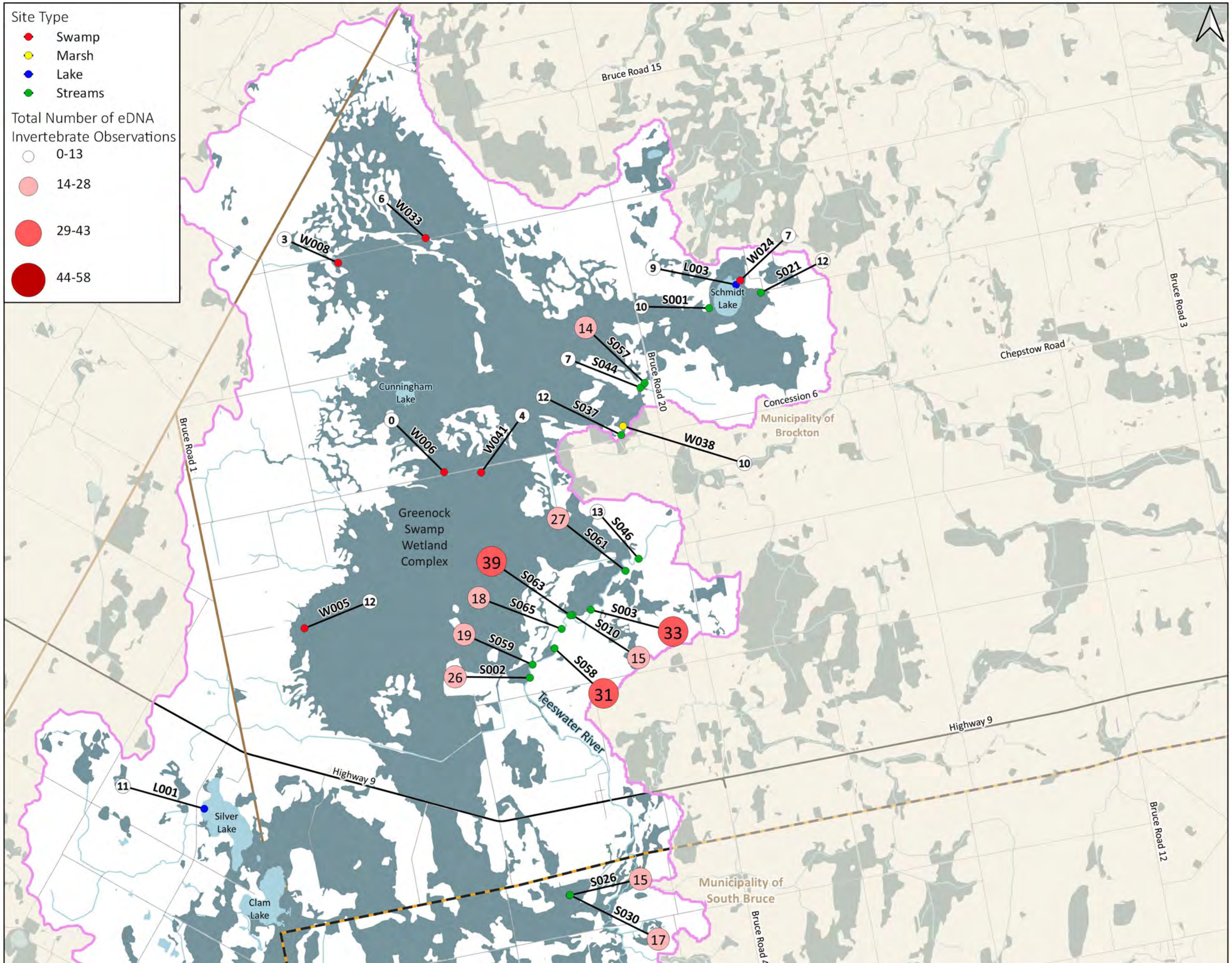
APPENDIX G – INVERTEBRATE SPECIES DETECTIONS BY SEASON, HABITAT GROUPING, AND STUDY AREA

G.1 Summer



NWMO Biodiversity Impact Studies

eDNA Summer Results (Invertebrate) - North LSA_{AQU}

Figure G-1a

- Area of Interest (AOI)
- Local Study Area (LSA_{TER})
- Local Study Area (LSA_{AQU})
- Lake
- Wetland
- Watercourse
- Highway
- Local Road
- South Bruce Boundary
- Municipal Boundary

The number inside the observation symbols represents the count of detected species at that given site.

1:65,000

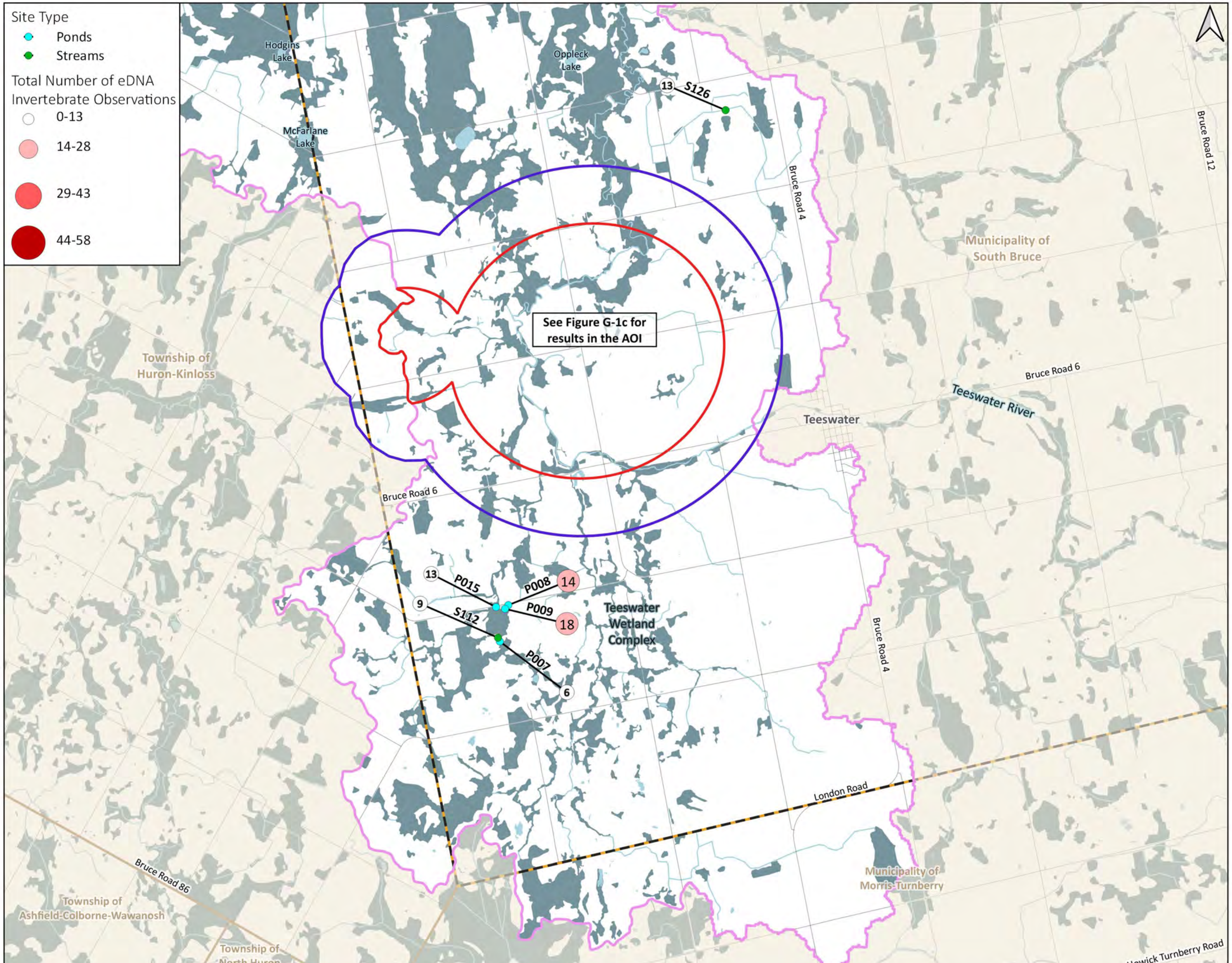
0 1 2 km

ZOETICA

Data received from:
Ontario GeoHub — OHN Waterbody (MNRF); OHN Watercourse (MNRF); MNRF Road Segments (MNRF); Municipal Boundary - Lower and Single Tier (MMAH); Wetlands (MNRF)
NWMO — AOI; 2022 SB eDNA Rev. B (NSC)
Wetlands and water features are mapped using ecosite data within the LSA_{ECO} and data available from Ontario GeoHub outside the LSA_{ECO}.

Project CRS: NAD83 / UTM zone 17N

Author: AH	Reviewed by: CW	Approved by: HB
December 12, 2023	Map ID: NWMO_BIS_A108a	



NWMO Biodiversity Impact Studies

eDNA Summer Results (Invertebrate) - South LSA_{AQU}

Figure G-1b

- Area of Interest (AOI)
- Local Study Area (LSA_{TER})
- Local Study Area (LSA_{AQU})
- Lake
- Wetland
- Watercourse
- Highway
- Local Road
- South Bruce Boundary
- Municipal Boundary

The number inside the observation symbols represents the count of detected species at that given site.

1:65,000

0 1 2 km

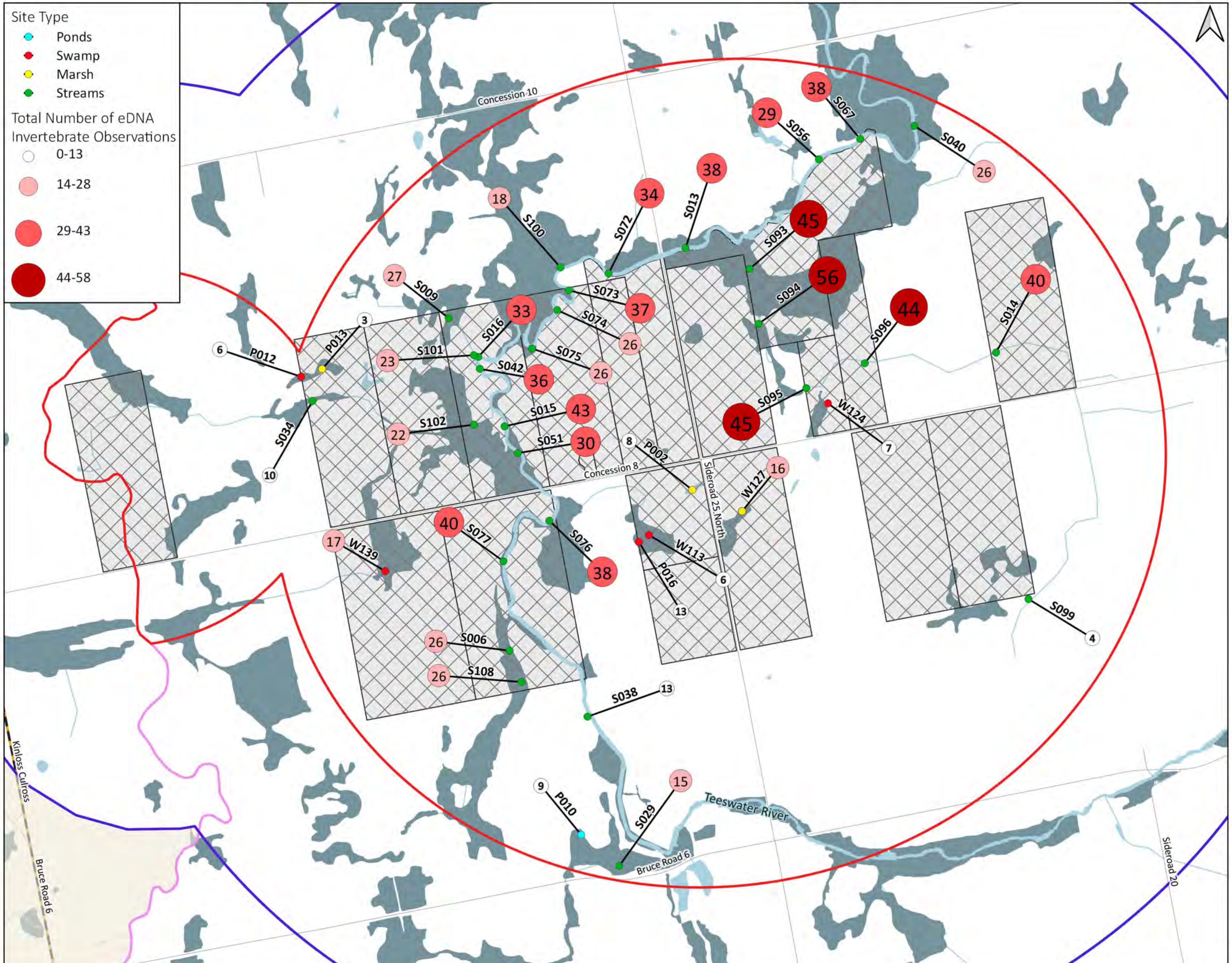
ZOETICA

Data received from:
Ontario GeoHub — OHN Waterbody (MNRF); OHN Watercourse (MNRF); MNRF Road Segments (MNRF); Municipal Boundary - Lower and Single Tier (MMAH); Wetlands (MNRF)
NWMO — AOI; 2022 SB eDNA Rev. B (NSC)
Wetlands and water features are mapped using ecosite data within the LSA_{ECO} and data available from Ontario GeoHub outside the LSA_{ECO}.

Project CRS: NAD83 / UTM zone 17N

Author: AH	Reviewed by: CW	Approved by: HB

December 12, 2023	Map ID: NWMO_BIS_A108b



NWMO Biodiversity Impact Studies

eDNA Summer Results (Invertebrate) - AOI

Figure G-1c

- Area of Interest (AOI)
- Local Study Area (LSA_{TER})
- Local Study Area (LSA_{AQU})
- Lake
- Wetland
- Watercourse
- Highway
- Local Road
- South Bruce Boundary
- Municipal Boundary
- NWMO Purchased or Optioned Land

The number inside the observation symbols represents the count of detected species at that given site.

1:20,000

0 0.5 1 km

ZOETICA

Data received from:
Ontario GeoHub — OHN Waterbody (MNRF); OHN Watercourse (MNRF); MNRF Road Segments (MNRF); Municipal Boundary - Lower and Single Tier (MMAH); Wetlands (MNRF)
NWMO — AOI; 2022 SB eDNA Rev. B (NSC); NWMO Purchased or Optioned Land
Wetlands and water features are mapped using ecosite data within the LSA_{ECO} and data available from Ontario GeoHub outside the LSA_{ECO}.

Project CRS: NAD83 / UTM zone 17N

Author: AH	Reviewed by: CW	Approved by: HB
December 12, 2023	Map ID: NWMO_BIS_A108c	

G.1.1 Watercourses

Table G-1. Summer 2022 detections of invertebrate species in watercourses in the AOI.

Family	Scientific Name	S006	S009	S013	S014	S015	S016	S029	S034	S038	S040	S042	S051	S056	S067	S072	S073	S074	S075	S076	S077	S093	S094	S095	S096	S099	S100	S101	S102	S108
Phylum: Annelida																														
Class: Clitellata																														
Order: Crassiclitellata																														
Lumbricidae	*Lumbricus rubellus*	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Order: Enchytraeida																														
Enchytraeidae	*Fridericia ratzeli*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Order: Haplotaxida																														
Naididae	*Aulodrilus pluriseta*	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1
Naididae	*Branchiura sowerbyi*	0	0	1	0	1	1	1	0	1	0	1	1	1	0	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0
Naididae	*Ilyodrilus templetoni*	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Naididae	*Nais bretscheri*	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0
Naididae	*Nais communis*	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Naididae	*Nais stolci*	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Naididae	*Potamothrix bavaricus*	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Order: Lumbriculida																														
Sparganophilidae	*Sparganophilus tamesis*	0	0	0	0	0	1	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Order: Rhynchobdellida																														
Glossiphoniidae	*Placobdella parasitica*	0	0	1	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Phylum: Arthropoda																														
Class: Branchiopoda																														
Order: Diplostraca																														
Chydoridae	*Alona circumfimbriata*	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Daphniidae	*Ceriodaphnia dubia*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Daphniidae	*Simocephalus serrulatus*	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Class: Insecta																														
Order: Coleoptera																														
Carabidae	*Loricera pilicornis*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Carabidae	*Pterostichus melanarius*	0	0	1	0	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chrysomelidae	*Dibolia chelones*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Chrysomelidae	*Psylliodes picinus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0
Cleridae	*Cymatodera bicolor*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Cleridae	*Isohydnocera curtipennis*	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Curculionidae	*Sciaphilus asperatus*	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	0	1	0	0	1	1	1	1	0	0	0	1	0
Dytiscidae	*Dytiscus fasciventris*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0
Dytiscidae	*Hygrotus impressopunctatus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Dytiscidae	*Ilybiosoma seriatum*	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	1	0	0	0	0	1
Dytiscidae	*Laccophilus maculosus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Dytiscidae	*Liodessus affinis*	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dytiscidae	*Neoporus clypealis*	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1	0	0	1	0	0	1	1	0
Dytiscidae	*Neoporus undulatus*	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dytiscidae	*Platambus semivittatus*	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0

Family	Scientific Name	S006	S009	S013	S014	S015	S016	S029	S034	S038	S040	S042	S051	S056	S067	S072	S073	S074	S075	S076	S077	S093	S094	S095	S096	S099	S100	S101	S102	S108
Elateridae	*Dalopius pallidus*	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elateridae	*Hemicrepidius brevicollis*	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Elateridae	*Hemicrepidius hemipodus*	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Elmidae	*Dubiraphia vittata*	0	0	1	0	0	1	0	0	0	0	1	0	0	1	0	1	0	0	0	1	0	1	1	1	0	0	0	0	0
Elmidae	*Optioservus fastiditus*	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Elmidae	*Stenelmis quadrimaculata*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Gyrinidae	*Dineutus hornii*	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Haliplidae	*Haliplus immaculicollis*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Haliplidae	*Peltodytes tortulosus*	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydrophilidae	*Hydrobius fuscipes*	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydrophilidae	*Tropisternus mixtus*	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Hydrophilidae	*Tropisternus natator*	0	0	1	0	0	1	0	0	0	0	0	0	1	0	1	1	0	1	0	1	0	0	0	0	0	0	0	0	0
Lampyridae	*Pyropyga decipiens*	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	1	0	0	1	0
Lampyridae	*Pyropyga nigricans*	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Psephenidae	*Psephenus herricki*	0	0	0	0	1	0	1	0	0	0	1	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
Scarabaeidae	*Amphimallon majale*	0	0	1	0	1	1	0	0	1	1	1	0	1	1	1	0	1	0	0	0	1	1	1	1	0	0	0	1	0
Scirtidae	*Contacyphon obscurus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Staphylinidae	*Lathrobium othioides*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Staphylinidae	*Philonthus carbonarius*	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Staphylinidae	*Philonthus flavibasis*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Staphylinidae	*Philonthus longicornis*	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Order: Diptera																														
Agromyzidae	*Cerodontha incisa*	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Agromyzidae	*Cerodontha longipennis*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Agromyzidae	*Cerodontha muscina*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Agromyzidae	*Liriomyza brassicae*	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
Agromyzidae	*Nemorimyza posticata*	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Agromyzidae	*Phytomyza crassiseta*	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0
Anthomyzidae	*Stiphrosoma balteatum*	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Asilidae	*Machimus notatus*	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Calliphoridae	*Phormia regina*	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Ceratopogonidae	*Atrichopogon fusculus*	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Ceratopogonidae	*Culicoides haematopotus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Ceratopogonidae	*Dasyhelea turficola*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Chaoboridae	*Chaoborus albipes*	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chaoboridae	*Chaoborus punctipennis*	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Chironomidae	*Ablabesmyia annulata*	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Chironomidae	*Brillia flavifrons*	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1	1	1	0	0	0	0	0
Chironomidae	*Chironomus acidophilus*	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0
Chironomidae	*Chironomus bifurcatus*	0	1	0	0	0	1	1	0	1	0	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1
Chironomidae	*Chironomus maturus*	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	1	1	1	0
Chironomidae	*Chironomus melanescens*	0	0	0	1	1	1	0	0	0	1	1	0	0	0	1	1	1	1	0	1	1	1	0	0	0	0	0	0	0

Family	Scientific Name	S006	S009	S013	S014	S015	S016	S029	S034	S038	S040	S042	S051	S056	S067	S072	S073	S074	S075	S076	S077	S093	S094	S095	S096	S099	S100	S101	S102	S108
Chironomidae	*Cladopelma edwardsi*	0	0	1	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Chironomidae	*Cladotanytarsus atridorsum*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Chironomidae	*Conchapelopia telema*	0	0	0	1	1	1	0	1	0	0	1	0	1	1	1	1	1	0	1	1	1	1	1	1	0	0	0	1	0
Chironomidae	*Corynoneura arctica*	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chironomidae	*Corynoneura scutellata*	1	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1
Chironomidae	*Cricotopus annulator*	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chironomidae	*Cricotopus bicinctus*	0	0	1	0	1	1	0	0	0	1	0	1	0	1	1	0	1	1	1	0	0	1	0	0	0	1	0	1	0
Chironomidae	*Cricotopus sylvestris*	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0
Chironomidae	*Cricotopus tremulus*	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Chironomidae	*Cricotopus triannulatus*	0	0	1	1	0	1	1	0	1	0	0	1	1	1	0	1	0	0	1	1	1	0	1	1	0	0	0	0	0
Chironomidae	*Cricotopus trifascia*	0	0	0	0	1	0	0	0	0	1	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Chironomidae	*Cricotopus tristis*	0	0	0	0	0	1	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Chironomidae	*Cryptochironomus digitatus*	0	1	0	1	1	0	0	0	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	0	0	1	0	0
Chironomidae	*Dicrotendipes modestus*	0	1	1	0	1	0	1	0	1	1	1	1	1	0	1	1	1	0	1	1	0	0	0	0	0	1	0	1	0
Chironomidae	*Dicrotendipes tritomus*	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Chironomidae	*Eukiefferiella claripennis*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	0	0	1	1	1
Chironomidae	*Glyptotendipes meridionalis*	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chironomidae	*Heterotrissocladius changi*	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0
Chironomidae	*Hydrobaenus johannseni*	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Chironomidae	*Lauterborniella agrayloides*	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chironomidae	*Metriocnemus albolineatus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Chironomidae	*Micropsectra nigripila*	1	1	1	0	1	1	0	0	0	1	1	0	1	1	0	0	1	0	1	1	1	1	0	1	0	0	1	1	0
Chironomidae	*Micropsectra polita*	1	0	0	0	0	1	0	0	0	0	0	0	1	1	0	0	1	0	0	0	0	1	1	1	0	0	0	0	1
Chironomidae	*Micropsectra subletteorum*	1	1	0	1	1	1	0	0	0	1	1	0	1	1	1	1	0	1	0	0	0	0	1	1	0	0	1	0	1
Chironomidae	*Micropsectra xantha*	1	0	0	1	1	1	0	1	0	0	0	0	0	0	0	1	1	0	1	0	1	1	1	1	0	0	0	1	1
Chironomidae	*Microtendipes pedellus*	0	0	1	1	1	1	1	0	0	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0	1	0	0	0
Chironomidae	*Monopelopia tenuicalcar*	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chironomidae	*Nilotanypus fimbriatus*	0	0	0	0	1	1	1	0	1	1	1	1	0	1	1	1	1	1	1	1	0	0	0	1	0	0	1	0	0
Chironomidae	*Orthocladius carlatus*	0	0	0	0	0	0	0	0	1	0	1	0	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Chironomidae	*Orthocladius oliveri*	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chironomidae	*Orthocladius smolandicus*	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chironomidae	*Pagastia orthogonia*	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0
Chironomidae	*Parachironomus frequens*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chironomidae	*Paralauterborniella nigrohalteralis*	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Chironomidae	*Polypedilum aviceps*	1	0	0	0	1	0	1	1	0	0	0	1	1	1	0	0	1	1	1	1	1	1	1	1	0	0	1	0	1
Chironomidae	*Polypedilum convictum*	0	0	0	0	0	1	0	0	1	1	1	0	1	1	0	0	0	1	1	1	0	1	1	0	0	1	1	1	0
Chironomidae	*Potthastia gaedii*	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chironomidae	*Procladius denticulatus*	0	0	1	0	0	0	0	0	0	1	1	1	0	1	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0
Chironomidae	*Prodiamesa olivacea*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0
Chironomidae	*Rheocricotopus robacki*	0	0	1	0	0	0	0	0	0	1	0	0	1	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Chironomidae	*Stempellinella fimbriata*	0	0	0	0	1	1	1	0	0	1	0	1	0	0	1	0	1	0	0	1	1	1	0	0	0	0	0	0	0
Chironomidae	*Tanypus neopunctipennis*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Family	Scientific Name	S006	S009	S013	S014	S015	S016	S029	S034	S038	S040	S042	S051	S056	S067	S072	S073	S074	S075	S076	S077	S093	S094	S095	S096	S099	S100	S101	S102	S108
Chironomidae	*Tanypus stellatus*	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chironomidae	*Tanytarsus glabrescens*	0	1	0	0	1	1	1	0	0	1	1	0	1	1	1	1	1	1	1	1	1	0	1	1	0	1	0	0	0
Chironomidae	*Tanytarsus guerlus*	0	0	0	0	0	0	0	0	1	0	1	1	0	1	1	0	1	1	1	1	0	0	0	0	0	0	0	0	0
Chironomidae	*Tanytarsus wirthi*	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chironomidae	*Thienemanniella xena*	0	0	1	1	1	1	0	1	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	0
Chironomidae	*Tvetenia paucunca*	1	1	1	1	1	0	1	1	0	0	0	0	0	1	1	1	1	1	1	0	1	1	1	1	0	0	1	0	1
Chironomidae	*Xenochironomus xenolabis*	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	1	1	0	0	0	0	0	1	0	0	0
Chloropidae	*Malloewia nigripalpis*	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chloropidae	*Rhopalopterum soror*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Empididae	*Clinocera binotata*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Empididae	*Neoplasta scapularis*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
Ephydridae	*Hydrellia albilabris*	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0
Ephydridae	*Hydrellia notata*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	1
Ephydridae	*Notiphila olivacea*	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Ephydridae	*Notiphila scalaris*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0
Ephydridae	*Parydra quadrituberculata*	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ephydridae	*Scatella stagnalis*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Lauxaniidae	*Minettia lyraformis*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Limoniidae	*Antocha saxicola*	0	0	1	0	1	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	0	0	0	0	1	0
Limoniidae	*Hexatoma spinosa*	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Limoniidae	*Pseudolimnophila luteipennis*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Muscidae	*Coenosia tigrina*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0
Muscidae	*Gymnodia delecta*	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pediciidae	*Dicranota guerini*	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	1	0	0	0	1
Phoridae	*Diplonevra nitidula*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Phoridae	*Phalacrotophora longifrons*	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pipunculidae	*Dorylomorpha atramontensis*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Platystomatidae	*Rivellia steyskali*	1	0	1	1	1	0	0	0	1	0	1	1	1	1	0	1	1	0	1	1	1	1	1	1	0	1	0	1	1
Polleniidae	*Pollenia pediculata*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0
Psychodidae	*Psychoda alternata*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Psychodidae	*Psychoda phalaenoides*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Ptychopteridae	*Ptychoptera quadrifasciata*	1	1	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1	1	1	0	0	1	0	1
Rhagionidae	*Rhagio vertebratus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0
Sarcophagidae	*Boettcheria latisterna*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Sciomyzidae	*Elgiva solicita*	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sciomyzidae	*Sepedon armipes*	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sciomyzidae	*Sepedon fuscipennis*	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sepsidae	*Themira putris*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Simuliidae	*Simulium tuberosum*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Simuliidae	*Simulium verecundum*	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	1	0	0	0
Simuliidae	*Simulium vittatum*	1	0	1	0	1	1	0	0	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	0	0	1	0	0
Sphaeroceridae	*Leptocera erythrocera*	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0

