciduous Forest
- MAS2-1: Cattail Mineral Shallow Marsh
- OA: Open Aquatic
- OAGM1: Annual Row Crops

Data Source: Ministry of Natural Resources, Ontario Base Mapping, October 2016.

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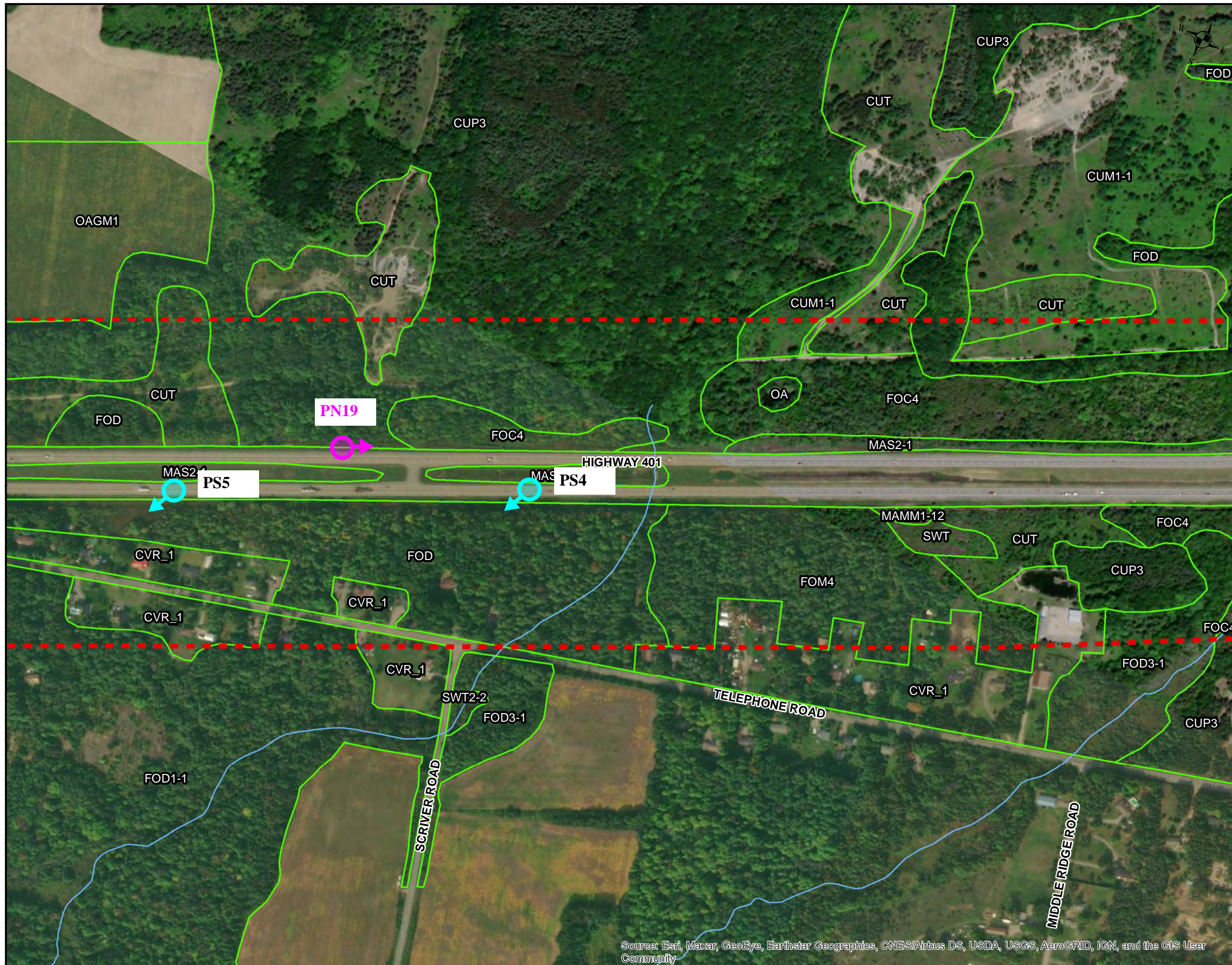
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TITLE:
 VEGETATION COMMUNITIES