Family	Scientific Name	S006	S009	S013	S014	S015	S016	S029	S034	S038	S040	S042	S051	S056	S067	S072	S073	S074	S075	S076	S077	S093	S094	S095	S096	S099	S100	S101	S102	S108
Syrphidae	*Allograpta obliqua*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Syrphidae	*Eristalis flavipes*	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Syrphidae	*Eristalis transversa*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Syrphidae	*Lejops chrysostomus*	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Syrphidae	*Platycheirus quadratus*	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Syrphidae	*Syrphus rectus*	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0
Syrphidae	*Toxomerus marginatus*	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	1
Tabanidae	*Chrysops ater*	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	1	0
Tabanidae	*Chrysops sackeni*	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tabanidae	*Tabanus aegrotus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Tipulidae	*Nephrotoma cornicina*	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0
Tipulidae	*Tipula abdominalis*	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0
Tipulidae	*Tipula mallochi*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Order: Ephemeroptera																														
Baetidae	*Baetis brunneicolor*	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Baetidae	*Baetis rusticans*	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Baetidae	*Baetis tricaudatus*	1	0	1	1	0	1	1	1	0	0	1	1	0	0	0	0	1	1	0	0	1	1	1	1	0	0	0	1	1
Baetidae	*Procloeon rubropictum*	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Ephemeridae	*Hexagenia atrocaudata*	0	0	1	0	1	1	1	0	0	1	1	1	0	1	1	1	0	0	1	1	0	0	0	0	0	1	0	0	0
Ephemeridae	*Hexagenia limbata*	0	0	1	0	1	1	0	0	0	0	0	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Heptageniidae	*Stenacron interpunctatum*	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Isonychiidae	*Isonychia bicolor*	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Order: Hemiptera																														
Cicadellidae	*Erythroneura bakeri*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Corixidae	*Palmacorixa buenoi*	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
Notonectidae	*Notonecta lunata*	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pentatomidae	*Euschistus variolarius*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Pleidae	*Neoplea striola*	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Order: Hymenoptera																														
Tenthredinidae	*Dolerus apricus*	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tenthredinidae	*Macrophya flavolineata*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Order: Lepidoptera																														
Argyresthiidae	*Argyresthia canadensis*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Erebidae	*Apantesis phalerata*	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Erebidae	*Lascoria ambigualis*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Erebidae	*Lymantria dispar*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Erebidae	*Macrochilo absorptalis*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Tortricidae	*Cochylis temerana*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Tortricidae	*Gypsonoma salicicolana*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Order: Mecoptera																														
Meropeidae	*Merope tuber*	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Order: Megaloptera																														

Family	Scientific Name	S006	S009	S013	S014	S015	S016	S029	S034	S038	S040	S042	S051	S056	S067	S072	S073	S074	S075	S076	S077	S093	S094	S095	S096	S099	S100	S101	S102	S108
Corydalidae	*Chauliodes rastricornis*	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0
Corydalidae	*Nigronia serricornis*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Sialidae	*Sialis joppa*	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Sialidae	*Sialis vagans*	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sialidae	*Sialis velata*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Order: Neuroptera																														
Coniopterygidae	*Conwentzia pineticola*	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hemerobiidae	*Micromus posticus*	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1	0	1	0	0	1	0	0
Hemerobiidae	*Micromus subanticus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Sisyridae	*Climacia areolaris*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Order: Plecoptera																														
Capniidae	*Paracapnia angulata*	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Leuctridae	*Leuctra rickeri*	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nemouridae	*Amphinemura delosa*	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Perlodidae	*Isoperla nana*	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0
Taeniopterygidae	*Strophopteryx fasciata*	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Taeniopterygidae	*Taeniopteryx nivalis*	0	0	0	0	1	1	1	0	0	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Order: Psocoptera																														
Psocidae	*Trichadenotecnum majus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Order: Trichoptera																														
Hydroptilidae	*Hydroptila consimilis*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Hydroptilidae	*Hydroptila jackmanni*	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lepidostomatidae	*Lepidostoma griseum*	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Limnephilidae	*Frenesia difficilis*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Limnephilidae	*Ironoquia punctatissima*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Limnephilidae	*Limnephilus canadensis*	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Limnephilidae	*Platycentropus radiatus*	0	1	0	1	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	1	1	1	0	0	1	0	0
Limnephilidae	*Psychoglypha subborealis*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Limnephilidae	*Pycnopsyche subfasciata*	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Philopotamidae	*Dolophilodes distinctus*	1	0	0	1	0	0	0	0	0	0	0	1	0	0	1	0	0	1	1	1	1	1	1	0	0	0	0	1	0
Class: Malacostraca																														
Order: Amphipoda																														
Hyalellidae	*Hyalella azteca*	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0
Order: Decapoda																														
Cambaridae	*Faxonius rusticus*	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Class: Ostracoda																														
Order: Podocopida																														
Cyprididae	*Cypridopsis vidua*	0	0	1	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Phylum: Bacillariophyta																														
Class: Bacillariophyceae																														
Order: Naviculales																														
Sellaphoraceae	*Sellaphora pupula*	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0

Table G-2. Summer 2022 detections of invertebrate species in watercourses outside of the AOI.

Family	Scientific Name	S001	S002	S003	S010	S021	S026	S030	S037	S044	S046	S057	S058	S059	S061	S063	S065	S112	S126
Phylum: Annelida																			
Class: Clitellata																			
Order: Crassiclitellata																			
Lumbricidae	*Lumbricus rubellus*	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Order: Haplotaxida																			
Naididae	*Aulodrilus pluriseta*	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0
Naididae	*Branchiura sowerbyi*	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Naididae	*Ilyodrilus templetoni*	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Naididae	*Nais stolci*	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Order: Lumbriculida																			
Sparganophilidae	*Sparganophilus tamesis*	0	1	1	0	0	1	1	0	0	0	0	1	1	1	1	0	0	0
Order: Rhynchobdellida																			
Glossiphoniidae	*Placobdella parasitica*	0	0	0	0	0	1	0	0	0	0	0	1	0	1	0	0	0	0
Phylum: Arthropoda																			
Class: Arachnida																			
Order: Opiliones																			
Phalangiidae	*Phalangium opilio*	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Class: Collembola																			
Order: Symphypleona																			
Katiannidae	*Sminthurinus elegans*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Class: Insecta																			
Order: Coleoptera																			
Carabidae	*Pterostichus corvinus*	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0
Carabidae	*Pterostichus melanarius*	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Cerambycidae	*Orthosoma brunneum*	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Curculionidae	*Sciaphilus asperatus*	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0
Dermestidae	*Attagenus brunneus*	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Dytiscidae	*Ilybiosoma seriatum*	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Dytiscidae	*Laccophilus maculosus*	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Dytiscidae	*Neoporus clypealis*	0	0	1	0	0	0	1	0	0	0	1	1	0	0	1	1	0	0
Dytiscidae	*Neoporus undulatus*	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Dytiscidae	*Platambus semivittatus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Elmidae	*Dubiraphia vittata*	0	0	0	0	0	0	0	0	0	1	0	1	0	0	1	0	0	0
Erotylidae	*Ischyrus quadripunctatus*	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Gyrinidae	*Dineutus hornii*	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Haliplidae	*Haliplus immaculicollis*	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydrophilidae	*Hydrobius fuscipes*	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Hydrophilidae	*Paracymus tarsalis*	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Lampyridae	*Ellychnia corrusca*	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0
Lampyridae	*Pyropyga decipiens*	0	0	1	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0
Melandryidae	*Symphora rugosa*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Psephenidae	*Psephenus herricki*	0	1	1	1	0	0	0	0	0	0	0	0	1	0	1	1	0	0
Scarabaeidae	*Amphimallon majale*	0	1	1	1	0	0	0	0	0	0	0	1	0	1	1	1	0	1
Scarabaeidae	*Serica intermixta*	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Scirtidae	*Contacyphon obscurellus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Scirtidae	*Prionocyphon limbatus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Scirtidae	*Scirtes tibialis*	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Staphylinidae	*Dinothenarus badipes*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Staphylinidae	*Hemiquedius ferox*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Order: Diptera																			
Agromyzidae	*Nemorimyza posticata*	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ceratopogonidae	*Atrichopogon fusculus*	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ceratopogonidae	*Culicoides biguttatus*	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Family	Scientific Name	S001	S002	S003	S010	S021	S026	S030	S037	S044	S046	S057	S058	S059	S061	S063	S065	S112	S126
Chironomidae	*Brillia flavifrons*	0	1	1	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0
Chironomidae	*Chironomus acidophilus*	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Chironomidae	*Chironomus bifurcatus*	0	1	1	0	1	0	1	1	0	0	0	1	1	1	1	0	0	0
Chironomidae	*Chironomus lugubris*	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Chironomidae	*Chironomus maturus*	0	0	0	0	1	0	0	1	0	1	1	0	0	0	0	0	0	0
Chironomidae	*Chironomus melanescens*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Chironomidae	*Conchapelopia telema*	0	0	1	0	0	0	0	0	0	1	0	0	0	1	1	0	0	1
Chironomidae	*Corynoneura scutellata*	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0
Chironomidae	*Cricotopus bicinctus*	0	1	1	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1
Chironomidae	*Cricotopus triannulatus*	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Chironomidae	*Cricotopus trifascia*	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chironomidae	*Cricotopus tristis*	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0	0	0
Chironomidae	*Cryptochironomus digitatus*	0	0	0	0	1	1	1	0	1	0	1	0	0	0	0	0	0	1
Chironomidae	*Dicrotendipes modestus*	0	0	0	0	1	0	1	1	1	0	1	0	0	0	1	0	0	0
Chironomidae	*Dicrotendipes tritomus*	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Chironomidae	*Eukiefferiella claripennis*	0	0	1	0	0	0	0	1	0	0	0	1	1	0	0	0	0	1
Chironomidae	*Hydrobaenus johannseni*	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chironomidae	*Micropsectra nigripila*	1	1	0	0	1	1	0	0	1	0	1	0	0	0	0	0	0	0
Chironomidae	*Micropsectra polita*	0	1	0	0	0	0	1	1	0	1	0	0	1	0	1	0	1	0
Chironomidae	*Micropsectra subletteorum*	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0
Chironomidae	*Micropsectra xantha*	0	0	1	0	1	0	0	0	0	0	0	0	1	0	0	0	1	0
Chironomidae	*Microtendipes pedellus*	0	0	0	1	0	0	0	0	0	1	0	1	1	1	1	1	0	1
Chironomidae	*Nilotanypus fimbriatus*	0	1	1	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0
Chironomidae	*Orthocladius carlatus*	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chironomidae	*Orthocladius oliveri*	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0
Chironomidae	*Pagastia orthogonia*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Chironomidae	*Paralauterborniella nigrohalteralis*	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0
Chironomidae	*Polypedilum aviceps*	0	0	1	0	0	0	0	0	0	1	1	1	1	0	1	0	1	1
Chironomidae	*Polypedilum convictum*	0	1	1	1	0	1	1	0	0	1	0	1	0	1	1	1	0	1
Chironomidae	*Procladius denticulatus*	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0
Chironomidae	*Rheocricotopus robacki*	0	1	1	0	0	0	0	0	0	1	0	1	1	1	1	1	0	0
Chironomidae	*Stempellinella fimbriata*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Chironomidae	*Synorthocladius semivirens*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Chironomidae	*Tanytarsus glabrescens*	0	1	1	1	0	1	1	0	1	1	1	1	1	1	1	1	0	0
Chironomidae	*Tanytarsus guerlus*	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chironomidae	*Tanytarsus mendax*	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Chironomidae	*Thienemanniella xena*	0	1	1	1	0	1	1	0	1	0	1	1	1	1	1	0	0	0
Chironomidae	*Tvetenia paucunca*	0	0	1	0	0	0	0	0	0	0	0	1	1	1	1	0	1	1
Chironomidae	*Xenochironomus xenolabis*	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Dolichopodidae	*Pelastoneurus vagans*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Empididae	*Hemerodromia melanosoma*	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Ephydridae	*Nostima picta*	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Ephydridae	*Scatella tenuicosta*	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Limoniidae	*Antocha saxicola*	0	1	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0	1
Limoniidae	*Discobola annulata*	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Limoniidae	*Pseudolimnophila luteipennis*	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Muscidae	*Hebecnema nigra*	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Muscidae	*Lispe albitarsis*	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Platystomatidae	*Rivellia steyskali*	0	0	1	0	1	0	1	0	0	0	0	1	0	0	0	0	0	0
Polleniidae	*Pollenia griseotomentosa*	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polleniidae	*Pollenia pediculata*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Ptychopteridae	*Ptychoptera quadrifasciata*	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Sciomyzidae	*Pherbellia parallela*	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Simuliidae	*Simulium decorum*	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Simuliidae	*Simulium tuberosum*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0

Family	Scientific Name	S001	S002	S003	S010	S021	S026	S030	S037	S044	S046	S057	S058	S059	S061	S063	S065	S112	S126
Simuliidae	*Simulium verecundum*	0	0	1	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0
Simuliidae	*Simulium vittatum*	0	0	1	0	0	0	0	0	1	1	0	1	0	1	0	1	0	0
Sphaeroceridae	*Leptocera erythrocera*	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stratiomyidae	*Sargus cuprarius*	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Syrphidae	*Syrphus rectus*	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Tabanidae	*Chrysops sackeni*	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tipulidae	*Tipula abdominalis*	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Order: Ephemeroptera																			
Baetidae	*Baetis tricaudatus*	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	1
Ephemeridae	*Hexagenia atrocaudata*	0	1	1	1	0	0	0	0	0	1	0	1	0	1	1	1	0	0
Leptophlebiidae	*Leptophlebia nebulosa*	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Order: Hemiptera																			
Nepidae	*Nepa apiculata*	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Notonectidae	*Notonecta irrorata*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Pentatomidae	*Amaurochrous cinctipes*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Pentatomidae	*Euschistus ictericus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Pleidae	*Neoplea striola*	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Order: Megaloptera																			
Corydalidae	*Chauliodes rastricornis*	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0
Corydalidae	*Nigronia serricornis*	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Sialidae	*Sialis vagans*	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Order: Neuroptera																			
Hemerobiidae	*Micromus posticus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Sisyridae	*Climacia areolaris*	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Order: Plecoptera																			
Capniidae	*Allocapnia vivipara*	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0
Taeniopterygidae	*Taeniopteryx nivalis*	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0	0
Order: Psocoptera																			
Psocidae	*Trichadenotecnum majus*	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stenopsocidae	*Graphopsocus cruciatus*	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Order: Trichoptera																			
Lepidostomatidae	*Lepidostoma griseum*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Limnephilidae	*Platycentropus radiatus*	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Limnephilidae	*Pycnopsyche guttifera*	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Limnephilidae	*Pycnopsyche subfasciata*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Philopotamidae	*Dolophilodes distinctus*	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Uenoidae	*Neophylax oligius*	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Class: Malacostraca																			
Order: Amphipoda																			
Hyalellidae	*Hyalella azteca*	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Order: Decapoda																			
Cambaridae	*Faxonius rusticus*	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

G.1.2 Waterbodies

Table G-3. Summer 2022 detections of invertebrate species in waterbodies in the AOI.

Family	Scientific Name	P010
Phylum: Annelida		
Class: Clitellata		
Order: Haplotaxida		
Naididae	*Potamothrix bavaricus*	1
Phylum: Arthropoda		
Class: Insecta		
Order: Coleoptera		
Haliplidae	*Peltodytes tortulosus*	1
Hydrophilidae	*Tropisternus mixtus*	1
Order: Diptera		
Chaoboridae	*Chaoborus punctipennis*	1
Chironomidae	*Chironomus maturus*	1
Chironomidae	*Chironomus staegeri*	1
Chironomidae	*Dicrotendipes tritomus*	1
Ephydridae	*Hydrellia tenebricosa*	1
Class: Ostracoda		
Order: Podocopida		
Cyprididae	*Cypridopsis vidua*	1

Table G-4. Summer 2022 detections of invertebrate species in waterbodies outside of the AOI.

Family	Scientific Name	L001	L003	P007	P008	P009	P015
Phylum: Annelida							
Class: Clitellata							
Order: Haplotaxida							
Naididae	*Nais communis*	0	0	0	0	1	0
Phylum: Arthropoda							
Class: Branchiopoda							
Order: Diplostraca							
Sididae	*Diaphanosoma brachyurum*	1	0	0	0	0	0
Class: Collembola							
Order: Symphypleona							
Katiannidae	*Sminthurinus elegans*	1	0	0	0	0	0
Class: Insecta							
Order: Coleoptera							
Dytiscidae	*Agabus anthracinus*	0	1	0	0	0	0
Dytiscidae	*Hydroporus dentellus*	0	1	0	0	0	0
Gyrinidae	*Dineutus hornii*	0	1	1	0	0	0
Haliplidae	*Haliplus immaculicollis*	0	0	0	0	1	1
Hydrophilidae	*Hydrobius fuscipes*	0	0	0	1	1	0
Hydrophilidae	*Hydrochara obtusata*	0	0	0	1	0	0
Hydrophilidae	*Tropisternus mixtus*	0	0	1	0	1	0
Phalacridae	*Olibrus semistriatus*	0	0	0	0	0	1
Scirtidae	*Scirtes tibialis*	0	1	0	0	1	0
Order: Diptera							
Chaoboridae	*Chaoborus punctipennis*	1	0	1	0	0	1
Chironomidae	*Chironomus acidophilus*	0	0	0	0	1	0
Chironomidae	*Chironomus atrella*	0	0	0	1	1	1
Chironomidae	*Chironomus bifurcatus*	0	0	0	0	0	1
Chironomidae	*Chironomus dilutus*	0	0	0	1	0	0
Chironomidae	*Chironomus maturus*	0	0	0	1	0	0
Chironomidae	*Corynoneura scutellata*	0	0	0	1	0	1
Chironomidae	*Cricotopus intersectus*	0	1	0	0	0	0
Chironomidae	*Cricotopus sylvestris*	1	0	0	0	0	0
Chironomidae	*Dicrotendipes modestus*	0	0	0	0	1	0
Chironomidae	*Dicrotendipes tritomus*	1	0	0	1	1	1
Chironomidae	*Lauterborniella agrayloides*	1	0	0	0	0	0
Chironomidae	*Micropsectra nigripila*	0	1	0	0	1	1
Chironomidae	*Monopelopia tenuicalcar*	0	1	0	0	0	0
Chironomidae	*Orthocladius smolandicus*	0	0	0	1	1	1
Chironomidae	*Parachironomus tenuicaudatus*	1	1	0	0	1	0
Chironomidae	*Paratanytarsus laccophilus*	0	0	0	0	0	1
Chironomidae	*Procladius denticulatus*	0	0	1	0	0	0
Chironomidae	*Psectrocladius obvius*	0	0	0	0	1	0
Chironomidae	*Psectrocladius sordidellus*	0	0	0	0	1	0
Chironomidae	*Tanytarsus mendax*	0	0	1	0	1	1
Chironomidae	*Tanytarsus recurvatus*	0	0	0	1	0	0
Chironomidae	*Tanytarsus usmaensis*	0	0	0	0	0	1
Culicidae	*Anopheles punctipennis*	0	0	0	0	0	1
Culicidae	*Ochlerotatus thibaulti*	0	0	0	1	0	0
Ephydridae	*Notiphila olivacea*	0	0	0	1	0	0
Sarcophagidae	*Sarcophaga albiceps*	1	0	0	0	0	0
Simuliidae	*Simulium vittatum*	1	0	0	0	0	0
Syrphidae	*Eristalis flavipes*	0	0	0	0	1	0
Order: Ephemeroptera							
Caenidae	*Caenis diminuta*	0	0	1	0	0	0
Ephemeridae	*Hexagenia atrocaudata*	1	0	0	0	0	0
Order: Hemiptera							
Belostomatidae	*Belostoma flumineum*	0	0	0	1	0	0
Notonectidae	*Notonecta undulata*	0	0	0	0	1	0
Pleidae	*Neoplea striola*	0	0	0	1	1	0
Class: Ostracoda							
Order: Podocopida							
Cyprididae	*Cypridopsis vidua*	1	1	0	1	0	0

G.1.3 Wetlands

Table G-5. Summer 2022 detections of invertebrate species in wetlands in the AOI.