DISCIPLINE:
 ENVIRONMENT

ISSUE: -	REV.: -
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Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



126 DON HILLOCK DRIVE, UNIT 2
 AURORA, ONTARIO CANADA L4G 0G9
 TEL.: 905-750-3080 | FAX: 905-727-0463 | WWW.WSP.COM

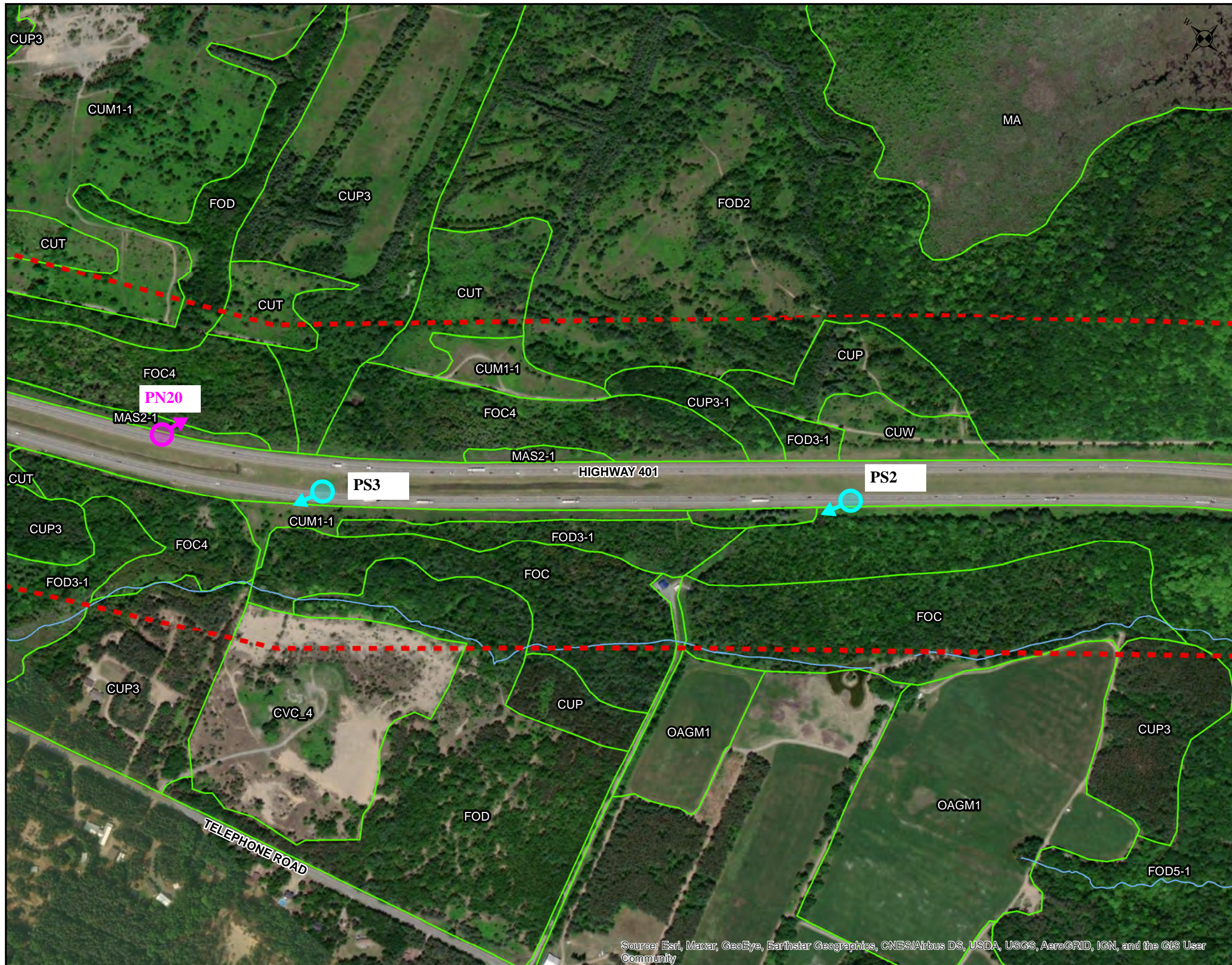
Legend

- Study Area
- Watercourse (LIO)
- ELC
- CUM1-1: Dry - Moist Old Field Meadow
- CUP3: Coniferous Plantation
- CUT: Cultural Thicket
- CVR_1: Low Density Residential
- FOC4: Fresh - Moist White Cedar Coniferous Forest
- FOD: Deciduous Forest
- FOD1-1: Dry - Fresh Red Oak Deciduous Forest
- FOD3-1: Dry - Fresh Poplar Deciduous Forest
- FOM4: Dry - Fresh White Cedar Mixed Forest
- MAMM1-12: Common Reed Graminoid Mineral Meadow Marsh
- MAS2-1: Cattail Mineral Shallow Marsh
- OA: Open Aquatic
- OAGM1: Annual Row Crops
- SWT: Thicket Swamp
- SWT2-2: Willow Mineral Thicket Swamp

Data Source: Ministry of Natural Resources, Ontario Base Mapping, October 2016.

CLIENT:	