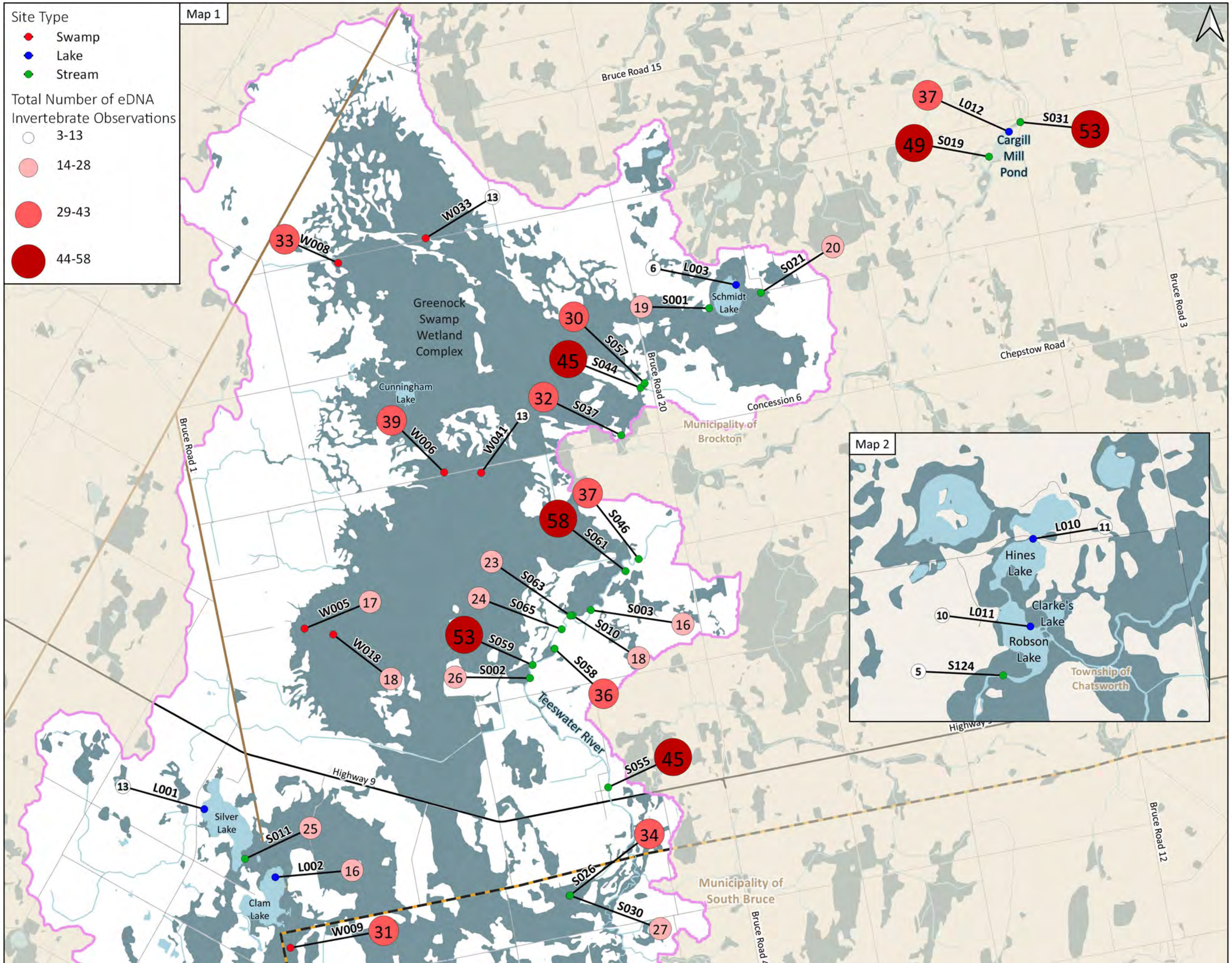
Family	Scientific Name	P002 marsh	P012 swamp	P013 marsh	P016 swamp	W113 swamp	W124 swamp	W127 marsh	W139 swamp
Phylum: Annelida									
Class: Clitellata									
Order: Haplotaxida									
Naididae	*Ilyodrilus templetoni*	0	0	0	0	0	0	1	0
Naididae	*Slavina appendiculata*	0	0	0	0	0	0	1	0
Phylum: Arthropoda									
Class: Insecta									
Order: Coleoptera									
Carabidae	*Pterostichus melanarius*	0	0	0	1	0	0	0	0
Curculionidae	*Barypeithes pellucidus*	0	0	0	0	0	0	0	1
Curculionidae	*Sciaphilus asperatus*	0	0	0	0	0	0	0	1
Dytiscidae	*Ilybiosoma seriatum*	0	0	0	0	0	0	0	1
Dytiscidae	*Neoporus undulatus*	0	0	0	0	0	0	1	0
Haliplidae	*Haliplus immaculicollis*	0	0	0	0	0	0	1	0
Hydrophilidae	*Berosus sayi*	0	0	0	0	1	0	0	0
Hydrophilidae	*Coelostoma orbiculare*	0	0	0	0	0	0	1	0
Hydrophilidae	*Hydrochara obtusata*	0	0	0	0	0	0	1	0
Scarabaeidae	*Amphimallon majale*	1	0	0	0	0	0	0	1
Scirtidae	*Scirtes tibialis*	0	0	0	0	0	0	1	0
Order: Diptera									
Bibionidae	*Bibio xanthopus*	0	0	0	1	0	0	0	0
Ceratopogonidae	*Culicoides mulrennani*	0	0	0	0	0	0	1	0
Chaoboridae	*Chaoborus albipes*	1	1	0	1	0	0	0	0
Chaoboridae	*Chaoborus punctipennis*	0	0	0	1	0	0	0	0
Chironomidae	*Chironomus acidophilus*	1	0	0	1	1	1	0	0
Chironomidae	*Chironomus bifurcatus*	1	1	0	1	1	1	1	0
Chironomidae	*Chironomus maturus*	1	0	0	1	1	1	1	0
Chironomidae	*Corynoneura scutellata*	1	1	0	1	1	1	0	0
Chironomidae	*Gymnometriocnemus brumalis*	0	0	0	0	0	0	0	1
Chironomidae	*Metriocnemus albolineatus*	0	0	0	0	0	0	0	1
Chironomidae	*Micropsectra nigripila*	0	0	1	0	0	1	1	0
Chironomidae	*Micropsectra subletteorum*	0	0	0	0	0	0	0	1
Chironomidae	*Micropsectra xantha*	0	0	0	0	0	0	0	1
Chironomidae	*Parachironomus tenuicaudatus*	0	1	1	0	0	0	0	0
Chironomidae	*Polypedilum convictum*	0	0	0	0	0	0	0	1
Chironomidae	*Procladius denticulatus*	0	0	0	1	0	0	0	0
Chironomidae	*Prodiamesa olivacea*	0	0	0	0	0	0	0	1
Chironomidae	*Tvetenia paucunca*	0	0	0	0	0	0	0	1
Culicidae	*Culex territans*	0	1	0	0	0	0	0	0
Drosophilidae	*Scaptomyza flava*	0	0	0	0	0	1	0	0
Ephydridae	*Hydrellia albilabris*	0	0	0	0	0	0	1	0
Ephydridae	*Hydrellia notata*	0	0	0	1	0	0	0	0
Limoniidae	*Erioptera septemtrionis*	0	0	0	0	0	0	1	0
Pediciidae	*Pedicia goldsworthyi*	0	0	0	0	0	0	0	1
Platystomatidae	*Rivellia steyskali*	0	0	0	1	1	0	1	1
Sciomyzidae	*Elgiva solicita*	0	0	0	0	0	0	1	0
Sciomyzidae	*Sepedon fuscipennis*	0	0	0	1	0	0	0	0
Sphaeroceridae	*Pullimosina pullula*	0	0	0	0	0	0	1	0
Syrphidae	*Allograpta obliqua*	0	0	0	0	0	1	0	0
Tipulidae	*Nephrotoma cornicina*	0	0	0	1	0	0	0	0
Tipulidae	*Tipula mallochi*	0	0	1	0	0	0	0	0
Tipulidae	*Tipula tephrocephala*	0	0	0	0	0	0	0	1
Order: Hemiptera									
Notonectidae	*Notonecta irrorata*	1	0	0	0	0	0	0	0
Order: Lepidoptera									
Tortricidae	*Choristoneura fumiferana*	0	0	0	0	0	0	0	1
Order: Megaloptera									
Corydalidae	*Chauliodes rastricornis*	0	1	0	0	0	0	0	0
Order: Neuroptera									
Hemerobiidae	*Sympherobius amiculus*	0	0	0	0	0	0	0	1
Order: Plecoptera									
Perlodidae	*Isoperla nana*	0	0	0	0	0	0	0	1
Class: Ostracoda									
Order: Podocopida									
Cyprididae	*Cypridopsis vidua*	1	0	0	0	0	0	0	0

Table G-6. Summer 2022 detections of invertebrate species in wetlands outside of the AOI.

Family	Scientific Name	W005 swamp	W008 swamp	W024 swamp	W033 swamp	W038 marsh	W041 swamp
Phylum: Annelida							
Class: Clitellata							
Order: Haplotaxida							
Naididae	*Nais communis*	0	0	0	0	1	0
Naididae	*Slavina appendiculata*	0	0	0	0	1	0
Phylum: Arthropoda							
Class: Branchiopoda							
Order: Diplostraca							
Daphniidae	*Simocephalus serrulatus*	0	0	0	0	1	0

Family	Scientific Name	W005 swamp	W008 swamp	W024 swamp	W033 swamp	W038 marsh	W041 swamp
Class: Insecta							
Order: Coleoptera							
Dytiscidae	*Clemnius laccophilinus*	0	0	1	0	0	0
Dytiscidae	*Neoporus undulatus*	0	0	1	0	0	0
Noteridae	*Hydrocanthus iricolor*	0	0	0	0	1	0
Scirtidae	*Contacyphon obscurus*	1	0	0	1	0	0
Scirtidae	*Scirtes tibialis*	0	0	0	0	1	0
Staphylinidae	*Hemiquedius ferox*	1	0	0	0	0	0
Order: Diptera							
Chaoboridae	*Chaoborus punctipennis*	0	0	0	0	1	0
Chironomidae	*Chironomus acidophilus*	1	1	0	1	0	0
Chironomidae	*Chironomus maturus*	1	1	0	0	0	1
Chironomidae	*Cricotopus bicinctus*	1	0	0	0	0	0
Chironomidae	*Dicrotendipes tritomus*	0	0	0	0	1	0
Chironomidae	*Micropsectra nigripila*	0	0	1	1	0	0
Chironomidae	*Micropsectra recurvata*	0	0	1	0	0	0
Chironomidae	*Micropsectra subletteorum*	0	0	1	0	0	0
Chironomidae	*Orthocladius smolandicus*	0	0	0	0	0	1
Chironomidae	*Parachironomus tenuicaudatus*	0	0	0	0	1	0
Chironomidae	*Tanytarsus mendax*	0	0	0	0	1	0
Culicidae	*Culex territans*	0	0	0	0	0	1
Ephydridae	*Hydrellia albilabris*	0	0	1	0	0	0
Fanniidae	*Fannia latifrons*	1	0	0	0	0	0
Limoniidae	*Ormosia affinis*	1	0	0	0	0	0
Limoniidae	*Pseudolimnophila luteipennis*	0	0	0	1	0	0
Muscidae	*Pentacricia aldrichii*	1	0	0	1	0	0
Ptychopteridae	*Ptychoptera quadrifasciata*	0	0	1	0	0	0
Sciomyzidae	*Atrichomelina pubera*	0	0	0	1	0	0
Tipulidae	*Tipula sayi*	1	0	0	0	0	0
Order: Neuroptera							
Hemerobiidae	*Micromus posticus*	1	0	0	0	0	0
Order: Psocoptera							
Lepidopsocidae	*Echmepteryx hageni*	1	0	0	0	0	0
Order: Trichoptera							
Limnephilidae	*Platycentropus radiatus*	0	0	0	0	0	1
Class: Ostracoda							
Order: Podocopida							
Cyprididae	*Cypridopsis vidua*	1	1	0	0	0	0
Phylum: Rotifera							
Class: Eurotatoria							
Order: Ploima							
Synchaetidae	*Polyarthra vulgaris*	0	0	0	0	1	0

G.2 Fall



NWMO Biodiversity Impact Studies

eDNA Fall Results (Invertebrate) - North LSA_{AQU}

Figure G-2a

- Area of Interest (AOI)
- Local Study Area (LSA_{TER})
- Local Study Area (LSA_{AQU})
- Lake
- Wetland
- Watercourse
- Highway
- Local Road
- South Bruce Boundary
- Municipal Boundary

The number inside the observation symbols represents the count of detected species at that given site.

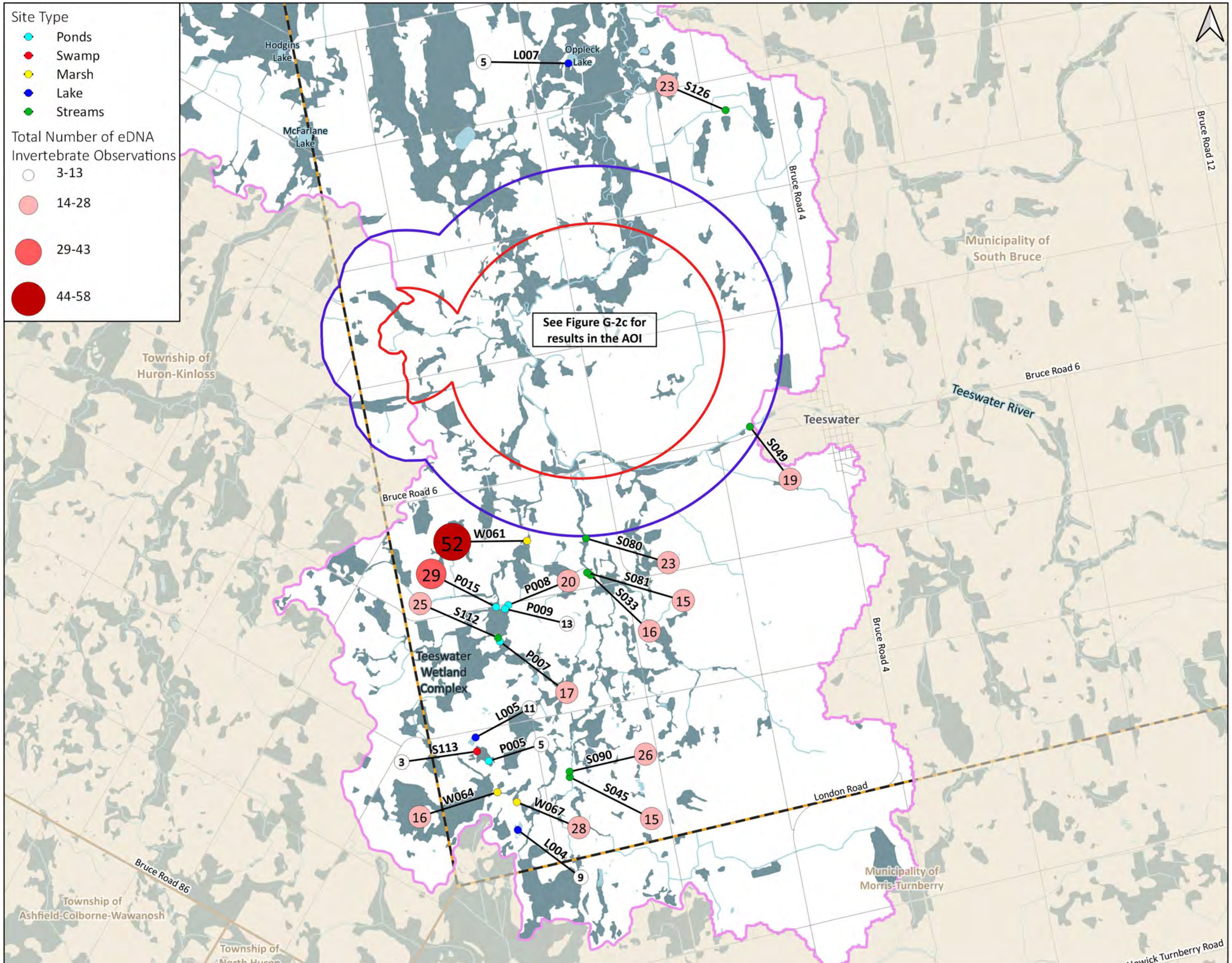
1:65,000

0 1 2 km

ZOETICA

Data received from:
Ontario GeoHub — OHN Waterbody (MNRF); OHN Watercourse (MNRF); MNRF Road Segments (MNRF); Municipal Boundary - Lower and Single Tier (MMAH); Wetlands (MNRF)
NWMO — AOI; 2022 SB eDNA Rev. B (NSC)
Wetlands and water features are mapped using ecosite data within the LSA_{ECO} and data available from Ontario GeoHub outside the LSA_{ECO}.

Project CRS: NAD83 / UTM zone 17N		
Author: AH	Reviewed by: CW	Approved by: HB
December 13, 2023	Map ID: NWMO_BIS_A112a	



NWMO Biodiversity Impact Studies

eDNA Fall Results (Invertebrate) - South LSA_{AQU}

Figure G-2b

- Area of Interest (AOI)
- Local Study Area (LSA_{TER})
- Local Study Area (LSA_{AQU})
- Lake
- Wetland
- Watercourse
- Highway
- Local Road
- South Bruce Boundary
- Municipal Boundary

The number inside the observation symbols represents the count of detected species at that given site.

1:65,000

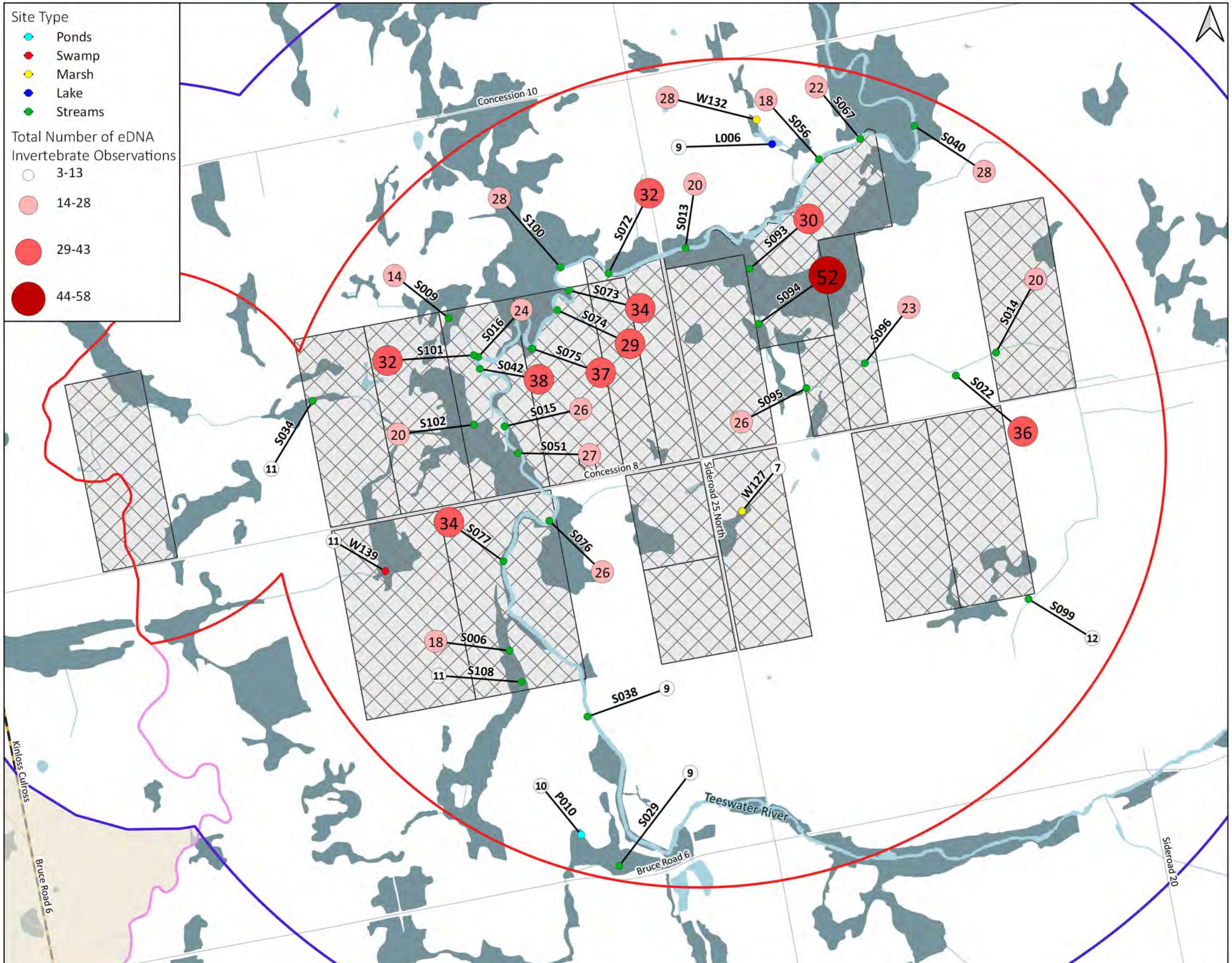
0 1 2 km

ZOETICA

Data received from:
Ontario GeoHub — OHN Waterbody (MNRF); OHN Watercourse (MNRF); MNRF Road Segments (MNRF); Municipal Boundary - Lower and Single Tier (MMAH); Wetlands (MNRF)
NWMO — AOI; 2022 SB eDNA Rev. B (NSC)
Wetlands and water features are mapped using ecosite data within the LSA_{ECO} and data available from Ontario GeoHub outside the LSA_{ECO}.

Project CRS: NAD83 / UTM zone 17N

Author: AH	Reviewed by: CW	Approved by: HB
December 13, 2023	Map ID: NWMO_BIS_A112b	



NWMO Biodiversity Impact Studies

eDNA Fall Results (Invertebrate) - AOI

Figure G-2c

- Area of Interest (AOI)
- Local Study Area (LSA_{TER})
- Local Study Area (LSA_{AQU})
- Lake
- Wetland
- Watercourse
- Highway
- Local Road
- South Bruce Boundary
- Municipal Boundary
- NWMO Purchased or Optioned Land

The number inside the observation symbols represents the count of detected species at that given site.

1:20,000
0 0.5 1 km

Data received from:
Ontario GeoHub — OHN Waterbody (MNRF); OHN Watercourse (MNRF); MNRF Road Segments (MNRF); Municipal Boundary - Lower and Single Tier (MMAH); Wetlands (MNRF)
NWMO — AOI; 2022 SB eDNA Rev. B (NSC); NWMO Purchased or Optioned Land
Wetlands and water features are mapped using ecosite data within the LSA_{ECO} and data available from Ontario GeoHub outside the LSA_{ECO}.

Project CRS: NAD83 / UTM zone 17N		
Author: AH	Reviewed by: CW	Approved by: HB
December 13, 2023	Map ID: NWMO_BIS_A112c	

G.2.1 Watercourses

Table G-7. Fall 2022 detections of invertebrate species in watercourses in the AOI.

Family	Scientific Name	S006	S009	S013	S014	S015	S016	S022	S029	S034	S038	S040	S042	S051	S056	S067	S072	S073	S074	S075	S076	S077	S093	S094	S095	S096	S099	S100	S101	S102	S108
Phylum: Annelida																															
Class: Clitellata																															
Order: Crassiclitellata																															
Lumbricidae	*Lumbricus rubellus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0
Lumbricidae	*Lumbricus terrestris*	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0
Lumbricidae	*Octolasion tyrtaeum*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0
Order: Enchytraeida																															
Enchytraeidae	*Henlea perpusilla*	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Order: Haplotaxida																															
Naididae	*Aulodrilus pluriseta*	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	0	1	0	1	1	0	1
Naididae	*Branchiura sowerbyi*	0	0	1	0	0	1	0	1	0	1	1	1	1	0	1	1	1	0	1	1	1	0	0	0	0	0	1	0	0	0
Naididae	*Chaetogaster diastrophus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Naididae	*Ilyodrilus templetoni*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	1	0	1	0	0	0	0	0	0	0	0
Naididae	*Limnodrilus hoffmeisteri*	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Naididae	*Nais bretscheri*	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Naididae	*Nais communis*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Naididae	*Nais stolci*	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Naididae	*Rhyacodrilus falciformis*	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0	1	0
Naididae	*Tubifex tubifex*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Order: Lumbriculida																															
Sparganophilidae	*Sparganophilus tamesis*	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0
Phylum: Arthropoda																															
Class: Arachnida																															
Order: Opiliones																															
Phalangiidae	*Lophopilio palpinalis*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Phalangiidae	*Oligolophus tridens*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0
Phalangiidae	*Phalangium opilio*	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0
Class: Branchiopoda																															
Order: Diplostraca																															
Chydoridae	*Alona circumfimbriata*	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Daphniidae	*Simocephalus serrulatus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Class: Collembola																															
Order: Entomobryomorpha																															
Isotomidae	*Folsomia candida*	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Order: Symphypleona																															
Katiannidae	*Sminthurinus elegans*	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Class: Insecta																															
Order: Coleoptera																															
Anthicidae	*Notoxus desertus*	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0
Carabidae	*Agonum thoreyi*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Family	Scientific Name	S006	S009	S013	S014	S015	S016	S022	S029	S034	S038	S040	S042	S051	S056	S067	S072	S073	S074	S075	S076	S077	S093	S094	S095	S096	S099	S100	S101	S102	S108
Carabidae	*Bembidion transparens*	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Carabidae	*Clivina fossor*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Carabidae	*Patrobus longicornis*	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Carabidae	*Pterostichus corvinus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Chrysomelidae	*Epitrix cucumeris*	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cleridae	*Enoclerus nigripes*	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Curculionidae	*Sciaphilus asperatus*	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	1	1	1	1	0	0	1	1	0	0	1	0	0	1	0
Dytiscidae	*Hydroporus niger*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Dytiscidae	*Ilybiosoma seriatum*	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
Dytiscidae	*Ilybius biguttulus*	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0
Dytiscidae	*Laccophilus maculosus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Dytiscidae	*Neoporus clypealis*	0	1	0	0	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0
Dytiscidae	*Platambus semivittatus*	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Dytiscidae	*Rhantus sinuatus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Elateridae	*Agriotes mancus*	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elmidae	*Dubiraphia vittata*	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elmidae	*Optioservus fastiditus*	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Elmidae	*Stenelmis quadrimaculata*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Erotylidae	*Acropteroxys gracilis*	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gyrinidae	*Gyrinus sayi*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Haliplidae	*Haliplus immaculicollis*	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Haliplidae	*Peltodytes tortulosus*	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Hydrophilidae	*Coelostoma orbiculare*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Lampyridae	*Ellychnia corrusca*	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	1	0
Lampyridae	*Lucidota atra*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Phalacridae	*Olibrus semistriatus*	0	0	0	1	1	0	0	1	0	1	0	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1	0	0	0	0
Psephenidae	*Psephenus herricki*	0	0	0	0	1	0	0	0	0	1	0	1	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0	1	0	0
Ptilodactylidae	*Ptilodactyla carinata*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Scarabaeidae	*Melinopterus prodromus*	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	1	0	0	0
Scarabaeidae	*Phyllophaga anxia*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Scirtidae	*Exneria ruficollis*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Scirtidae	*Prionocyphon limbatus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Staphylinidae	*Erichsonius nanus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Staphylinidae	*Gyrophaena insolens*	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Staphylinidae	*Meronera venustula*	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Staphylinidae	*Nehemitropia lividipennis*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Staphylinidae	*Rugilus angustatus*	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Staphylinidae	*Tachinus limbatus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	0
Staphylinidae	*Xantholinus linearis*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Order: Dermaptera																															
Forficulidae	*Forficula auricularia*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Order: Diptera																															

Family	Scientific Name	S006	S009	S013	S014	S015	S016	S022	S029	S034	S038	S040	S042	S051	S056	S067	S072	S073	S074	S075	S076	S077	S093	S094	S095	S096	S099	S100	S101	S102	S108
Acroceridae	*Actina viridis*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Agromyzidae	*Agromyza pseudoreptans*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Agromyzidae	*Cerodontha angulata*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Agromyzidae	*Cerodontha muscina*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Agromyzidae	*Nemorimyza posticata*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Agromyzidae	*Ophiomyia quinta*	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Agromyzidae	*Phytomyza solidaginophaga*	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ceratopogonidae	*Culicoides stellifer*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Chaoboridae	*Chaoborus punctipennis*	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Chironomidae	*Ablabesmyia americana*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Chironomidae	*Ablabesmyia annulata*	0	0	0	0	0	1	0	0	0	0	1	1	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0
Chironomidae	*Brillia flavifrons*	0	0	0	1	0	0	1	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	1	1	0	0	0	0	0
Chironomidae	*Chironomus acidophilus*	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Chironomidae	*Chironomus maturus*	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0
Chironomidae	*Chironomus melanescens*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0
Chironomidae	*Conchapelopia telema*	0	0	0	0	1	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chironomidae	*Corynoneura scutellata*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Chironomidae	*Cricotopus annulator*	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Chironomidae	*Cricotopus bicinctus*	0	0	1	0	0	1	0	0	0	1	1	0	0	0	0	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0
Chironomidae	*Cricotopus lebetis*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Chironomidae	*Cricotopus tremulus*	0	0	0	0	1	1	0	0	0	0	0	1	1	1	1	0	1	1	1	0	1	0	0	1	0	0	0	0	0	0
Chironomidae	*Cricotopus triannulatus*	0	0	1	0	1	1	0	0	0	1	1	1	1	0	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
Chironomidae	*Cricotopus trifascia*	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chironomidae	*Cricotopus tristis*	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	1	1	0	1	1	0	0	0	0	0	0	0
Chironomidae	*Cryptochironomus digitatus*	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chironomidae	*Dicrotendipes modestus*	0	0	1	0	0	0	0	0	0	0	0	0	1	0	1	1	0	1	1	0	1	0	1	0	0	0	1	0	0	0
Chironomidae	*Dicrotendipes tritomus*	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Chironomidae	*Eukiefferiella claripennis*	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0
Chironomidae	*Eukiefferiella endobryonia*	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chironomidae	*Heterotrissocladius changi*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Chironomidae	*Hydrobaenus johannseni*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0
Chironomidae	*Kiefferulus tainanus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Chironomidae	*Limnophyes natalensis*	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	1
Chironomidae	*Micropsectra nigripila*	1	1	1	0	0	0	1	0	0	0	0	0	0	1	0	1	1	0	1	0	0	1	1	1	1	1	1	1	1	0
Chironomidae	*Micropsectra polita*	1	1	0	0	0	1	0	0	0	0	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Chironomidae	*Micropsectra subletteorum*	1	0	1	0	1	1	0	0	0	0	1	1	1	1	0	0	1	1	1	0	1	1	1	0	0	0	0	1	1	0
Chironomidae	*Micropsectra xantha*	1	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	1	1	1
Chironomidae	*Microtendipes pedellus*	0	0	1	0	1	0	0	0	0	0	1	1	1	0	1	1	0	1	1	1	1	0	0	0	0	0	0	0	0	0
Chironomidae	*Nanocladius anderseni*	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chironomidae	*Nilotanypus fimbriatus*	0	0	1	0	1	1	0	0	0	0	1	1	1	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0
Chironomidae	*Orthocladius carlatus*	0	0	0	0	1	1	0	0	0	0	1	1	1	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
Chironomidae	*Orthocladius dorenus*	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0

Family	Scientific Name	S006	S009	S013	S014	S015	S016	S022	S029	S034	S038	S040	S042	S051	S056	S067	S072	S073	S074	S075	S076	S077	S093	S094	S095	S096	S099	S100	S101	S102	S108
Chironomidae	*Orthocladius oliveri*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chironomidae	*Pagastia orthogonia*	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	1	1	0
Chironomidae	*Paraphaenocladius impensus*	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0
Chironomidae	*Parochlus kiefferi*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Chironomidae	*Polypedilum aviceps*	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	1	0
Chironomidae	*Polypedilum convictum*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	0	1	0	0	0	0	1	0	0
Chironomidae	*Potthastia gaedii*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
Chironomidae	*Procladius denticulatus*	0	0	0	0	0	1	0	0	0	0	1	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Chironomidae	*Prodiamesa olivacea*	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Chironomidae	*Stempellinella fimbriata*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Chironomidae	*Tanytarsus glabrescens*	0	0	0	0	1	0	0	1	0	0	0	1	0	1	0	0	0	0	1	0	0	0	1	0	0	0	1	0	1	0
Chironomidae	*Tanytarsus guerlus*	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Chironomidae	*Tanytarsus mendax*	0	0	0	0	0	0	1	0	0	0	1	0	0	1	0	0	1	0	1	0	0	0	0	0	1	0	1	1	0	0
Chironomidae	*Thienemanniella xena*	1	0	1	1	1	0	1	1	1	0	1	1	1	0	1	1	0	1	1	1	1	1	1	1	0	0	1	1	1	1
Chironomidae	*Tvetenia paucunca*	1	1	1	1	0	1	1	1	0	1	1	1	0	0	0	0	1	1	0	1	1	1	1	1	0	0	0	1	1	1
Chironomidae	*Xenochironomus xenolabis*	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chloropidae	*Malloewia abdominalis*	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Culicidae	*Anopheles punctipennis*	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Drosophilidae	*Chymomyza amoena*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Drosophilidae	*Drosophila suzukii*	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0
Drosophilidae	*Drosophila tripunctata*	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Drosophilidae	*Scaptomyza flava*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Dryomyzidae	*Dryomyza anilis*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Ephydridae	*Hydrellia albilabris*	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Ephydridae	*Hydrellia notata*	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	1	0	0	0
Ephydridae	*Scatella stagnalis*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Fanniidae	*Fannia sociella*	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lauxaniidae	*Homoneura incerta*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Limoniidae	*Antocha saxicola*	0	0	0	1	0	1	1	0	0	1	0	0	1	1	1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Limoniidae	*Dicranomyia halterella*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Limoniidae	*Epiphragma fasciapenne*	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Limoniidae	*Euphylidorea luteola*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Limoniidae	*Hexatoma spinosa*	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Muscidae	*Coenosia tigrina*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Muscidae	*Hebecnema nigra*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Pediciidae	*Dicranota guerini*	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0
Pediciidae	*Tricyphona inconstans*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Phoridae	*Megaselia arcticae*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Pipunculidae	*Eudorylas minor*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Platystomatidae	*Rivellia steyskali*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Polleniidae	*Pollenia labialis*	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0
Psychodidae	*Psychoda phalaenoides*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0

Family	Scientific Name	S006	S009	S013	S014	S015	S016	S022	S029	S034	S038	S040	S042	S051	S056	S067	S072	S073	S074	S075	S076	S077	S093	S094	S095	S096	S099	S100	S101	S102	S108
Ptychopteridae	*Bittacomorpha clavipes*	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Ptychopteridae	*Ptychoptera quadrifasciata*	1	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0	1	0	0
Scathophagidae	*Scathophaga furcata*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Sciomyzidae	*Atrichomelina pubera*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Sciomyzidae	*Elgiva solicita*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Sciomyzidae	*Sepedon armipes*	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Sciomyzidae	*Tetanocera vicina*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0
Simuliidae	*Simulium tuberosum*	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0
Simuliidae	*Simulium venustum*	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Simuliidae	*Simulium vittatum*	0	0	0	0	1	1	0	0	0	0	1	1	1	1	0	0	0	1	1	1	1	0	0	1	0	0	0	0	0	0
Stratiomyidae	*Caloparyphus tetraspilus*	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Syrphidae	*Eristalis flavipes*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Syrphidae	*Lejops chrysostomus*	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tabanidae	*Chrysops ater*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0
Tabanidae	*Chrysops dawsoni*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Tachinidae	*Ptilodexia conjuncta*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Tephritidae	*Euaresta bella*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Tipulidae	*Tipula abdominalis*	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1	1	0	0	0	1	0
Tipulidae	*Tipula concava*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Tipulidae	*Tipula oropezoides*	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tipulidae	*Tipula sayi*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Tipulidae	*Tipula tephrocephala*	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0
Tipulidae	*Tipula tricolor*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Trichoceridae	*Trichocera bimacula*	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Order: Ephemeroptera																															
Baetidae	*Baetis brunneicolor*	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Baetidae	*Baetis intercalaris*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
Baetidae	*Baetis tricaudatus*	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Baetidae	*Procloeon rubropictum*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Baetidae	*Procloeon viridoculare*	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Caenidae	*Caenis latipennis*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Ephemeridae	*Hexagenia atrocaudata*	0	0	1	0	1	1	0	0	0	0	1	1	1	1	1	0	1	0	1	1	1	0	0	0	0	0	1	0	1	0
Ephemeridae	*Hexagenia limbata*	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0
Isonychiidae	*Isonychia bicolor*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Leptophlebiidae	*Leptophlebia cupida*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Leptophlebiidae	*Paraleptophlebia adoptiva*	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0
Order: Hemiptera																															
Belostomatidae	*Belostoma flumineum*	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Cicadellidae	*Erasmoneura vulnerata*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Cicadellidae	*Erythroneura elegans*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Cicadellidae	*Erythroneura tricincta*	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Corixidae	*Hesperocorixa atopodonta*	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Family	Scientific Name	S006	S009	S013	S014	S015	S016	S022	S029	S034	S038	S040	S042	S051	S056	S067	S072	S073	S074	S075	S076	S077	S093	S094	S095	S096	S099	S100	S101	S102	S108
Corixidae	*Palmacorixa buenoi*	0	0	1	0	0	0	0	0	0	0	1	0	0	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Nepidae	*Nepa apiculata*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Notonectidae	*Notonecta irrorata*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Pentatomidae	*Acrosternum hilare*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Pentatomidae	*Amaurochrous cinctipes*	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Pentatomidae	*Euschistus variolarius*	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0
Pleidae	*Neoplea striola*	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Rhopalidae	*Harmostes reflexulus*	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Order: Lepidoptera																															
Argyresthiidae	*Argyresthia thuiella*	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Erebidae	*Halysidota tessellaris*	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Erebidae	*Hyphantria cunea*	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Erebidae	*Lascoria ambigualis*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Erebidae	*Pyrrharctia isabella*	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Glyphipterigidae	*Diploschizia impigritella*	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lasiocampidae	*Malacosoma disstria*	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Order: Mecoptera																															
Meropeidae	*Merope tuber*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Order: Megaloptera																															
Corydalidae	*Chauliodes rastricornis*	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Corydalidae	*Nigronia serricornis*	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0
Sialidae	*Sialis joppa*	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0
Sialidae	*Sialis vagans*	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0
Sialidae	*Sialis velata*	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Order: Neuroptera																															
Hemerobiidae	*Micromus posticus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0
Order: Orthoptera																															
Rhaphidophoridae	*Ceuthophilus guttulosus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Order: Plecoptera																															
Capniidae	*Allocapnia recta*	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Capniidae	*Allocapnia vivipara*	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0
Capniidae	*Paracapnia angulata*	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nemouridae	*Amphinemura delosa*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Perlodidae	*Isoperla nana*	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	1	1	0	0	0	0	0
Taeniopterygidae	*Taeniopteryx nivalis*	0	0	1	0	1	0	1	0	0	0	0	0	1	0	0	1	1	0	1	1	0	0	1	0	1	0	0	0	0	0
Order: Psocoptera																															
Caeciliusidae	*Valenzuela flavidus*	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	1	0	0	0	0
Ectopsocidae	*Ectopsocus meridionalis*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Lepidopsocidae	*Echmepteryx hageni*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Psocidae	*Trichadenotecnum majus*	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Stenopsocidae	*Graphopsocus cruciatus*	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Order: Trichoptera																															

Family	Scientific Name	S006	S009	S013	S014	S015	S016	S022	S029	S034	S038	S040	S042	S051	S056	S067	S072	S073	S074	S075	S076	S077	S093	S094	S095	S096	S099	S100	S101	S102	S108
Goeridae	*Goera stylata*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0
Lepidostomatidae	*Lepidostoma bryanti*	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Lepidostomatidae	*Lepidostoma vernale*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Limnephilidae	*Hesperophylax consimilis*	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Limnephilidae	*Ironoquia punctatissima*	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0
Limnephilidae	*Platycentropus radiatus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	1	0	1	0	1	0	0	0
Limnephilidae	*Psychoglypha subborealis*	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Limnephilidae	*Pycnopsyche guttifera*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
Limnephilidae	*Pycnopsyche lepida*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Limnephilidae	*Pycnopsyche subfasciata*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Philopotamidae	*Dolophilodes distinctus*	1	0	0	0	1	0	1	0	1	0	1	1	1	1	1	1	0	1	0	0	1	1	1	1	1	0	0	0	1	1
Phryganeidae	*Agrypnia vestita*	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Class: Malacostraca																															
Order: Amphipoda																															
Hyalellidae	*Hyalella azteca*	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Order: Decapoda																															
Cambaridae	*Faxonius rusticus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Class: Ostracoda																															
Order: Podocopida																															
Cyprididae	*Cypridopsis vidua*	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Phylum: Mollusca																															
Class: Bivalvia																															
Order: Unionida																															
Unionidae	*Lasmigona compressa*	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table G-8. Fall 2022 detections of invertebrate species in watercourses outside of the AOI.

Family	Scientific Name	S001	S002	S003	S010	S011	S019[1]	S021	S026	S030	S031[1]	S033	S037	S044	S045	S046	S049	S055	S057	S058	S059	S061	S063	S065	S080	S081	S090	S112	S124[2]	S126
Phylum: Annelida																														
Class: Clitellata																														
Order: Crassiclitellata																														
Lumbricidae	*Aporrectodea limicola*	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lumbricidae	*Lumbricus rubellus*	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	1	0	0	0
Lumbricidae	*Lumbricus terrestris*	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lumbricidae	*Octolasion tyrtaeum*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Order: Enchytraeida																														
Enchytraeidae	*Cernosvitoviella minor*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Enchytraeidae	*Fridericia ratzeli*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Enchytraeidae	*Globulidrilus riparius*	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Enchytraeidae	*Henlea perpusilla*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Order: Haplotaxida																														
Naididae	*Aulodrilus pluriseta*	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	1
Naididae	*Branchiura sowerbyi*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	1	1	1	0	0	0	0	0	0	0
Naididae	*Dero vaga*	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Naididae	*Ilyodrilus templetoni*	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Naididae	*Nais bretscheri*	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Naididae	*Nais communis*	0	0	0	0	0	0	1	0	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Naididae	*Nais stolci*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1	0	1	0	0	0	0	0	0	0	0
Naididae	*Ophidonais serpentina*	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Naididae	*Slavina appendiculata*	1	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Naididae	*Vejdovskyella intermedia*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Order: Lumbriculida																														
Lumbriculidae	*Lumbriculus variegatus*	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Sparganophilidae	*Sparganophilus tamesis*	0	0	0	0	0	1	0	1	1	1	0	0	0	0	1	0	1	0	1	1	1	0	1	0	0	0	0	0	0
Order: Rhynchobdellida																														
Glossiphoniidae	*Placobdella parasitica*	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Phylum: Arthropoda																														
Class: Arachnida																														
Order: Ixodida																														
Ixodidae	*Haemaphysalis leporispalustris*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Class: Branchiopoda																														
Order: Diplostraca																														
Chydoridae	*Alona circumfimbriata*	0	0	0	0	0	0	0	1	1	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Daphniidae	*Ceriodaphnia dubia*	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Daphniidae	*Daphnia dentifera*	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Daphniidae	*Simocephalus serrulatus*	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eurycercidae	*Eurycercus longirostris*	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sididae	*Diaphanosoma brachyurum*	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Class: Collembola																														

Family	Scientific Name	S001	S002	S003	S010	S011	S019[1]	S021	S026	S030	S031[1]	S033	S037	S044	S045	S046	S049	S055	S057	S058	S059	S061	S063	S065	S080	S081	S090	S112	S124[2]	S126
Order: Entomobryomorpha																														
Isotomidae	*Folsomia candida*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Class: Insecta																														
Order: Coleoptera																														
Anthicidae	*Anthicus cervinus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Anthicidae	*Notoxus desertus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Anthicidae	*Omonadus floralis*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Carabidae	*Agonum gratiosum*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Carabidae	*Amara apricaria*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Carabidae	*Amara lunicollis*	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Carabidae	*Platynus cincticollis*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Carabidae	*Platynus decentis*	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Carabidae	*Pterostichus corvinus*	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
Carabidae	*Pterostichus melanarius*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Chrysomelidae	*Epitrix cucumeris*	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chrysomelidae	*Psylliodes picinus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Curculionidae	*Listronotus humilis*	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Curculionidae	*Sciaphilus asperatus*	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
Dytiscidae	*Ilybiosoma seriatum*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Dytiscidae	*Ilybius biguttulus*	1	0	0	0	0	1	0	1	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Dytiscidae	*Laccophilus maculosus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Dytiscidae	*Neoporus clypealis*	1	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	1	1	0	1	0	0	0	0	0	0	1
Dytiscidae	*Neoporus undulatus*	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elateridae	*Athous rufifrons*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Elmidae	*Dubiraphia vittata*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Elmidae	*Macronychus glabratus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Elmidae	*Optioservus fastiditus*	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Erotylidae	*Megalodacne fasciata*	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0
Gyrinidae	*Dineutus hornii*	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Haliplidae	*Haliplus immaculicollis*	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0
Hydrophilidae	*Enochrus ochraceus*	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydrophilidae	*Tropisternus natator*	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lampyridae	*Ellychnia corrusca*	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Lampyridae	*Pyropyga decipiens*	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Melandryidae	*Orchesia castanea*	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nitidulidae	*Carpophilus lugubris*	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Noteridae	*Hydrocanthus iricolor*	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Phalacridae	*Olibrus semistriatus*	0	0	0	0	0	0	0	1	1	1	1	0	1	0	1	0	0	0	1	0	1	1	0	1	1	1	0	0	1
Psephenidae	*Psephenus herricki*	0	0	1	0	0	0	0	0	0	1	1	0	0	0	0	1	1	0	0	1	0	0	0	1	0	0	0	0	0
Scarabaeidae	*Amphimallon majale*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Scarabaeidae	*Melinopterus prodromus*	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	0	0	0	0	0
Scirtidae	*Contacyphon fuscescens*	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Family	Scientific Name	S001	S002	S003	S010	S011	S019[1]	S021	S026	S030	S031[1]	S033	S037	S044	S045	S046	S049	S055	S057	S058	S059	S061	S063	S065	S080	S081	S090	S112	S124[2]	S126
Scirtidae	*Contacyphon obscurellus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0
Scirtidae	*Contacyphon obscurus*	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0
Scirtidae	*Exneria ruficollis*	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Scirtidae	*Prionocyphon limbatus*	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	0	0	0	0	0	0
Scirtidae	*Scirtes tibialis*	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Staphylinidae	*Gyrohypnus fracticornis*	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Staphylinidae	*Nehemitropia lividipennis*	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Staphylinidae	*Olophrum obtectum*	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Staphylinidae	*Platydracus cinnamopterus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Staphylinidae	*Tasgius melanarius*	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Order: Dermaptera																														
Forficulidae	*Forficula auricularia*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Order: Diptera																														
Agromyzidae	*Agromyza pseudoreptans*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0
Agromyzidae	*Nemorimyza posticata*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Agromyzidae	*Phytomyza loewii*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Agromyzidae	*Phytomyza nemopanthi*	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Anthomyiidae	*Hydrophoria lancifer*	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Anthomyzidae	*Anthomyza variegata*	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ceratopogonidae	*Culicoides haematopotus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Ceratopogonidae	*Culicoides mulrennani*	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Ceratopogonidae	*Culicoides stellifer*	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ceratopogonidae	*Dasyhelea turficola*	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ceratopogonidae	*Stilobezzia antennalis*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Chaoboridae	*Chaoborus albipes*	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0
Chaoboridae	*Chaoborus punctipennis*	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Chironomidae	*Ablabesmyia annulata*	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Chironomidae	*Brillia flavifrons*	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
Chironomidae	*Chironomus acidophilus*	0	0	0	1	1	0	0	0	0	0	0	1	0	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0
Chironomidae	*Chironomus bifurcatus*	0	0	0	0	0	0	0	0	1	1	0	1	1	0	1	0	0	1	0	0	0	1	0	0	0	1	0	1	0
Chironomidae	*Chironomus dilutus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Chironomidae	*Chironomus maturus*	0	1	1	0	1	0	1	0	1	0	0	1	0	0	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0
Chironomidae	*Chironomus melanescens*	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1	0	0	0	0	0	1	1	0	1	0	1	0	0	0
Chironomidae	*Conchapelopia telema*	1	0	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0
Chironomidae	*Corynoneura scutellata*	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Chironomidae	*Cricotopus annulator*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	1
Chironomidae	*Cricotopus bicinctus*	0	1	1	1	0	0	0	1	0	0	0	0	0	0	1	0	1	0	1	1	1	0	1	0	0	1	0	0	0
Chironomidae	*Cricotopus lebetis*	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0
Chironomidae	*Cricotopus sylvestris*	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chironomidae	*Cricotopus tremulus*	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Chironomidae	*Cricotopus triannulatus*	0	1	0	0	0	1	0	0	0	1	1	0	0	0	1	1	1	0	1	0	1	0	0	0	0	0	0	0	0
Chironomidae	*Cricotopus trifascia*	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0

Family	Scientific Name	S001	S002	S003	S010	S011	S019[1]	S021	S026	S030	S031[1]	S033	S037	S044	S045	S046	S049	S055	S057	S058	S059	S061	S063	S065	S080	S081	S090	S112	S124[2]	S126
Chironomidae	*Cricotopus tristis*	0	1	0	0	0	0	0	1	0	1	0	0	0	0	1	1	1	0	0	1	1	1	0	0	1	0	0	0	0
Chironomidae	*Cricotopus vierriensis*	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chironomidae	*Cryptochironomus digitatus*	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	1
Chironomidae	*Dicrotendipes modestus*	0	0	0	0	0	0	0	1	1	0	1	0	1	0	0	1	0	1	1	1	0	0	0	1	0	0	0	0	0
Chironomidae	*Dicrotendipes tritomus*	0	0	1	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	1	1	0
Chironomidae	*Eukiefferiella claripennis*	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chironomidae	*Eukiefferiella endobryonia*	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chironomidae	*Lauterborniella agrayloides*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Chironomidae	*Limnophyes natalensis*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Chironomidae	*Metriocnemus albolineatus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Chironomidae	*Micropsectra nigripila*	1	0	1	1	1	1	1	0	1	1	0	0	1	0	1	0	0	1	0	1	0	0	1	1	0	0	1	0	1
Chironomidae	*Micropsectra polita*	0	0	0	0	0	1	0	0	1	0	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Chironomidae	*Micropsectra subletteorum*	0	0	0	0	0	1	0	1	0	1	0	0	0	0	1	0	0	0	1	1	0	1	1	0	0	0	0	0	0
Chironomidae	*Micropsectra xantha*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Chironomidae	*Microtendipes pedellus*	0	1	1	0	0	1	0	0	0	0	1	0	0	1	1	1	1	0	1	1	1	0	0	0	1	1	0	0	1
Chironomidae	*Nanocladius anderseni*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Chironomidae	*Nilotanypus fimbriatus*	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0
Chironomidae	*Orthocladius carlatus*	0	1	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	1	0	1	0	0	0	0	0
Chironomidae	*Orthocladius dorenus*	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Chironomidae	*Orthocladius oliveri*	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Chironomidae	*Pagastia orthogonia*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
Chironomidae	*Parachironomus tenuicaudatus*	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chironomidae	*Paralauterborniella nigrohalteralis*	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	1	0	0	0	0	0
Chironomidae	*Paraphaenocladius impensus*	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Chironomidae	*Parochlus kiefferi*	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Chironomidae	*Polypedilum aviceps*	0	0	0	0	0	1	0	0	0	1	1	0	0	1	1	0	1	1	0	1	0	0	0	1	0	0	0	0	1
Chironomidae	*Polypedilum convictum*	0	1	0	0	0	1	0	1	1	1	0	0	0	0	1	0	0	1	1	1	1	1	0	1	0	0	0	0	1
Chironomidae	*Procladius denticulatus*	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Chironomidae	*Psectrocladius obvius*	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chironomidae	*Psectrocladius sordidellus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Chironomidae	*Rheocricotopus robacki*	0	1	1	0	0	0	0	0	0	1	1	1	0	0	1	1	1	0	1	1	1	0	1	0	0	1	0	0	0
Chironomidae	*Smittia edwardsi*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Chironomidae	*Stempellinella fimbriata*	1	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0	0	0	1	1	1	0	0	0
Chironomidae	*Tanytarsus glabrescens*	0	0	0	0	0	1	0	0	0	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
Chironomidae	*Tanytarsus mendax*	1	1	0	0	1	0	1	0	0	0	1	1	0	0	0	0	0	0	1	1	0	0	0	1	1	0	0	0	0
Chironomidae	*Tanytarsus wirthi*	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chironomidae	*Thienemanniella xena*	0	0	1	1	0	1	0	0	1	1	1	0	1	1	1	1	1	0	1	1	1	0	0	1	1	1	0	0	0
Chironomidae	*Tvetenia paucunca*	0	1	1	1	0	1	0	0	0	1	1	0	0	1	1	1	1	0	0	1	1	1	1	1	1	1	0	0	1
Chloropidae	*Chlorops cinerapennis*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Culicidae	*Anopheles punctipennis*	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Culicidae	*Uranotaenia sapphirina*	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dolichopodidae	*Achradocera arcuata*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0