ONTARIO MINISTRY OF TRANSPORTATION	
PROJECT:	
HIGHWAY 401 COLBORNE TO BRIGHTON	
PROJECT NO:	DATE:
17M-01712-11	November 2021
DESIGNED BY:	-
DRAWN BY:	-
CHECKED BY:	-
FIGURE NO:	SCALE:
Plate 12	1:5,000
TITLE:	
VEGETATION COMMUNITIES	
DISCIPLINE:	
ENVIRONMENT	
ISSUE:	REV.:
-	-

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



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Legend

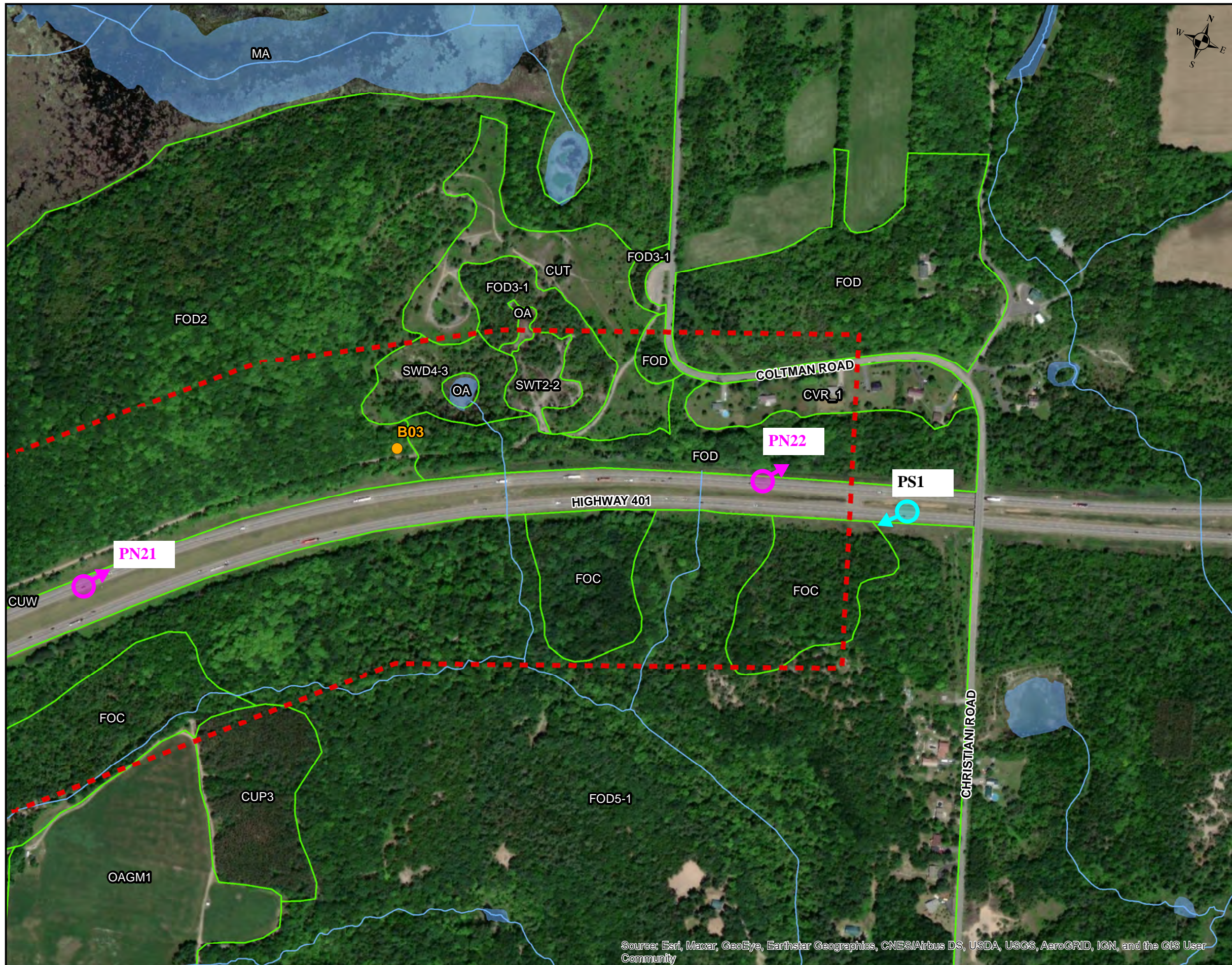
- Study Area
- Watercourse (LIO)
- ELC
- CUM1-1: Dry - Moist Old Field Meadow
- CUP: Cultural Plantation
- CUP3: Coniferous Plantation
- CUP3-1: Red Pine Coniferous Plantation
- CUT: Cultural Thicket
- CUW: Cultural Woodland
- CVC_4: Extraction
- FOC: Coniferous Forest
- FOC4: Fresh - Moist White Cedar Coniferous Forest
- FOD: Deciduous Forest
- FOD2: Dry - Fresh Oak - Maple - Hickory Deciduous Forest
- FOD3-1: Dry - Fresh Poplar Deciduous Forest
- FOD5-1: Dry - Fresh Sugar Maple Deciduous Forest
- MA: Marsh
- MAS2-1: Cattail Mineral Shallow Marsh
- OAGM1: Annual Row Crops