Family	Scientific Name	S001	S002	S003	S010	S011	S019[1]	S021	S026	S030	S031[1]	S033	S037	S044	S045	S046	S049	S055	S057	S058	S059	S061	S063	S065	S080	S081	S090	S112	S124[2]	S126
Dolichopodidae	*Dolichopus albiciliatus*	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Drosophilidae	*Drosophila tripunctata*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Drosophilidae	*Scaptomyza montana*	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dryomyzidae	*Dryomyza anilis*	0	0	0	0	1	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ephydridae	*Hydrellia albilabris*	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ephydridae	*Hydrellia notata*	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0
Ephydridae	*Ilythea spilota*	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0
Ephydridae	*Notiphila adusta*	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ephydridae	*Notiphila pulchra*	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ephydridae	*Scatella tenuicosta*	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ephydridae	*Setacera micans*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Limoniidae	*Antocha saxicola*	0	1	1	0	0	1	0	0	0	1	1	0	0	0	1	1	1	0	1	0	1	0	1	0	1	1	0	0	1
Limoniidae	*Dicranomyia frontalis*	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Limoniidae	*Discobola annulata*	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Limoniidae	*Epiphragma fasciapenne*	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Limoniidae	*Erioptera caliptera*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Limoniidae	*Euphylidorea luteola*	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Limoniidae	*Helius flavipes*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Limoniidae	*Hexatoma spinosa*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Limoniidae	*Metalimnobia immatura*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Limoniidae	*Neolimnophila placida*	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Limoniidae	*Ormosia affinis*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0
Limoniidae	*Pilaria quadrata*	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Limoniidae	*Pseudolimnophila luteipennis*	1	0	0	1	1	0	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Limoniidae	*Symplecta cana*	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Muscidae	*Lispe albitarsis*	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Muscidae	*Stomoxys calcitrans*	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mycetophilidae	*Allodia angulata*	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mycetophilidae	*Allodia rindeni*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Pediciidae	*Dicranota guerini*	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Pipunculidae	*Pipunculus horvathi*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Platypezidae	*Calotarsa pallipes*	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Platystomatidae	*Rivellia steyskali*	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polleniidae	*Pollenia griseotomentosa*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Polleniidae	*Pollenia labialis*	0	1	1	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0
Psychodidae	*Psychoda phalaenoides*	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ptychopteridae	*Bittacomorpha clavipes*	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0
Ptychopteridae	*Ptychoptera quadrifasciata*	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0
Sarcophagidae	*Boettcheria latisterna*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Sciomyzidae	*Atrichomelina pubera*	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sciomyzidae	*Sepedon armipes*	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sciomyzidae	*Tetanocera annae*	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Family	Scientific Name	S001	S002	S003	S010	S011	S019[1]	S021	S026	S030	S031[1]	S033	S037	S044	S045	S046	S049	S055	S057	S058	S059	S061	S063	S065	S080	S081	S090	S112	S124[2]	S126
Sciomyzidae	*Tetanocera vicina*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0
Simuliidae	*Simulium decorum*	0	0	0	0	0	1	0	1	0	1	0	1	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0	0	0
Simuliidae	*Simulium tuberosum*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Simuliidae	*Simulium verecundum*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0
Simuliidae	*Simulium vittatum*	0	1	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
Sphaeroceridae	*Leptocera erythrocera*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sphaeroceridae	*Pullimosina pullula*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Stratiomyidae	*Stratiomys normula*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Syrphidae	*Chalcosyrphus nemorum*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Syrphidae	*Eristalis flavipes*	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Syrphidae	*Helophilus fasciatus*	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0
Syrphidae	*Lejops chrysostomus*	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Syrphidae	*Syrphus rectus*	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tabanidae	*Chrysops dawsoni*	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Tabanidae	*Chrysops indus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tabanidae	*Chrysops sackeni*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Tabanidae	*Chrysops vittatus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Tabanidae	*Tabanus similis*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Tipulidae	*Tipula abdominalis*	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	1	0	1	1	0	0	1	1	1	0	0	0
Tipulidae	*Tipula concava*	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tipulidae	*Tipula dejecta*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0
Tipulidae	*Tipula hermannia*	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tipulidae	*Tipula oropezoides*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Tipulidae	*Tipula sayi*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
Tipulidae	*Tipula tephrocephala*	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0
Tipulidae	*Tipula tricolor*	1	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Order: Ephemeroptera																														
Baetidae	*Baetis rusticans*	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Baetidae	*Baetis tricaudatus*	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0	1	1	1	0	1	0
Baetidae	*Procloeon rubropictum*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Baetidae	*Procloeon viridoculare*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Ephemeridae	*Hexagenia atrocaudata*	0	1	1	1	0	1	0	0	0	1	0	0	0	0	1	0	1	0	1	1	1	1	1	0	0	0	0	0	0
Ephemeridae	*Hexagenia limbata*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Heptageniidae	*Maccaffertium exiguum*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Heptageniidae	*Maccaffertium vicarium*	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Isonychiidae	*Isonychia bicolor*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Leptophlebiidae	*Leptophlebia cupida*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0
Leptophlebiidae	*Paraleptophlebia adoptiva*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0
Order: Hemiptera																														
Belostomatidae	*Belostoma flumineum*	0	0	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0
Cicadellidae	*Erasmoneura vulnerata*	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cicadellidae	*Erythroneura tricincta*	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Family	Scientific Name	S001	S002	S003	S010	S011	S019[1]	S021	S026	S030	S031[1]	S033	S037	S044	S045	S046	S049	S055	S057	S058	S059	S061	S063	S065	S080	S081	S090	S112	S124[2]	S126
Cicadellidae	*Typhlocyba hockingensis*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Corixidae	*Palmacorixa buenoi*	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0
Membracidae	*Glossonotus univittatus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Membracidae	*Telamona tristis*	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nepidae	*Nepa apiculata*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0	0
Pentatomidae	*Banasa calva*	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0
Pentatomidae	*Euschistus variolarius*	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pleidae	*Neoplea striola*	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Order: Lepidoptera																														
Erebidae	*Pyrrharctia isabella*	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Glyphipterigidae	*Diploschizia impigritella*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Hesperiidae	*Ancyloxypha numitor*	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Order: Megaloptera																														
Corydalidae	*Chauliodes rastricornis*	1	1	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Sialidae	*Sialis joppa*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	1
Sialidae	*Sialis vagans*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	1	0
Order: Neuroptera																														
Chrysopidae	*Chrysopa oculata*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Coniopterygidae	*Conwentzia pineticola*	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Hemerobiidae	*Micromus posticus*	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0
Sisyridae	*Climacia areolaris*	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Order: Plecoptera																														
Capniidae	*Allocapnia vivipara*	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0
Nemouridae	*Amphinemura delosa*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Nemouridae	*Soyedina vallicularia*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Perlodidae	*Isoperla nana*	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Taeniopterygidae	*Taeniopteryx nivalis*	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1	0	1	1	1	0	0	1	0	1	0	0	0
Order: Psocoptera																														
Caeciliusidae	*Valenzuela flavidus*	0	1	1	1	1	1	1	1	0	0	0	1	1	0	1	0	1	0	1	1	0	0	1	0	0	0	1	0	0
Ectopsocidae	*Ectopsocus meridionalis*	0	0	0	0	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Lepidopsocidae	*Echmepteryx hageni*	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Psocidae	*Trichadenotecnum majus*	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	1	0	0	1	1	0	0	0	0	0	1	0	0
Psocidae	*Trichadenotecnum slossonae*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Stenopsocidae	*Graphopsocus cruciatus*	1	0	0	0	0	1	1	1	0	0	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Order: Trichoptera																														
Goeridae	*Goera stylata*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Lepidostomatidae	*Lepidostoma vernale*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Limnephilidae	*Ironoquia punctatissima*	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0
Limnephilidae	*Limnephilus indivisus*	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Limnephilidae	*Limnephilus submonilifer*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Limnephilidae	*Nemotaulius hostilis*	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Limnephilidae	*Platycentropus radiatus*	1	0	0	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Family	Scientific Name	S001	S002	S003	S010	S011	S019[1]	S021	S026	S030	S031[1]	S033	S037	S044	S045	S046	S049	S055	S057	S058	S059	S061	S063	S065	S080	S081	S090	S112	S124[2]	S126
Limnephilidae	*Pycnopsyche guttifera*	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Limnephilidae	*Pycnopsyche subfasciata*	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Philopotamidae	*Dolophilodes distinctus*	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	1	1	0	0	0	0	0	0	0	1	1	0	0	0
Phryganeidae	*Agrypnia vestita*	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Uenoidae	*Neophylax oligius*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Class: Malacostraca																														
Order: Amphipoda																														
Hyalellidae	*Hyalella azteca*	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0
Order: Decapoda																														
Cambaridae	*Cambarus robustus*	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Cambaridae	*Orconectes immunis*	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cambaridae	*Orconectes propinquus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Class: Ostracoda																														
Order: Podocopida																														
Cyprididae	*Cypridopsis vidua*	1	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Phylum: Mollusca																														
Class: Gastropoda																														
Order: Littorinimorpha																														
Amnicolidae	*Amnicola limosus*	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Notes:
1. S019 and S031 are in the RSA_{AQU}.
2. S124 is outside of the RSA_{AQU}.

G.2.2 Waterbodies

Table G-9. Fall 2022 detections of invertebrate species in waterbodies in the AOI.

Family	Scientific Name	L006	P010
Phylum: Arthropoda			
Class: Branchiopoda			
Order: Diplostraca			
Eurycercidae	*Eurycercus longirostris*	1	0
Class: Insecta			
Order: Coleoptera			
Dytiscidae	*Hydrovatus pustulatus*	1	0
Haliplidae	*Haliplus leechi*	0	1
Phalacridae	*Olibrus semistriatus*	0	1
Scirtidae	*Scirtes tibialis*	1	0
Order: Diptera			
Bibionidae	*Bibio xanthopus*	1	0
Chironomidae	*Chironomus bifurcatus*	0	1
Chironomidae	*Corynoneura arctica*	1	0
Chironomidae	*Corynoneura scutellata*	1	0
Chironomidae	*Cryptochironomus digitatus*	1	0
Chironomidae	*Dicrotendipes tritomus*	0	1
Chironomidae	*Micropsectra subletteorum*	1	0
Chironomidae	*Tanytarsus glabrescens*	0	1
Chironomidae	*Tanytarsus mendax*	1	1
Dolichopodidae	*Pelastoneurus vagans*	0	1
Polleniidae	*Pollenia labialis*	0	1
Syrphidae	*Tropidia quadrata*	0	1
Tabanidae	*Chrysops indus*	0	1

Table G-10. Fall 2022 detections of invertebrate species in waterbodies outside of the AOI.

Family	Scientific Name	L001	L002	L003	L004	L005	L007	L010[1]	L011[1]	L012[1]	P005	P007	P008	P009	P015
Phylum: Annelida															
Class: Clitellata															
Order: Crassiclitellata															
Lumbricidae	*Lumbricus rubellus*	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Order: Haplotaxida															
Naididae	*Aulodrilus pluriseta*	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Naididae	*Chaetogaster diastrophus*	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Naididae	*Dero vaga*	0	0	0	0	1	0	0	0	0	0	1	0	0	0
Naididae	*Ilyodrilus templetoni*	0	1	0	0	0	0	0	0	1	0	0	0	0	0
Naididae	*Nais bretscheri*	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Naididae	*Nais communis*	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Naididae	*Rhyacodrilus falciformis*	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Naididae	*Slavina appendiculata*	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Order: Lumbriculida															
Sparganophilidae	*Sparganophilus tamesis*	0	0	0	0	0	0	1	0	1	0	0	0	0	0
Phylum: Arthropoda															
Class: Branchiopoda															
Order: Diplostraca															
Bosminidae	*Bosmina longirostris*	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Chydoridae	*Alona circumfimbriata*	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Chydoridae	*Graptoleberis testudinaria*	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Daphniidae	*Ceriodaphnia dubia*	1	1	0	0	0	1	0	0	0	0	0	0	0	0
Daphniidae	*Daphnia dentifera*	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Daphniidae	*Daphnia mendotae*	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Daphniidae	*Simocephalus serrulatus*	0	0	0	0	0	0	0	1	0	0	0	1	0	0
Eurycercidae	*Eurycercus longirostris*	0	1	0	0	0	0	0	1	0	0	0	0	0	0
Sididae	*Diaphanosoma brachyurum*	1	1	0	0	0	1	0	0	0	0	0	0	0	0
Class: Insecta															
Order: Coleoptera															
Carabidae	*Clivina fossor*	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Carabidae	*Pterostichus corvinus*	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Curculionidae	*Sciaphilus asperatus*	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Dytiscidae	*Acilius confusus*	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Dytiscidae	*Hygrotus nubilus*	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Dytiscidae	*Ilybius biguttulus*	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Dytiscidae	*Ilybius oblitus*	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Dytiscidae	*Laccophilus maculosus*	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Dytiscidae	*Neoporus undulatus*	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Elateridae	*Hemicrepidius memnonius*	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Elmidae	*Optioservus fastiditus*	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Gyrinidae	*Dineutus hornii*	0	0	1	0	0	0	0	0	0	0	0	0	0	0

Family	Scientific Name	L001	L002	L003	L004	L005	L007	L010[1]	L011[1]	L012[1]	P005	P007	P008	P009	P015
Haliplidae	*Haliplus immaculicollis*	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Haliplidae	*Haliplus leechi*	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Hydrophilidae	*Tropisternus mixtus*	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Phalacridae	*Olibrus semistriatus*	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Psephenidae	*Psephenus herricki*	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Scirtidae	*Contacyphon obscurus*	0	0	0	0	0	0	0	0	0	0	1	1	1	0
Scirtidae	*Prionocyphon limbatus*	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Scirtidae	*Scirtes tibialis*	0	0	0	0	0	0	0	0	0	0	0	1	1	1
Staphylinidae	*Nehemitropia lividipennis*	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Order: Diptera															
Agromyzidae	*Agromyza pseudoreptans*	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Agromyzidae	*Cerodontha longipennis*	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Chaoboridae	*Chaoborus albipes*	0	0	0	0	0	0	0	0	0	1	0	1	0	0
Chaoboridae	*Chaoborus punctipennis*	0	0	0	1	0	1	1	0	0	1	0	1	1	0
Chironomidae	*Chironomus acidophilus*	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Chironomidae	*Chironomus atrella*	0	0	0	0	0	0	0	0	0	0	0	1	1	1
Chironomidae	*Chironomus bifurcatus*	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Chironomidae	*Chironomus dilutus*	1	0	0	0	0	0	0	0	0	0	0	1	0	1
Chironomidae	*Chironomus entis*	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Chironomidae	*Chironomus maturus*	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Chironomidae	*Conchapelopia telema*	0	0	1	0	0	0	0	0	1	0	0	0	0	0
Chironomidae	*Corynoneura arctica*	0	0	0	0	0	0	1	1	0	0	0	0	0	1
Chironomidae	*Corynoneura scutellata*	0	1	0	0	0	0	0	0	0	0	0	1	0	1
Chironomidae	*Cricotopus sylvestris*	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Chironomidae	*Cricotopus triannulatus*	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Chironomidae	*Cricotopus trifascia*	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Chironomidae	*Cryptochironomus digitatus*	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Chironomidae	*Dicrotendipes modestus*	0	1	1	1	0	0	0	0	1	0	1	0	0	0
Chironomidae	*Dicrotendipes tritomus*	1	1	0	1	1	1	1	0	1	0	1	1	1	1
Chironomidae	*Eukiefferiella endobryonia*	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Chironomidae	*Glyptotendipes lobiferus*	1	0	0	0	0	0	1	0	0	0	0	0	0	0
Chironomidae	*Lauterborniella agrayloides*	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Chironomidae	*Micropsectra nigripila*	1	0	0	0	0	0	0	0	1	0	0	0	0	1
Chironomidae	*Micropsectra subletteorum*	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Chironomidae	*Microtendipes pedellus*	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Chironomidae	*Orthocladius carlatus*	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Chironomidae	*Orthocladius smolandicus*	0	1	0	0	1	0	1	0	0	0	0	1	1	0
Chironomidae	*Parachironomus tenuicaudatus*	0	1	0	0	0	0	0	0	0	0	0	1	1	1
Chironomidae	*Paraphaenocladius impensus*	0	0	0	0	0	0	0	0	0	1	1	0	0	0
Chironomidae	*Polypedilum convictum*	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Chironomidae	*Procladius denticulatus*	0	1	0	0	0	0	0	0	0	0	1	0	0	0
Chironomidae	*Psectrocladius obvius*	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Chironomidae	*Psectrocladius sordidellus*	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Chironomidae	*Rheocricotopus robacki*	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Chironomidae	*Smittia edwardsi*	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Chironomidae	*Tanytarsus glabrescens*	0	0	0	0	1	0	0	1	0	0	0	0	0	0
Chironomidae	*Tanytarsus mendax*	1	0	1	1	1	0	0	1	0	0	1	1	1	1
Chironomidae	*Thienemanniella xena*	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Chironomidae	*Xenochironomus xenolabis*	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Culicidae	*Anopheles punctipennis*	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Drosophilidae	*Drosophila funebris*	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Ephydridae	*Hydrellia albilabris*	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Ephydridae	*Notiphila olivacea*	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Ephydridae	*Notiphila pulchra*	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Limoniidae	*Antocha saxicola*	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Limoniidae	*Dicranomyia frontalis*	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Limoniidae	*Discobola annulata*	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Limoniidae	*Epiphragma fasciapenne*	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Limoniidae	*Erioptera caliptera*	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Limoniidae	*Pseudolimnophila luteipennis*	1	0	0	0	0	0	0	0	0	0	1	1	0	1
Muscidae	*Coenosia tigrina*	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Polleniidae	*Pollenia labialis*	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Simuliidae	*Simulium decorum*	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Sphaeroceridae	*Copromyza neglecta*	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Syrphidae	*Lejops curvipes*	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Tabanidae	*Chrysops ater*	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Tabanidae	*Hybomitra lasiophthalma*	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Tachinidae	*Ptilodexia conjuncta*	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Tipulidae	*Tipula oleracea*	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Tipulidae	*Tipula sayi*	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Tipulidae	*Tipula tephrocephala*	0	0	0	0	0	0	0	0	0	0	1	0	0	0

Family	Scientific Name	L001	L002	L003	L004	L005	L007	L010[1]	L011[1]	L012[1]	P005	P007	P008	P009	P015
Order: Ephemeroptera															
Caenidae	*Caenis diminuta*	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Ephemerellidae	*Eurylophella lutulenta*	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Ephemeridae	*Hexagenia atrocaudata*	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Order: Hemiptera															
Corixidae	*Palmacorixa buenoi*	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Pleidae	*Neoplea striola*	0	0	0	0	1	0	0	0	0	0	0	1	0	0
Order: Lepidoptera															
Crambidae	*Parapoynx maculalis*	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Geometridae	*Protoboarmia porcelaria*	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Order: Megaloptera															
Sialidae	*Sialis vagans*	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Order: Neuroptera															
Chrysopidae	*Meleoma signoretii*	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Order: Plecoptera															
Capniidae	*Allocapnia vivipara*	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Order: Psocoptera															
Caeciliusidae	*Valenzuela burmeisteri*	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Caeciliusidae	*Valenzuela flavidus*	1	0	0	0	0	0	1	0	1	0	0	0	0	1
Stenopsocidae	*Graphopsocus cruciatus*	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Order: Trichoptera															
Leptoceridae	*Leptocerus americanus*	1	1	0	1	0	0	0	0	0	0	0	0	0	0
Limnephilidae	*Glyphopsyche irrorata*	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Limnephilidae	*Nemotaulius hostilis*	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Uenoidae	*Neophylax oligius*	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Class: Malacostraca															
Order: Amphipoda															
Hyalellidae	*Hyalella azteca*	0	1	0	0	0	0	0	0	1	0	0	0	0	0
Order: Decapoda															
Cambaridae	*Orconectes propinquus*	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Class: Ostracoda															
Order: Podocopida															
Cyprididae	*Cypridopsis vidua*	0	1	1	0	1	0	0	0	1	0	1	1	0	0
Phylum: Rotifera															
Class: Eurotatoria															
Order: Ploima															
Synchaetidae	*Polyarthra vulgaris*	0	0	0	0	1	0	0	0	0	0	0	0	0	0

Notes:

1. L010 and L011 are outside of the RSA_{AQU}.
2. L012 is in the RSA_{AQU}.

G.2.3 Wetlands

Table G-11. Fall 2022 detections of invertebrate species in wetlands in the AOI.

Family	Scientific Name	W127 marsh	W132 marsh	W139 swamp
Phylum: Annelida				
Class: Clitellata				
Order: Haplotaxida				
Naididae	*Slavina appendiculata*	0	1	0
Phylum: Arthropoda				
Class: Branchiopoda				
Order: Diplostraca				
Bosminidae	*Bosmina longirostris*	0	1	0
Chydoridae	*Alona circumfimbriata*	0	1	0
Class: Insecta				
Order: Coleoptera				
Carabidae	*Agonum placidum*	0	0	1
Curculionidae	*Sciaphilus asperatus*	0	0	1
Dytiscidae	*Acilius confusus*	0	1	0
Dytiscidae	*Hydrovatus pustulatus*	0	1	0
Dytiscidae	*Ilybiosoma seriatum*	0	0	1
Dytiscidae	*Ilybius biguttulus*	0	1	0
Dytiscidae	*Neoporus clypealis*	1	0	0
Haliplidae	*Haliplus immaculicollis*	0	1	0
Scirtidae	*Contacyphon obscurus*	0	1	0
Scirtidae	*Scirtes tibialis*	0	1	0
Order: Diptera				
Anthomyzidae	*Anthomyza dichroa*	0	0	1
Ceratopogonidae	*Culicoides venustus*	0	1	0
Chironomidae	*Conchapelopia telema*	0	0	1
Chironomidae	*Corynoneura scutellata*	1	0	0
Chironomidae	*Glyptotendipes glaucus*	0	1	0
Chironomidae	*Micropsectra subletteorum*	0	0	1
Chironomidae	*Micropsectra xantha*	0	0	1
Chironomidae	*Microtendipes pedellus*	1	0	0
Chironomidae	*Prodiamesa olivacea*	0	0	1
Chironomidae	*Tanytarsus glabrescens*	0	1	0
Chironomidae	*Tanytarsus mendax*	0	1	0
Ephydridae	*Hydrellia albilabris*	1	1	0
Limoniidae	*Helius flavipes*	0	1	0
Limoniidae	*Pseudolimnophila inornata*	0	1	0
Limoniidae	*Pseudolimnophila luteipennis*	1	1	0
Psychodidae	*Psychoda alternata*	0	1	0
Sciomyzidae	*Elgiva solicita*	0	1	0
Sciomyzidae	*Sepedon armipes*	0	1	0
Sciomyzidae	*Tetanocera annae*	1	1	0
Sphaeroceridae	*Copromyza neglecta*	0	1	0
Tabanidae	*Tabanus atratus*	1	0	0
Tabanidae	*Tabanus superjumentarius*	0	1	0
Tipulidae	*Tipula oropezoides*	0	0	1
Tipulidae	*Tipula tephrocephala*	0	0	1
Order: Ephemeroptera				
Caenidae	*Caenis diminuta*	0	1	0
Order: Hemiptera				
Pleidae	*Neoplea striola*	0	1	0

Family	Scientific Name	W127 marsh	W132 marsh	W139 swamp
Order: Orthoptera				
Gryllidae	*Eunemobius carolinus*	0	1	0
Order: Plecoptera				
Perlodidae	*Isoperla nana*	0	0	1
Order: Trichoptera				
Limnephilidae	*Platycentropus radiatus*	0	1	0
Class: Ostracoda				
Order: Podocopida				
Cyprididae	*Cypridopsis vidua*	0	1	0

Table G-12. Fall 2022 detections of invertebrate species in wetlands outside of the AOI.

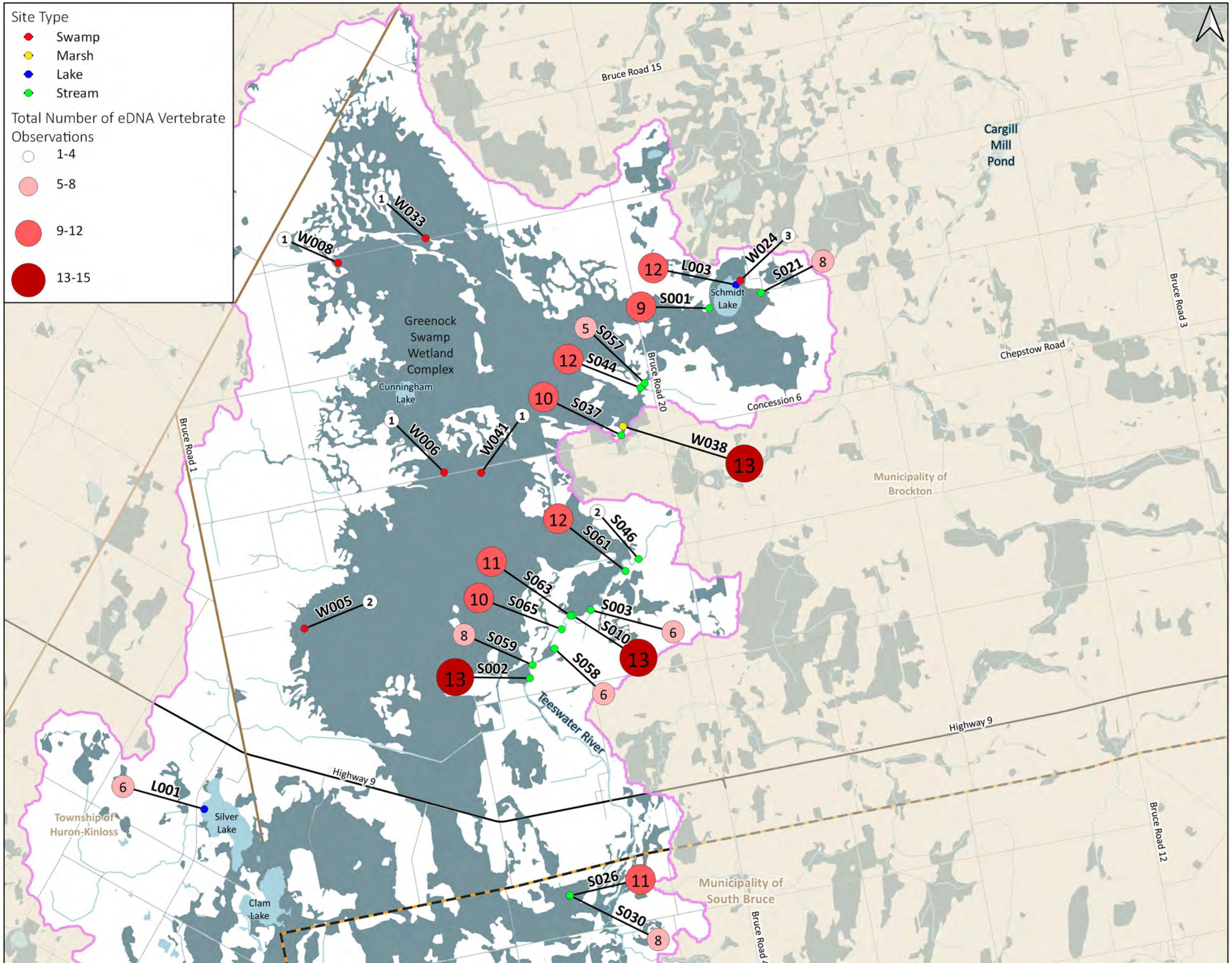
Family	Scientific Name	S113 swamp	W005 swamp	W006 swamp	W008 swamp	W009 swamp	W018 swamp	W033 swamp	W041 swamp	W061 marsh	W064 marsh	W067 marsh
Phylum: Annelida												
Class: Clitellata												
Order: Crassiclitellata												
Lumbricidae	*Dendrobaena octaedra*	0	0	1	0	0	0	0	1	0	0	0
Lumbricidae	*Lumbricus terrestris*	0	0	0	1	0	0	0	0	0	0	0
Lumbricidae	*Octolasion tyrtaeum*	0	0	0	0	0	0	0	0	0	0	1
Order: Enchytraeida												
Enchytraeidae	*Cernosvitoviella minor*	0	0	1	0	1	1	0	1	0	0	0
Enchytraeidae	*Globulidrilus riparius*	0	1	0	0	0	0	0	0	1	0	0
Enchytraeidae	*Henlea perpusilla*	0	1	0	0	0	0	0	0	0	0	0
Order: Haplotaxida												
Naididae	*Aulodrilus pluriseta*	0	0	0	0	0	0	0	0	0	0	1
Naididae	*Branchiura sowerbyi*	0	0	0	0	0	0	0	0	1	0	0
Naididae	*Nais communis*	1	0	1	0	1	1	0	0	0	0	1
Naididae	*Nais stolci*	0	0	0	0	0	0	0	0	1	0	0
Phylum: Arthropoda												
Class: Insecta												
Order: Coleoptera												
Carabidae	*Clivina fossor*	0	0	0	0	0	0	0	0	1	0	0
Carabidae	*Elaphrus clairvillei*	0	1	0	0	0	0	0	0	0	0	0
Chrysomelidae	*Longitarsus suspectus*	0	0	0	0	0	0	0	0	1	0	0
Corylophidae	*Orthoperus scutellaris*	0	0	0	0	0	1	0	0	0	0	0
Curculionidae	*Sciaphilus asperatus*	0	0	0	0	0	0	0	0	1	0	1
Dytiscidae	*Hydrocolus persimilis*	0	0	1	0	0	0	0	0	0	0	0
Dytiscidae	*Ilybiosoma seriatum*	0	0	0	1	0	0	0	0	0	0	0
Dytiscidae	*Ilybius biguttulus*	0	0	1	0	1	0	1	0	0	1	1
Dytiscidae	*Neoporus clypealis*	0	0	1	0	0	0	0	0	0	0	0
Dytiscidae	*Neoporus undulatus*	0	0	0	0	0	0	1	0	0	0	0
Elateridae	*Athous rufifrons*	0	0	1	0	0	0	0	0	0	0	0
Elmidae	*Optioservus fastiditus*	0	0	0	0	0	0	0	0	0	0	1
Elmidae	*Stenelmis crenata*	0	0	0	0	0	0	0	0	1	0	0
Hydrophilidae	*Hydrobius fuscipes*	0	0	1	0	1	0	0	0	0	0	0
Phalacridae	*Olibrus semistriatus*	0	0	0	0	0	0	0	0	1	0	0
Psephenidae	*Psephenus herricki*	0	0	0	0	0	0	0	0	1	0	0
Scarabaeidae	*Melinopterus prodromus*	0	0	1	0	0	0	0	1	0	0	0
Scirtidae	*Contacyphon obscurus*	0	1	1	1	1	1	1	1	0	0	0
Scirtidae	*Prionocyphon limbatus*	0	0	0	1	0	0	1	0	0	0	0
Staphylinidae	*Erichsonius nanus*	0	0	1	0	0	0	0	0	0	0	0
Staphylinidae	*Lathrobium simplex*	0	0	0	1	0	0	0	0	0	0	0

Family	Scientific Name	S113 swamp	W005 swamp	W006 swamp	W008 swamp	W009 swamp	W018 swamp	W033 swamp	W041 swamp	W061 marsh	W064 marsh	W067 marsh
Staphylinidae	*Myllaena arcana*	0	0	0	0	0	1	0	0	0	0	0
Staphylinidae	*Olophrum obtectum*	0	0	0	0	0	0	0	0	0	1	0
Staphylinidae	*Philonthus lomatus*	0	0	1	0	0	0	0	0	0	0	0
Staphylinidae	*Philonthus monaeses*	0	0	0	1	0	0	0	0	0	0	0
Staphylinidae	*Tachinus limbatus*	0	0	0	0	0	0	0	0	1	0	0
Tenebrionidae	*Isomira quadristriata*	0	0	0	1	0	0	0	0	0	0	0
Order: Diptera												
Agromyzidae	*Nemorimyza posticata*	0	0	0	0	0	0	0	0	1	0	0
Anthomyzidae	*Anthomyza dichroa*	0	0	0	1	0	0	0	0	0	0	0
Ceratopogonidae	*Culicoides haematopotus*	0	0	0	0	0	0	0	0	1	0	0
Ceratopogonidae	*Culicoides mulrennani*	0	1	0	0	0	0	0	0	0	0	0
Ceratopogonidae	*Dasyhelea turficola*	0	0	0	0	0	0	0	0	1	0	0
Chironomidae	*Bryophaenocladius ictericus*	0	0	0	0	0	0	0	1	0	0	0
Chironomidae	*Chironomus acidophilus*	0	0	0	1	0	0	1	0	0	0	0
Chironomidae	*Chironomus lugubris*	0	0	0	0	0	1	0	0	0	0	0
Chironomidae	*Chironomus maturus*	1	0	0	0	0	0	0	0	0	0	1
Chironomidae	*Chironomus melanescens*	0	1	0	0	0	0	0	0	0	0	0
Chironomidae	*Cladopelma edwardsi*	0	0	0	0	0	0	0	0	1	0	0
Chironomidae	*Cladopelma galeator*	0	0	0	0	0	0	0	0	1	0	0
Chironomidae	*Conchapelopia telema*	0	0	0	0	0	0	0	0	1	0	1
Chironomidae	*Corynoneura scutellata*	0	0	0	0	1	0	1	0	1	1	0
Chironomidae	*Cricotopus annulator*	0	0	0	0	0	0	0	0	1	0	0
Chironomidae	*Cricotopus bicinctus*	0	0	0	0	0	0	0	0	1	0	0
Chironomidae	*Cricotopus triannulatus*	0	0	0	0	0	0	0	0	1	0	0
Chironomidae	*Cricotopus tristis*	0	0	0	0	0	0	0	0	1	0	1
Chironomidae	*Dicrotendipes modestus*	0	0	0	0	0	0	0	0	1	0	1
Chironomidae	*Dicrotendipes tritomus*	0	0	0	0	0	0	1	0	0	0	0
Chironomidae	*Lauterborniella agrayloides*	0	0	0	1	0	0	0	0	0	0	0
Chironomidae	*Limnophyes asquamatus*	0	0	0	1	0	0	0	0	0	0	0
Chironomidae	*Limnophyes minimus*	0	0	1	1	0	0	0	1	0	0	0
Chironomidae	*Limnophyes natalensis*	0	0	0	0	1	0	0	0	0	0	0
Chironomidae	*Micropsectra nigripila*	0	0	0	0	1	0	1	0	1	0	1
Chironomidae	*Micropsectra polita*	0	0	0	0	0	0	0	0	1	1	0
Chironomidae	*Micropsectra subletteorum*	0	0	1	1	0	0	0	0	0	0	0
Chironomidae	*Micropsectra xantha*	0	0	0	1	0	0	0	0	1	1	1
Chironomidae	*Microtendipes pedellus*	0	0	0	0	0	0	0	0	1	0	0
Chironomidae	*Nilotanypus fimbriatus*	0	0	0	0	0	0	0	0	0	1	0
Chironomidae	*Pagastia orthogonia*	0	0	0	0	0	0	0	0	1	0	0
Chironomidae	*Paraphaenocladius impensus*	0	1	1	0	1	1	0	0	1	0	0
Chironomidae	*Parochlus kiefferi*	0	0	1	0	0	0	0	0	1	0	0
Chironomidae	*Polypedilum aviceps*	0	0	0	0	0	0	0	0	1	0	0
Chironomidae	*Polypedilum convictum*	0	0	0	0	0	0	0	0	1	0	0
Chironomidae	*Prodiamesa olivacea*	0	0	0	1	0	0	0	0	0	0	0
Chironomidae	*Rheocricotopus robacki*	0	0	0	0	0	0	0	0	0	0	1
Chironomidae	*Stempellinella fimbriata*	0	0	0	0	1	0	0	0	1	0	1
Chironomidae	*Tanytarsus glabrescens*	0	0	0	0	0	0	0	0	0	0	1
Chironomidae	*Thienemanniella xena*	0	0	0	0	1	0	0	0	1	0	1
Chironomidae	*Tvetenia paucunca*	0	0	0	0	0	0	0	0	1	1	1
Chironomidae	*Xenochironomus xenolabis*	0	0	0	0	0	0	0	0	0	0	1
Culicidae	*Anopheles punctipennis*	0	0	0	1	0	0	0	0	0	0	0
Culicidae	*Culex territans*	0	0	0	1	0	0	0	0	0	0	0

Family	Scientific Name	S113 swamp	W005 swamp	W006 swamp	W008 swamp	W009 swamp	W018 swamp	W033 swamp	W041 swamp	W061 marsh	W064 marsh	W067 marsh
Culicidae	*Ochlerotatus thibaulti*	0	0	0	0	0	1	0	0	0	0	0
Dolichopodidae	*Dolichopus albiciliatus*	0	0	1	0	1	1	0	1	0	0	0
Dolichopodidae	*Gymnopternus lividifrons*	0	0	0	0	0	0	0	1	0	0	0
Dryomyzidae	*Dryomyza anilis*	0	0	0	0	0	0	0	0	1	0	0
Ephydridae	*Hydrellia albilabris*	0	0	0	1	1	0	0	0	0	0	0
Ephydridae	*Hydrellia notata*	0	0	0	0	0	0	0	0	1	0	0
Fanniidae	*Fannia falcata*	0	0	1	0	0	0	0	0	0	0	0
Fanniidae	*Fannia sociella*	0	0	1	1	0	0	0	0	1	0	0
Heleomyzidae	*Suillia laevis*	0	0	1	0	0	0	0	0	0	0	0
Lauxaniidae	*Poecilominettia puncticeps*	0	0	1	0	1	0	0	0	0	0	0
Limoniidae	*Antocha saxicola*	0	0	0	0	0	0	0	0	1	0	0
Limoniidae	*Discobola annulata*	0	1	1	0	0	1	0	0	0	0	0
Limoniidae	*Epiphragma fasciapenne*	0	1	1	0	0	0	0	0	0	0	0
Limoniidae	*Erioptera ebenina*	0	0	0	1	0	0	0	0	0	0	0
Limoniidae	*Euphylidorea luteola*	0	0	0	0	1	0	0	0	0	0	0
Limoniidae	*Helius flavipes*	0	0	1	1	1	0	0	0	0	0	0
Limoniidae	*Hexatoma spinosa*	0	0	0	0	0	0	0	0	1	0	0
Limoniidae	*Molophilus hirtipennis*	0	0	1	0	0	0	0	0	0	0	0
Limoniidae	*Pseudolimnophila luteipennis*	0	0	0	1	1	1	1	0	0	0	0
Muscidae	*Lispe albitarsis*	0	0	0	0	1	0	0	0	0	0	0
Muscidae	*Neodexiopsis rufitibia*	0	0	0	0	0	1	0	0	0	0	0
Mycetophilidae	*Exechia nigroscutellata*	0	0	1	0	0	0	0	0	0	0	0
Mycetophilidae	*Mycomya pulchella*	0	0	1	0	0	0	0	0	0	0	0
Pediciidae	*Dicranota guerini*	0	0	0	0	0	0	0	0	0	0	1
Periscelididae	*Cyamops nebulosus*	0	0	0	0	1	0	0	0	0	0	0
Psychodidae	*Psychoda phalaenoides*	0	1	0	1	0	0	0	0	0	0	0
Ptychopteridae	*Bittacomorpha clavipes*	0	0	1	0	1	0	0	0	0	1	1
Ptychopteridae	*Ptychoptera quadrifasciata*	0	0	0	0	0	0	0	0	0	0	1
Rhagionidae	*Chrysopilus quadratus*	0	1	0	0	0	0	0	0	0	0	0
Sciomyzidae	*Sepedon armipes*	0	0	0	0	0	0	0	0	1	0	0
Sciomyzidae	*Tetanocera annae*	0	0	1	0	1	0	0	0	0	0	0
Sphaeroceridae	*Copromyza neglecta*	0	0	0	0	0	0	0	0	1	0	0
Syrphidae	*Chalcosyrphus nemorum*	0	0	0	0	1	0	0	0	0	0	0
Syrphidae	*Eristalis anthophorina*	0	0	0	0	0	0	0	0	1	0	0
Syrphidae	*Helophilus fasciatus*	0	0	0	0	0	1	0	0	0	0	0
Tabanidae	*Chrysops calvus*	0	0	0	0	0	0	0	0	0	1	0
Tephritidae	*Campiglossa albiceps*	0	0	0	0	0	0	0	0	0	0	1
Tipulidae	*Tipula abdominalis*	0	0	0	0	1	0	0	0	1	1	0
Tipulidae	*Tipula sayi*	0	1	1	0	1	0	0	1	0	0	0
Tipulidae	*Tipula senega*	0	0	0	0	0	0	0	1	0	0	0
Tipulidae	*Tipula tephrocephala*	0	0	1	1	0	0	0	0	0	0	0
Tipulidae	*Tipula tricolor*	0	0	0	0	1	0	0	0	0	1	0
Order: Ephemeroptera												
Caenidae	*Caenis diminuta*	0	0	0	0	0	0	1	0	0	0	0
Ephemeridae	*Hexagenia atrocaudata*	0	0	0	0	0	0	0	0	1	0	0
Leptophlebiidae	*Paraleptophlebia adoptiva*	0	0	0	0	0	0	0	0	0	1	0
Order: Hemiptera												
Belostomatidae	*Belostoma flumineum*	0	0	0	0	0	0	0	0	1	0	0
Cicadellidae	*Typhlocyba hockingensis*	0	0	1	1	0	1	0	0	0	0	0
Pentatomidae	*Euschistus variolarius*	0	0	1	0	0	0	0	0	0	0	0
Order: Lepidoptera												

Family	Scientific Name	S113 swamp	W005 swamp	W006 swamp	W008 swamp	W009 swamp	W018 swamp	W033 swamp	W041 swamp	W061 marsh	W064 marsh	W067 marsh
Erebidae	*Palthis angulalis*	0	0	0	0	1	0	0	0	0	0	0
Erebidae	*Pyrrharctia isabella*	0	0	0	0	0	0	0	0	1	0	0
Tortricidae	*Argyrotaenia velutinana*	0	0	0	0	0	0	0	0	1	0	0
Tortricidae	*Epinotia lindana*	0	0	0	1	0	0	0	0	0	0	0
Order: Megaloptera												
Corydalidae	*Chauliodes rastricornis*	0	1	1	1	1	0	1	0	0	0	0
Corydalidae	*Nigronia serricornis*	0	0	0	0	0	0	0	0	0	0	1
Sialidae	*Sialis vagans*	0	0	0	0	0	0	0	0	1	0	0
Order: Neuroptera												
Coniopterygidae	*Conwentzia pineticola*	0	0	0	1	0	0	0	0	0	0	0
Hemerobiidae	*Micromus posticus*	0	0	0	0	0	1	0	0	1	0	0
Order: Plecoptera												
Capniidae	*Paracapnia angulata*	0	0	0	0	0	0	0	0	1	0	0
Nemouridae	*Soyedina vallicularia*	0	0	0	0	0	0	0	0	0	0	1
Order: Psocoptera												
Caeciliusidae	*Valenzuela flavidus*	0	0	1	1	1	1	0	1	0	0	1
Ectopsocidae	*Ectopsocus meridionalis*	0	0	1	1	1	1	0	1	0	0	0
Lepidopsocidae	*Echmepteryx hageni*	0	0	0	1	0	0	0	0	0	0	0
Psocidae	*Trichadenotecnum majus*	0	1	1	1	0	0	0	1	0	0	0
Stenopsocidae	*Graphopsocus cruciatus*	0	1	1	1	0	0	0	0	0	0	0
Order: Trichoptera												
Lepidostomatidae	*Lepidostoma vernale*	0	0	0	0	0	0	0	0	0	0	1
Limnephilidae	*Limnephilus indivisus*	0	1	0	0	1	1	0	0	0	0	0
Limnephilidae	*Limnephilus ornatus*	0	0	0	0	0	0	0	0	0	1	1
Limnephilidae	*Platycentropus radiatus*	0	0	0	0	1	0	1	0	1	1	1
Class: Malacostraca												
Order: Decapoda												
Cambaridae	*Orconectes immunis*	0	0	0	0	0	0	0	0	0	1	0
Class: Ostracoda												
Order: Podocopida												
Cyprididae	*Cypridopsis vidua*	1	1	0	0	0	0	1	0	1	1	0

APPENDIX H – VERTEBRATE SPECIES DETECTIONS IN SUMMER AND FALL



NWMO Biodiversity Impact Studies

Total Summer Vertebrate Results - North LSA_{AQU}

Figure H-1a

- Area of Interest (AOI)
- Local Study Area (LSA_{TER})
- Local Study Area (LSA_{AQU})
- Lake
- Wetland
- Watercourse
- Highway
- Local Road
- South Bruce Boundary
- Municipal Boundary

The number inside the observation symbols represents the count of detected species at that given site

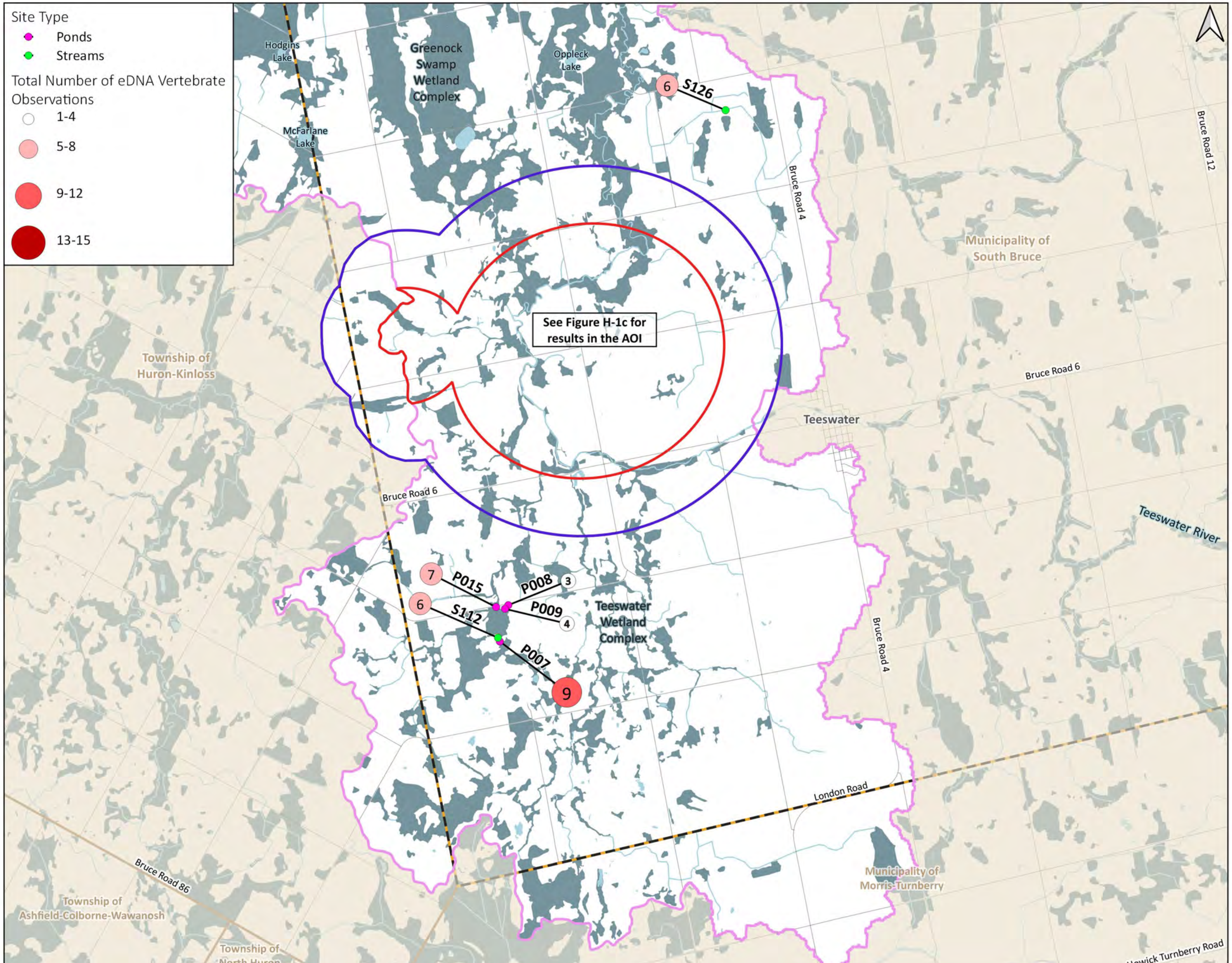
1:65,000

0 1 2 km

ZOETICA

Data received from:
Ontario GeoHub — OHN Waterbody (MNRF); OHN Watercourse (MNRF); MNRF Road Segments (MNRF); Municipal Boundary - Lower and Single Tier (MMAH); Wetlands (MNRF)
NWMO — AOI; 2022 SB eDNA Rev. B (NSC)
Wetlands and water features are mapped using ecosite data within the LSA_{ECO} and data available from Ontario GeoHub outside the LSA_{ECO}.