50 25 0 50 Metres

Data Source: Ministry of Natural Resources, Ontario Base Mapping, October 2016.

CLIENT:	
ONTARIO MINISTRY OF TRANSPORTATION	
PROJECT:	
HIGHWAY 401 COLBORNE TO BRIGHTON	
PROJECT NO:	DATE:
17M-01712-11	November 2021
DESIGNED BY:	-
DRAWN BY:	-
CHECKED BY:	-
FIGURE NO:	SCALE:
Plate 13	1:5,000
TITLE:	
VEGETATION COMMUNITIES	
DISCIPLINE:	
ENVIRONMENT	
ISSUE:	REV.:
-	-

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



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Legend

- Butternut Location
- Study Area
- Watercourse (LIO)
- ELC
- CUP3: Coniferous Plantation
- CUT: Cultural Thicket
- CUW: Cultural Woodland
- CVR_1: Low Density Residential
- FOC: Coniferous Forest
- FOD: Deciduous Forest
- FOD2: Dry - Fresh Oak - Maple - Hickory Deciduous Forest
- FOD3-1: Dry - Fresh Poplar Deciduous Forest
- FOD5-1: Dry - Fresh Sugar Maple Deciduous Forest
- MA: Marsh
- OA: Open Aquatic
- OAGM1: Annual Row Crops
- SWD4-3: White Birch - Poplar Mineral Deciduous Swamp
- SWT2-2: Willow Mineral Thicket Swamp

Data Source: Ministry of Natural Resources, Ontario Base Mapping, October 2016.