Project CRS: NAD83 / UTM zone 17N		
Author: AH	Reviewed by: CW	Approved by: HB
December 12, 2023	Map ID: NWMO_BIS_A102a	



NWMO Biodiversity Impact Studies

Total Summer Vertebrate Results - South LSA_{AQU}

Figure H-1b

- Area of Interest (AOI)
- Local Study Area (LSA_{TER})
- Local Study Area (LSA_{AQU})
- Lake
- Wetland
- Watercourse
- Highway
- Local Road
- South Bruce Boundary
- Municipal Boundary

The number inside the observation symbols represents the count of detected species at that given site

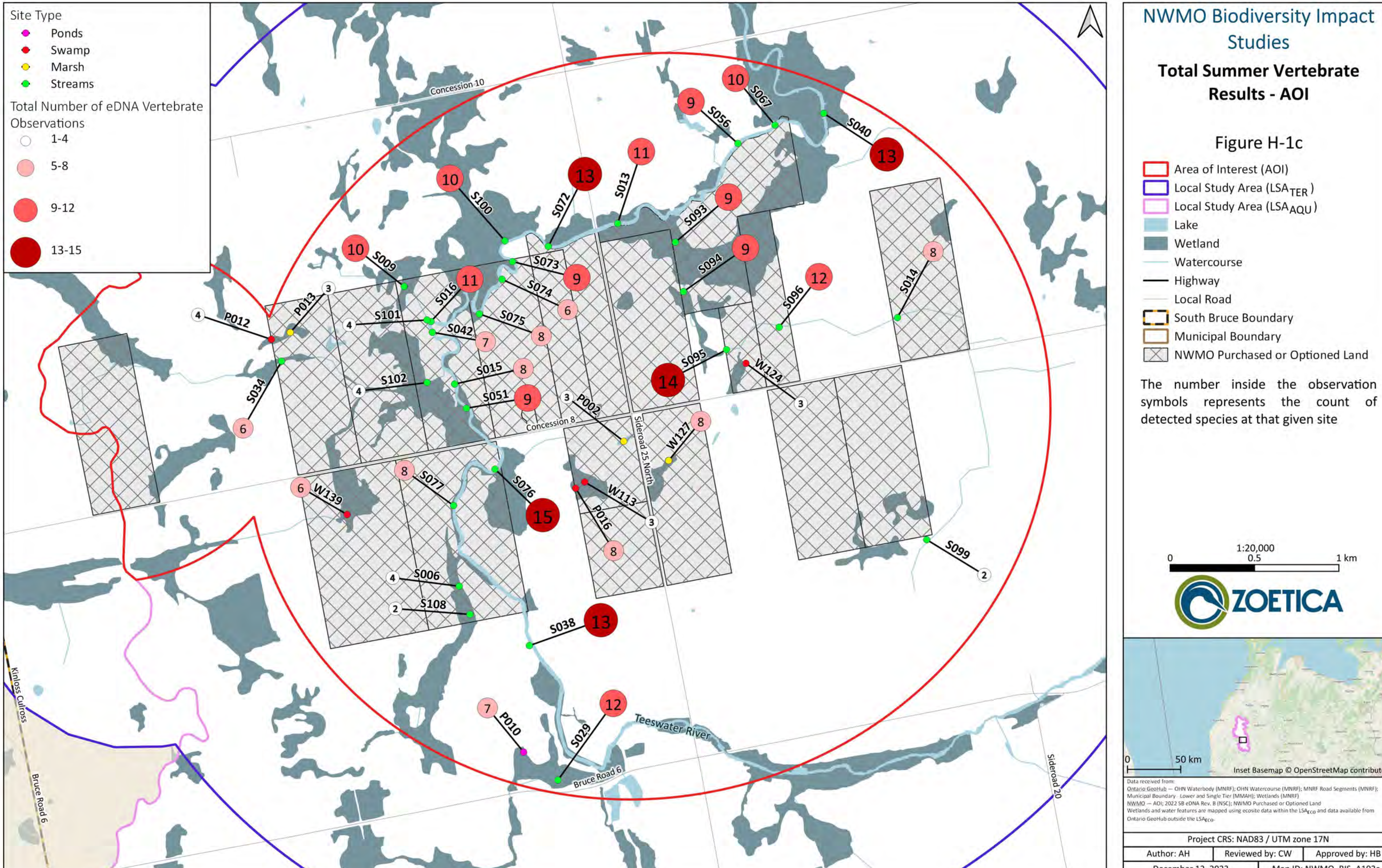
1:65,000

0 1 2 km

ZOETICA

Data received from:
Ontario GeoHub — OHN Waterbody (MNRF); OHN Watercourse (MNRF); MNRF Road Segments (MNRF); Municipal Boundary - Lower and Single Tier (MMAH); Wetlands (MNRF)
NWMO — AOI; 2022 SB eDNA Rev. B (NSC)
Wetlands and water features are mapped using ecosite data within the LSA_{ECO} and data available from Ontario GeoHub outside the LSA_{ECO}.

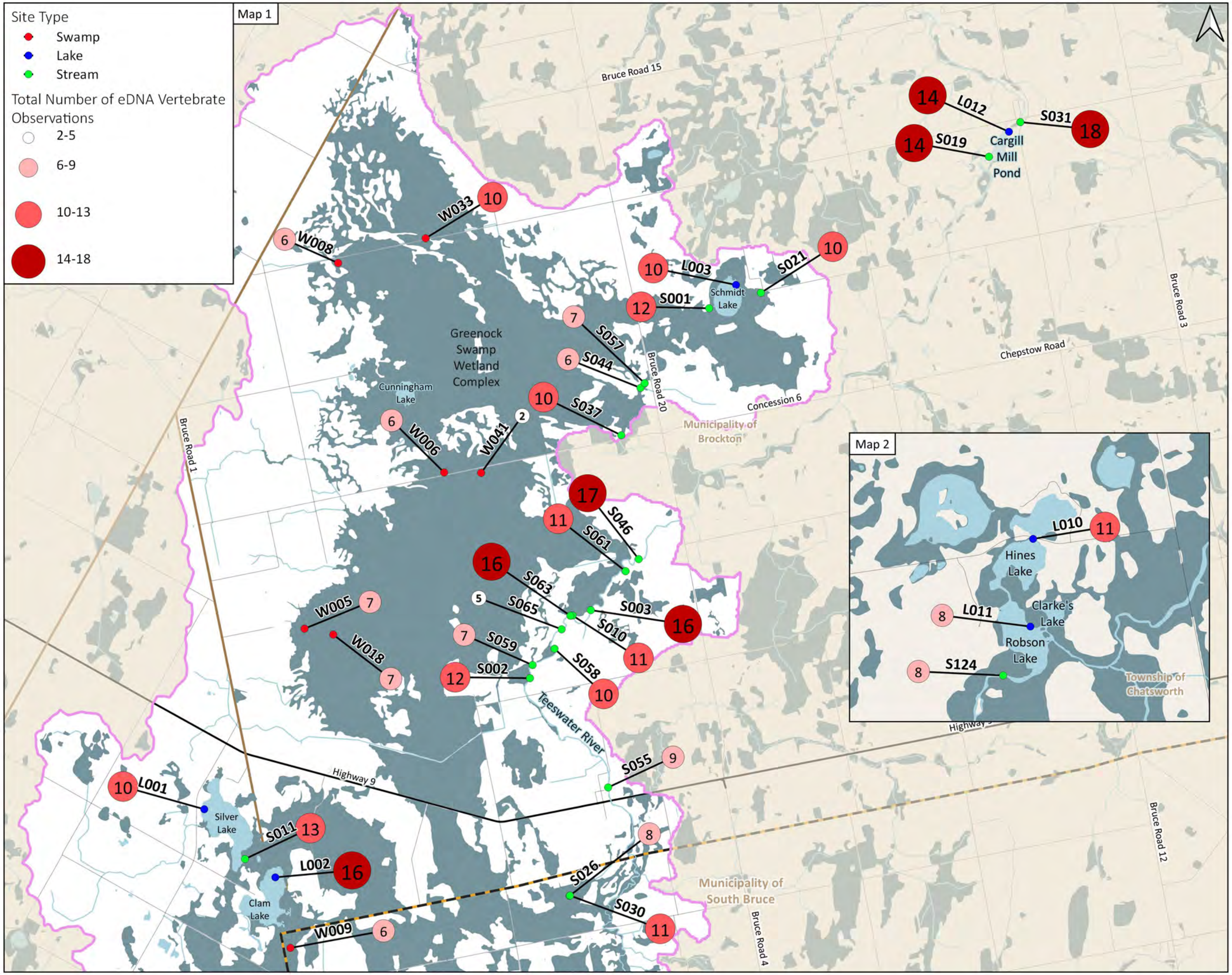
Project CRS: NAD83 / UTM zone 17N		
Author: AH	Reviewed by: CW	Approved by: HB
December 12, 2023	Map ID: NWMO_BIS_A102b	


NWMO Biodiversity Impact Studies
Total Summer Vertebrate Results - AOI
Figure H-1c
Area of Interest (AOI)
Local Study Area (LSA_{TER})
Local Study Area (LSA_{AQU})
Lake
Wetland
Watercourse
Highway
Local Road
South Bruce Boundary
Municipal Boundary
NWMO Purchased or Optioned Land
The number inside the observation symbols represents the count of detected species at that given site
1:20,000
0
0.5
1 km
ZOETICA
0
50 km
Inset Basemap © OpenStreetMap contributors
Data received from:
Ontario GeoHub — OHN Waterbody (MNRF); OHN Watercourse (MNRF); MNRF Road Segments (MNRF); Municipal Boundary - Lower and Single Tier (MMAH); Wetlands (MNRF)
NWMO — AOI; 2022 SB eDNA Rev. B (NSC); NWMO Purchased or Optioned Land
Wetlands and water features are mapped using ecosite data within the LSA_{ECO} and data available from Ontario GeoHub outside the LSA_{ECO}.
Project CRS: NAD83 / UTM zone 17N
Author: AH
Reviewed by: CW
Approved by: HB
December 12, 2023
Map ID: NWMO_BIS_A102c
Site Type
Ponds
Swamp
Marsh
Streams
Total Number of eDNA Vertebrate Observations
1-4
5-8
9-12
13-15
Concession 10
Concession 8
Sideroad 25 North
Teeswater River
Bruce Road 6
Kinloss Culross
Sideroad 20
P012
P013
S034
S101
S042
S102
S015
S051
S016
S009
S100
S072
S073
S074
S075
S013
S093
S094
S056
S067
S040
S014
S096
S095
W124
P002
W127
W113
P016
S099
S076
S077
W139
S006
S108
S038
S029
P010

NWMO Biodiversity Impact Studies

Total Fall Vertebrate Results - North LSA_{AQU}

Figure H-2a



- Area of Interest (AOI)
- Local Study Area (LSA_{TER})
- Local Study Area (LSA_{AQU})
- Lake
- Wetland
- Watercourse
- Highway
- Local Road
- South Bruce Boundary
- Municipal Boundary

The number inside the observation symbols represents the count of detected species at that given site.

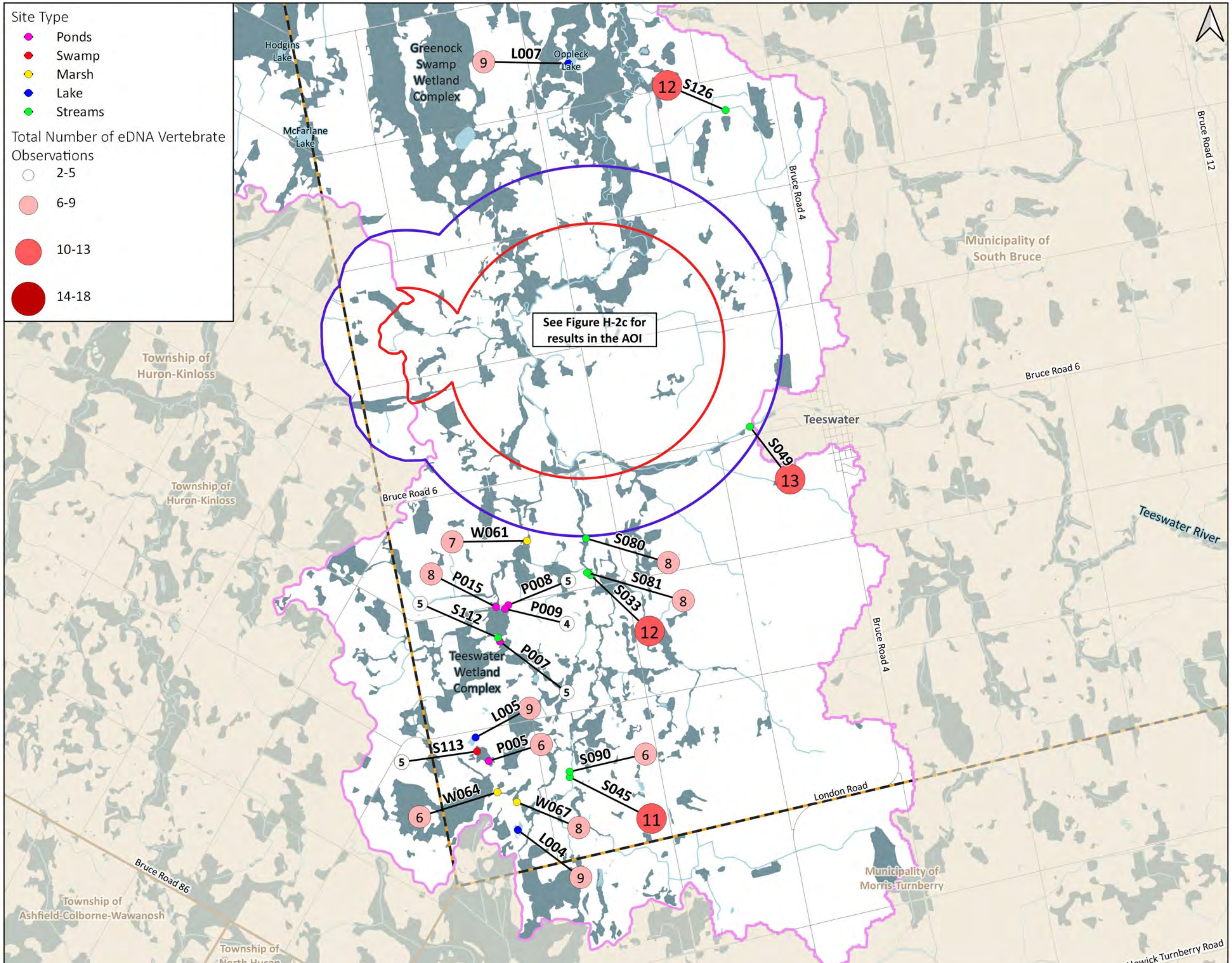
1:65,000

0 1 2 km

ZOETICA

Data received from:
Ontario GeoHub — OHN Waterbody (MNRF); OHN Watercourse (MNRF); MNRF Road Segments (MNRF); Municipal Boundary - Lower and Single Tier (MMAH); Wetlands (MNRF)
NWMO — AOI; 2022 SB eDNA Rev. B (NSC)
Wetlands and water features are mapped using ecosite data within the LSA_{ECO} and data available from Ontario GeoHub outside the LSA_{ECO}.

Project CRS: NAD83 / UTM zone 17N		
Author: AH	Reviewed by: CW	Approved by: HB
December 12, 2023	Map ID: NWMO_BIS_A103a	



NWMO Biodiversity Impact Studies

Total Fall Vertebrate Results - South LSA_{AQU}

Figure H-2b

- Area of Interest (AOI)
- Local Study Area (LSA_{TER})
- Local Study Area (LSA_{AQU})
- Lake
- Wetland
- Watercourse
- Highway
- Local Road
- South Bruce Boundary
- Municipal Boundary

The number inside the observation symbols represents the count of detected species at that given site.

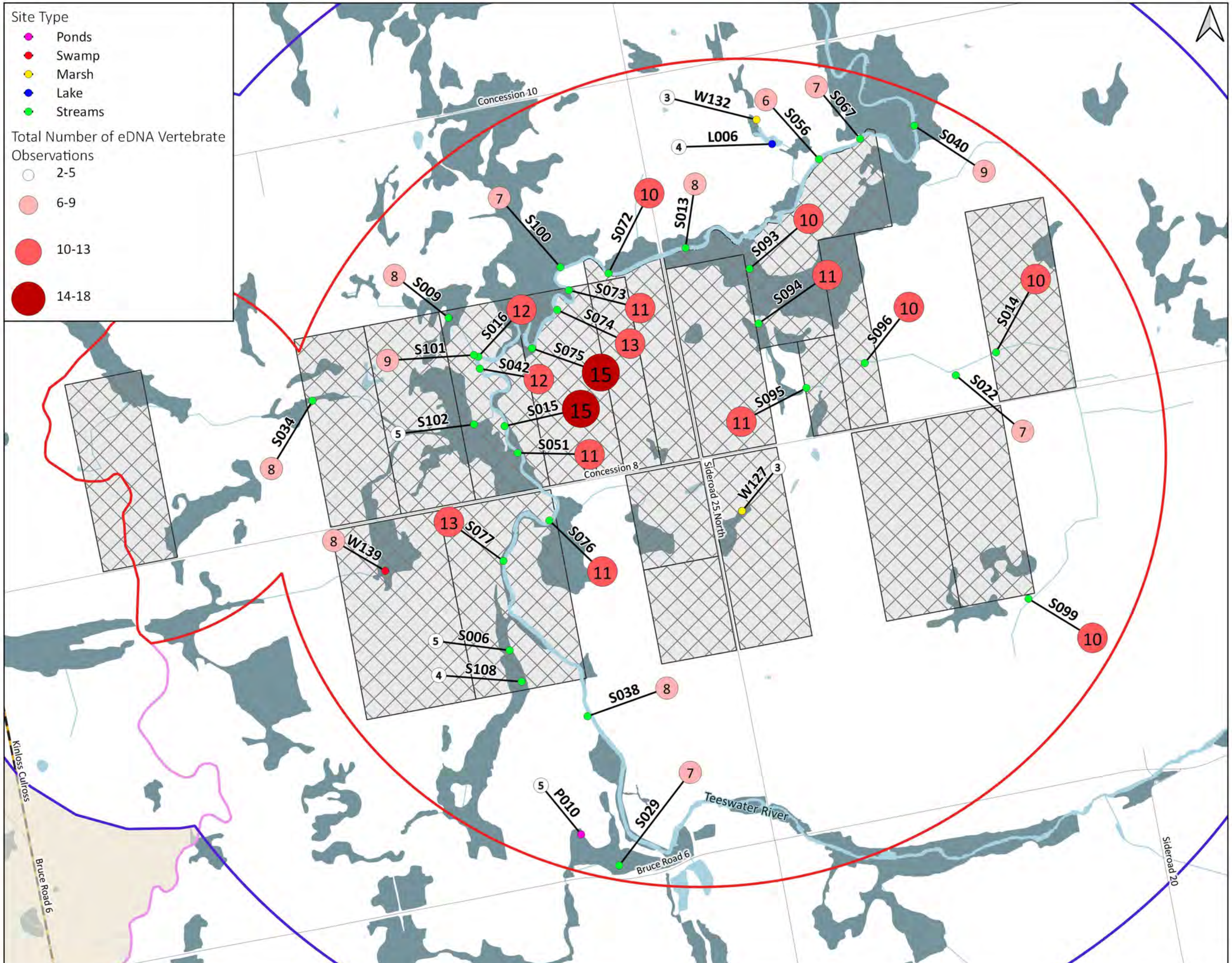
1:65,000

0 1 2 km

ZOETICA

Data received from:
Ontario GeoHub — OHN Waterbody (MNRF); OHN Watercourse (MNRF); MNRF Road Segments (MNRF); Municipal Boundary - Lower and Single Tier (MMAH); Wetlands (MNRF)
NWMO — AOI; 2022 SB eDNA Rev. B (NSC)
Wetlands and water features are mapped using ecosite data within the LSA_{ECO} and data available from Ontario GeoHub outside the LSA_{ECO}.

Project CRS: NAD83 / UTM zone 17N		
Author: AH	Reviewed by: CW	Approved by: HB
December 12, 2023	Map ID: NWMO_BIS_A103b	



NWMO Biodiversity Impact Studies

Total Fall Vertebrate Results - AOI

Figure H-2c

- Area of Interest (AOI)
- Local Study Area (LSA_{TER})
- Local Study Area (LSA_{AQU})
- Lake
- Wetland
- Watercourse
- Highway
- Local Road
- South Bruce Boundary
- Municipal Boundary
- NWMO Purchased or Optioned Land

The number inside the observation symbols represents the count of detected species at that given site.

1:20,000
0 0.5 1 km

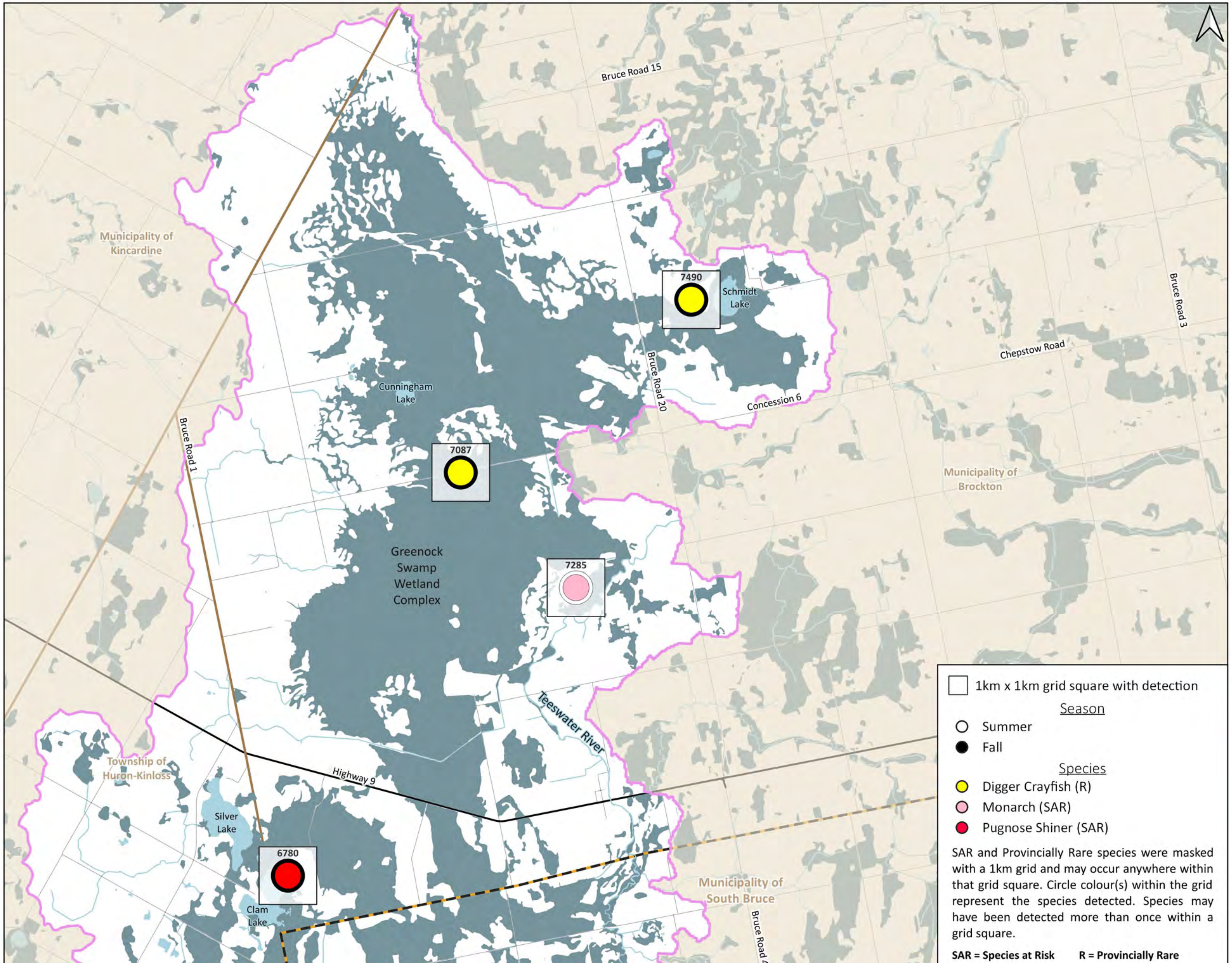
ZOETICA

Data received from:
Ontario GeoHub — OHN Waterbody (MNRF); OHN Watercourse (MNRF); MNRF Road Segments (MNRF); Municipal Boundary - Lower and Single Tier (MMAH); Wetlands (MNRF)
NWMO — AOI; 2022 SB eDNA Rev. B (NSC); NWMO Purchased or Optioned Land
Wetlands and water features are mapped using ecosite data within the LSA_{ECO} and data available from Ontario GeoHub outside the LSA_{ECO}.