CLIENT:
 ONTARIO MINISTRY OF TRANSPORTATION

PROJECT:
 HIGHWAY 401
 COLBORNE TO BRIGHTON

PROJECT NO: 17M-01712-11	DATE: November 2021
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DESIGNED BY:
-

DRAWN BY:
-

CHECKED BY:
-

FIGURE NO: Plate 14	SCALE: 1:5,000
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TITLE:
 VEGETATION COMMUNITIES

DISCIPLINE:
 ENVIRONMENT

ISSUE: -	REV.: -
-------------	------------

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

APPENDIX

B PHOTOGRAPHIC INVENTORY



PN1



PN2



PN3



PN4



PN5



PN6



PN7



PN8



Highway 401 Colborne to Brighton
LANDSCAPE COMPOSITION REPORT PHOTOGRAPHIC INVENTORY

Date: July 2023

Project No: 17M-01712-11

Appendix B



PN9



PN10



PN11



PN12



PN13



PN14



PN15



PN16



Highway 401 Colborne to Brighton
LANDSCAPE COMPOSITION REPORT PHOTOGRAPHIC INVENTORY

Date: July 2023

Project No: 17M-01712-11

Appendix B



PN17



PN18



PN19



PN20



PN21



PN22



PN23



PN24



Highway 401 Colborne to Brighton
LANDSCAPE COMPOSITION REPORT PHOTOGRAPHIC INVENTORY

Date: July 2023

Project No: 17M-01712-11

Appendix B



PN25



PN26



PN27



PN28



PN29



PN30



PN31



PN32



Highway 401 Colborne to Brighton
LANDSCAPE COMPOSITION REPORT PHOTOGRAPHIC INVENTORY

Date: July 2023

Project No: 17M-01712-11

Appendix B



PN33



PS1



PS2



PS3



PS4



PS5



PS6



PS7



Highway 401 Colborne to Brighton
LANDSCAPE COMPOSITION REPORT PHOTOGRAPHIC INVENTORY

Date: July 2023

Project No: 17M-01712-11

Appendix B



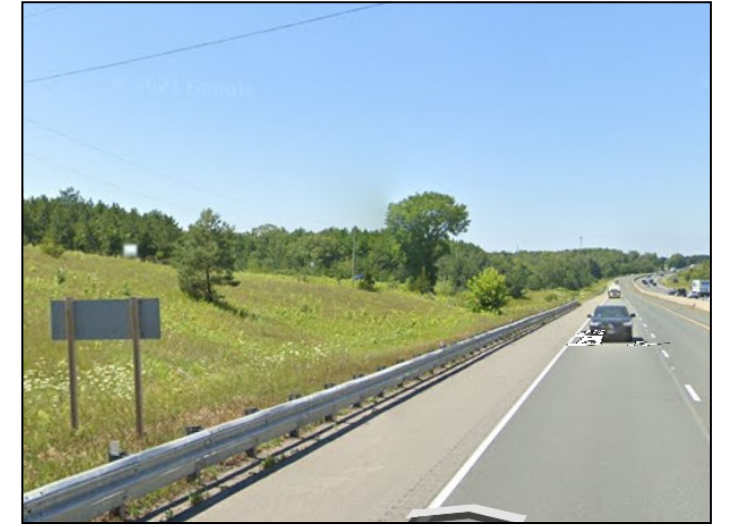
PS8



PS9



PS10



PS11



PS12



PS13



PS14



PS15



Highway 401 Colborne to Brighton
LANDSCAPE COMPOSITION REPORT PHOTOGRAPHIC INVENTORY

Date: July 2023

Project No: 17M-01712-11

Appendix B



PS16



PS17



PS18



PS19



PS20



PS21



PS22



PS23



Highway 401 Colborne to Brighton
LANDSCAPE COMPOSITION REPORT PHOTOGRAPHIC INVENTORY

Date: July 2023

Project No: 17M-01712-11

Appendix B



PS24



PS25



PS26



PS27



PS28



PS29



PS30



PS31



Highway 401 Colborne to Brighton
LANDSCAPE COMPOSITION REPORT PHOTOGRAPHIC INVENTORY

Date: July 2023

Project No: 17M-01712-11

Appendix B



P32



PS33



PS34



PN34



PS35



PS36



PN35



PN36



Highway 401 Colborne to Brighton
LANDSCAPE COMPOSITION REPORT PHOTOGRAPHIC INVENTORY

Date: July 2023

Project No: 17M-01712-11

Appendix B

APPENDIX

C LIST OF RECOMMENDED SPECIES

APPENDIX C

LIST OF RECOMMENDED SPECIES FROM CONCEPTUAL PLANTING PLANS (APPENDIX E)

MEADOW EDGE:

Trees:

- Silver Maple (*Acer saccharinum*)
- Bitternut Hickory (*Carya cordiformis*)
- Tamarack (*Larix laricina*)
- White Spruce (*Picea glauca*)
- Bur Oak (*Quercus macrocarpa*)
- Red Oak (*Quercus rubra*)
- White Pine (*Pinus strobus*)
- Trembling Aspen (*Populus tremuloides*)
- White Cedar (*Thuja occidentalis*)
- Basswood (*Tilia americana*)

Shrubs:

- Black Chokecherry (*Aronia melanocarpa*)
- Bush Honeysuckle (*Diervilla lonicera*)
- Common Ninebark (*Physocarpus opulifolius*)
- Choke Cherry (*Prunus virginiana*)
- Staghorn Sumac (*Rhus typhina*)
- Sage-leaved/ Hoary Willow (*Salix candida*)
- Shining Willow (*Salix lucida*)
- Witherod Viburnum (*Viburnum cassinoides*)

WOODLAND EDGE:

Trees:

- Red Maple (*Acer rubra*)
- Sugar Maple (*Acer saccharum*)
- Shagbark Hickory (*Carya ovata*)
- Eastern Cottonwood (*Populus deltoides*)
- White Spruce (*Picea glauca*)
- White Pine (*Pinus strobus*)
- Bur Oak (*Quercus macrocarpa*)
- White Oak (*Quercus alba*)
- Basswood (*Tilia americana*)
- Paper Birch (*Betula papyrifera*)
- American Hornbeam (*Carpinus caroliniana*)
- Balsam Poplar (*Populus balsamifera*)

Shrubs:

- Smooth Serviceberry (*Amelanchier laevis*)
- Grey Dogwood (*Cornus racemosa*)

APPENDIX C

- Red-osier Dogwood (*Cornus sericea*)
- Fragrant Sumac (*Rhus aromatica*)
- Staghorn Sumac (*Rhus typhina*)
- Bush Honeysuckle (*Diervilla lonicera*)
- Nannyberry (*Viburnum lentago*)
- Winterberry Holly (*Ilex verticillate*)
- Witch Hazel (*Hamamelis virginiana*)
- Highbush Cranberry (*Viburnum trilobum*)

LOWLAND WOODLOT EDGE:

Trees:

- Silver Maple (*Acer saccharinum*)
- Bitternut Hickory (*Carya cordiformis*)
- White Spruce (*Picea glauca*)
- Bur Oak (*Quercus macrocarpa*)
- White Pine (*Pinus strobus*)
- Black Cherry (*Prunus serotina*)
- White Cedar (*Thuja occidentalis*)
- Tamarack (*Larix laricina*)
- Red Maple (*Acer rubrum*)
- White Willow (*Salix alba*)
- Eastern Cottonwood (*Populus deltoides*)
- Freeman's Maple (*Acer x freemanii*)
- Trembling Aspen (*Populus tremuloides*)
- Speckled Alder (*Alnus incana*)

Shrubs:

- Red osier Dogwood (*Cornus sericea*)
- Bush Honeysuckle (*Diervilla lonicera*)
- Common Ninebark (*Physocarpus opulifolius*)
- Choke Cherry (*Prunus virginiana*)
- Sage-leaved/ Hoary Willow (*Salix candida*)
- Nannyberry (*Viburnum lentago*)

APPENDIX C

List of recommended seed mixtures:

MTO MODIFIED NATIVE STANDARD ROADSIDE MIX:

- Creeping Red Fescue (*Festuca rubra*)
- Canada Bluegrass (*Poa compressa*)
- Colonial Bentgrass (*Agtostis capillaris*)
- Intermediate Ryegrass (*Lolium hybridum*)

MTO LOWLAND MIX:

- Creeping Red Fescue (*Festuca rubra*)
- Brome Grass (*Bromus nerres*)
- Kentucky Bluegrass (*Poa pratensis*)
- Birdsfood Trefoil (*Lotus corniculatus*) inoculated seed
- White Clover (*Trifolium repens*)
- Perennial Ryegrass (*Lolium perrenne*)

APPENDIX

D

PRELIMINARY
LANDSCAPE PLAN