Project CRS: NAD83 / UTM zone 17N

Author: AH	Reviewed by: CW	Approved by: HB
December 12, 2023	Map ID: NWMO_BIS_A103c	

APPENDIX I – SPECIES OF INTEREST DETECTIONS

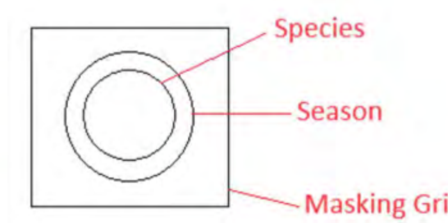


NWMO Biodiversity Impact Studies

eDNA Results: Species of Conservation Concern - North LSA_{AQU}

Figure I-1a

- Area of Interest (AOI)
- Local Study Area (LSA_{TER})
- Local Study Area (LSA_{AQU})
- Lake
- Watercourse
- Wetland
- Highway
- Local Road
- Municipal Boundary
- South Bruce Boundary



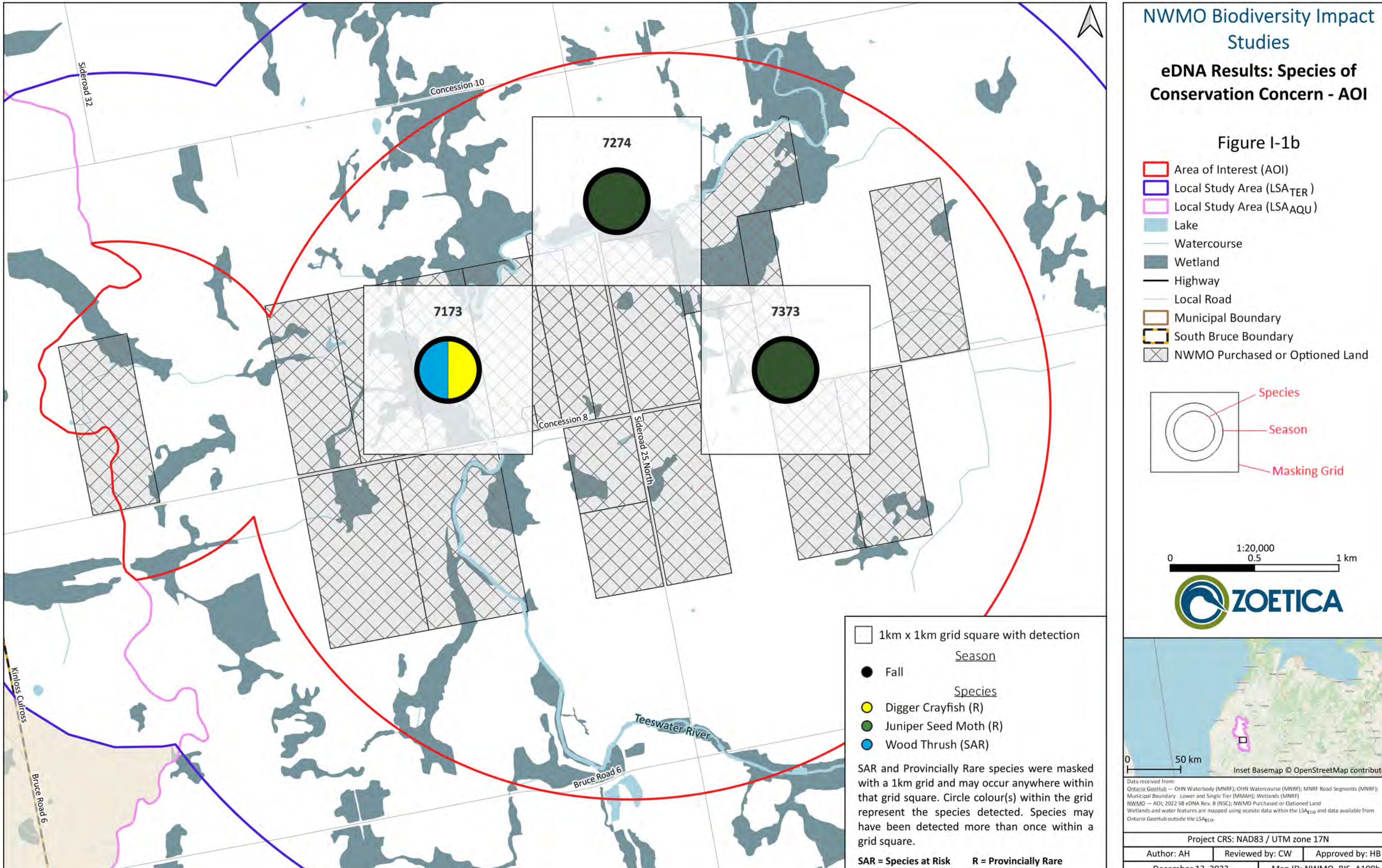
1:65,000

0 1 2 km

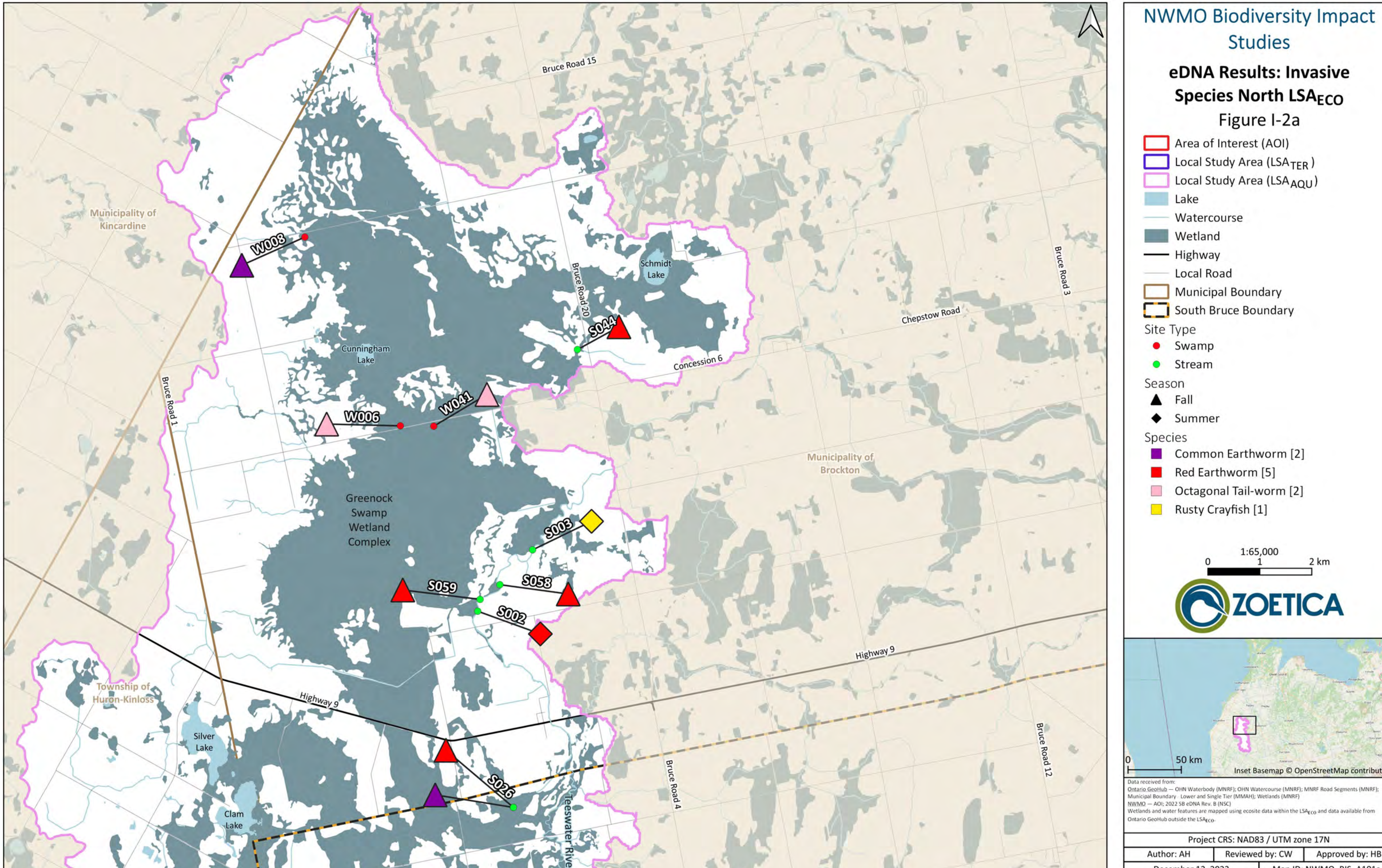
Data received from:
Ontario GeoHub — OHN Waterbody (MNRF); OHN Watercourse (MNRF); MNRF Road Segments (MNRF); Municipal Boundary - Lower and Single Tier (MMAH); Wetlands (MNRF)
NWMO — AOI; 2022 SB eDNA Rev. B (NSC)
Wetlands and water features are mapped using ecosite data within the LSA_{ECO} and data available from Ontario GeoHub outside the LSA_{ECO}.

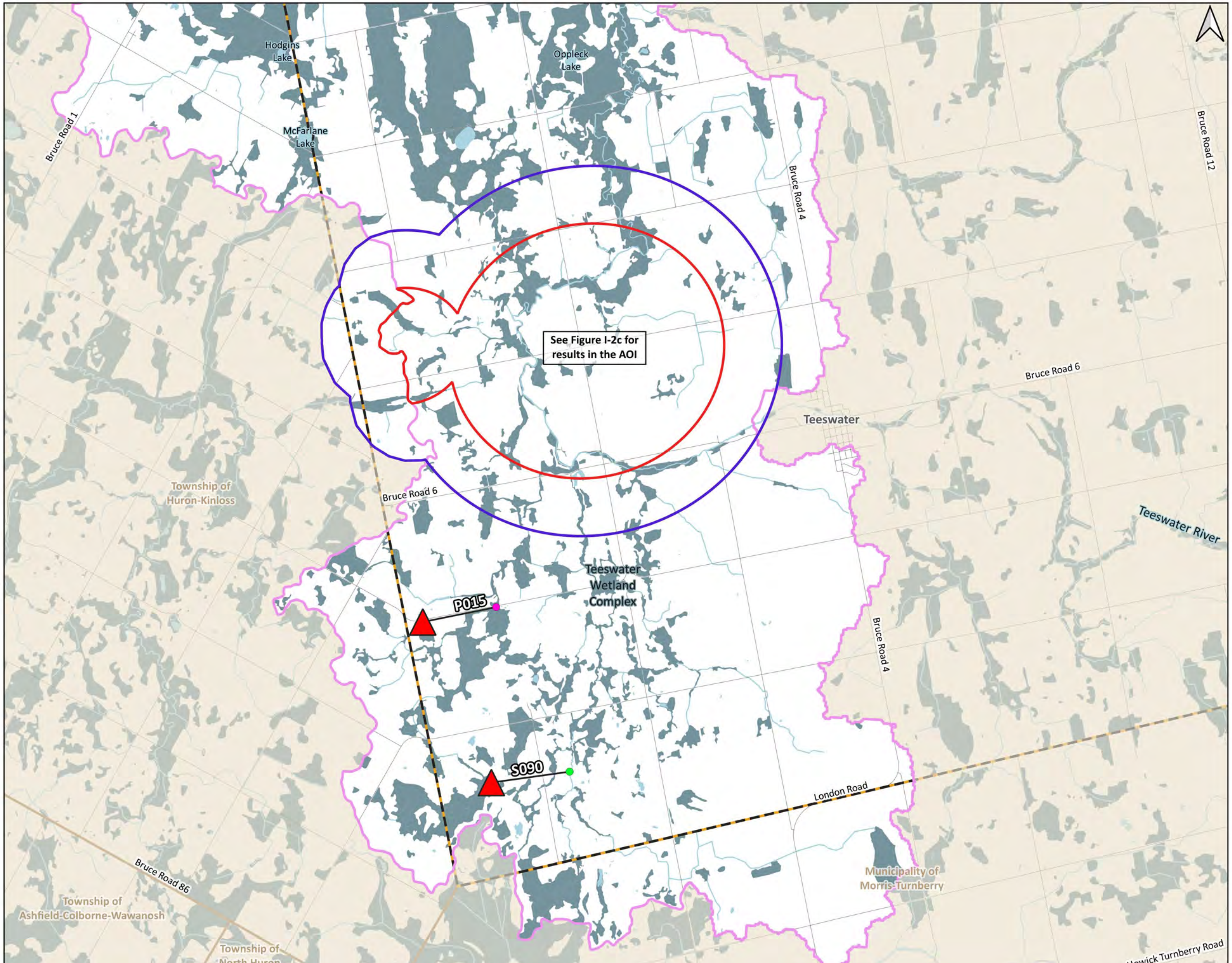
Project CRS: NAD83 / UTM zone 17N

Author: AH	Reviewed by: CW	Approved by: HB
December 13, 2023	Map ID: NWMO_BIS_A100a	



NWMO Biodiversity Impact Studies
eDNA Results: Species of Conservation Concern - AOI
Figure I-1b
Area of Interest (AOI)
Local Study Area (LSA TER)
Local Study Area (LSA AQU)
Lake
Watercourse
Wetland
Highway
Local Road
Municipal Boundary
South Bruce Boundary
NWMO Purchased or Optioned Land
Species
Season
Masking Grid
1:20,000
0
0.5
1 km
ZOETICA
0
50 km
Inset Basemap © OpenStreetMap contributors
Data received from:
Ontario GeoHub — OHN Waterbody (MNRF); OHN Watercourse (MNRF); MNRF Road Segments (MNRF); Municipal Boundary - Lower and Single Tier (MMAH); Wetlands (MNRF)
NWMO — AOI; 2022 SB eDNA Rev. B (NSC); NWMO Purchased or Optioned Land
Wetlands and water features are mapped using ecosite data within the LSA ECO and data available from Ontario GeoHub outside the LSA ECO.
Project CRS: NAD83 / UTM zone 17N
Author: AH
Reviewed by: CW
Approved by: HB
December 13, 2023
Map ID: NWMO_BIS_A100b
Sideroad 32
Concession 10
7274
7173
7373
Concession 8
Sideroad 25 North
Kinloss Culross
Bruce Road 6
Teeswater River
Bruce Road 6
1km x 1km grid square with detection
Season
Fall
Species
Digger Crayfish (R)
Juniper Seed Moth (R)
Wood Thrush (SAR)
SAR and Provincially Rare species were masked with a 1km grid and may occur anywhere within that grid square. Circle colour(s) within the grid represent the species detected. Species may have been detected more than once within a grid square.
SAR = Species at Risk
R = Provincially Rare


Bruce Road 15
Municipality of Kincardine
W008
Schmidt Lake
Bruce Road 20
S044
Chepstow Road
Bruce Road 3
Cunningham Lake
Concession 6
Bruce Road 1
W041
W006
Municipality of Brockton
Greenock Swamp Wetland Complex
S003
S059
S058
S002
Highway 9
Township of Huron-Kinloss
Highway 9
Silver Lake
S026
Clam Lake
Teeswater River
Bruce Road 4
Bruce Road 12
NWMO Biodiversity Impact Studies
eDNA Results: Invasive Species North LSA$_{ECO}$
Figure I-2a
Area of Interest (AOI)
Local Study Area (LSA$_{TER}$)
Local Study Area (LSA$_{AQU}$)
Lake
Watercourse
Wetland
Highway
Local Road
Municipal Boundary
South Bruce Boundary
Site Type
Swamp
Stream
Season
Fall
Summer
Species
Common Earthworm [2]
Red Earthworm [5]
Octagonal Tail-worm [2]
Rusty Crayfish [1]
1:65,000
0 1 2 km
ZOETICA
0 50 km
Inset Basemap © OpenStreetMap contributors
Data received from:
Ontario GeoHub — OHN Waterbody (MNRF); OHN Watercourse (MNRF); MNRF Road Segments (MNRF); Municipal Boundary - Lower and Single Tier (MMAH); Wetlands (MNRF)
NWMO — AOI; 2022 SB eDNA Rev. B (NSC)
Wetlands and water features are mapped using ecosite data within the LSA$_{ECO}$ and data available from Ontario GeoHub outside the LSA$_{ECO}$.
Project CRS: NAD83 / UTM zone 17N
Author: AH
Reviewed by: CW
Approved by: HB
December 12, 2023
Map ID: NWMO_BIS_A101a



NWMO Biodiversity Impact Studies

eDNA Results: Invasive Species South LSA_{ECO}

Figure I-2b

- Area of Interest (AOI)
- Local Study Area (LSA_{TER})
- Local Study Area (LSA_{AQU})
- Lake
- Watercourse
- Wetland
- Highway
- Local Road
- Municipal Boundary
- South Bruce Boundary

Site Type
- Pond
- Stream

Season
- Fall

Species
- Red Earthworm [2]

1:65,000

0 1 2 km

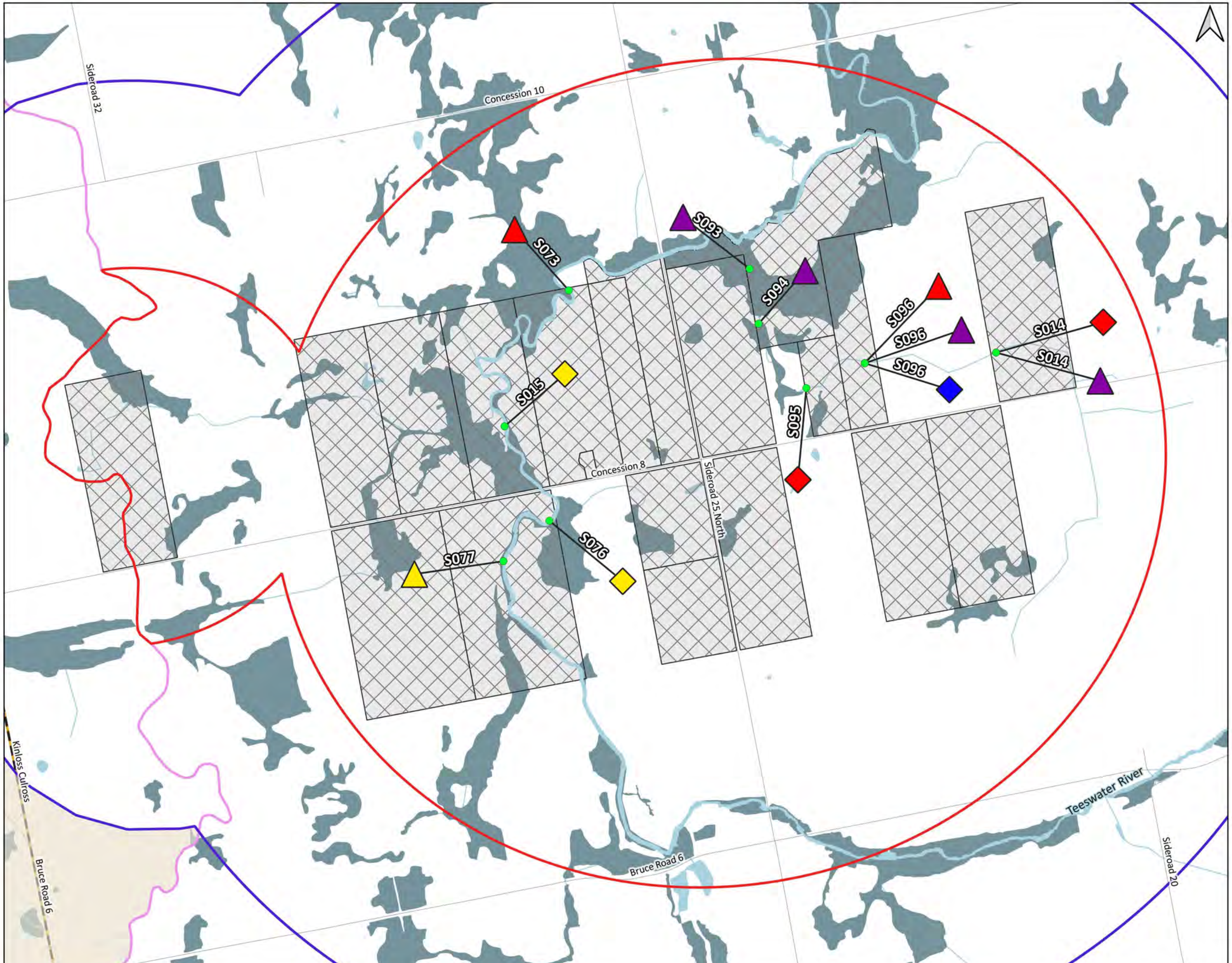
ZOETICA

Inset Basemap © OpenStreetMap contributors

Data received from:
Ontario GeoHub — OHN Waterbody (MNRF); OHN Watercourse (MNRF); MNRF Road Segments (MNRF); Municipal Boundary - Lower and Single Tier (MMAH); Wetlands (MNRF)
NWMO — AOI; 2022 SB eDNA Rev. B (NSC)
Wetlands and water features are mapped using ecosite data within the LSA_{ECO} and data available from Ontario GeoHub outside the LSA_{ECO}.

Project CRS: NAD83 / UTM zone 17N

Author: AH	Reviewed by: CW	Approved by: HB
December 12, 2023	Map ID: NWMO_BIS_A101b	



NWMO Biodiversity Impact Studies

eDNA Results: Invasive Species AOI

Figure I-2c

Area of Interest (AOI)
Local Study Area (LSA_{TER})
Local Study Area (LSA_{AQU})
Lake
Watercourse
Wetland
Highway
Local Road
Municipal Boundary
South Bruce Boundary
NWMO Purchased or Optioned Land

Site Type
Stream

Season
Fall
Summer

Species
Common Earthworm [4]
Red Earthworm [4]
Rusty Crayfish [3]
LDD Moth [1]

1:20,000
0 0.5 1 km

Data received from:
Ontario GeoHub — OHN Waterbody (MNRF); OHN Watercourse (MNRF); MNRF Road Segments (MNRF); Municipal Boundary - Lower and Single Tier (MMAH); Wetlands (MNRF)
NWMO — AOI; 2022 SB eDNA Rev. B (NSC); NWMO Purchased or Optioned Land
Wetlands and water features are mapped using ecosite data within the LSA_{ECO} and data available from Ontario GeoHub outside the LSA_{ECO}.

Project CRS: NAD83 / UTM zone 17N

Author: AH	Reviewed by: CW	Approved by: HB

December 12, 2023	Map ID: NWMO_BIS_A101c

APPENDIX J – SUMMARY OF SAMPLING EFFORT AND COVARIATES

Table J-1. Summary of planned, sampled, and unsampleable eDNA sampling locations within the BIS aquatic study areas.

	AOI			LSA_{AQU}			Outside LSA_{AQU}			***Total***		
Habitat Grouping	Planned	Actual	Dry or Inaccessible	Planned	Actual	Dry or Inaccessible	Planned	Actual	Dry or Inaccessible	*Planned*	*Actual*	*Dry or Inaccessible*
Waterbodies ≤ 1 ha	7	1	0	10	5	1	N/A	N/A	N/A	*17*	*6*	*1*
Waterbodies > 1 ha	1	1	0	8	6	0	3	3	*0*	*12*	*10*	*0*
Watercourses	32	30	2	40	26	4	9	3	*1*	*81*	*59*	*7*
Wetlands – Swamp	20	3	17	31	8	28	N/A	N/A	N/A	*51*	*11*	*45*
Wetlands – Marsh	10	2	8	9	3	6	N/A	N/A	N/A	*19*	*5*	*14*
Reclassified Watercourses	0	0	0	0	1 (stream to watercourse)	0	0	0	0	*0*	*1*	*0*
Reclassified Waterbodies	0	4 (ponds to 2 swamps and 2 marshes)	1 (pond to wetland)	0	0	3 (ponds to wetlands)	0	0	0	*0*	*4*	*4*
Reclassified Wetlands	0	0	0	0	1 (marsh to watercourse)	0	0	0	0	*0*	*1*	*0*
Total[1]	*70*	*41*	*28*	*98*	*50*	*42*	*12*	*6*	*1*	*180*	*97*	*71*

Notes:

1. Sites planned for eDNA sampling that were not visited in 2022 were not accessible at the time of surveys.

Table J-2. 2022 eDNA sample site conditions. All reported values are summarized and not filtered for outliers.

Variable	Sample Size	Minimum	Mean	Standard Deviation	Maximum
pH	534	4.7	7.9	0.5	8.9
Water Temperature (°C)	535	7.4	14.6	4.5	27.1
Dissolved Oxygen (mg/L)	533	0.2	7.0	2.7	14.5
Conductivity (µs/cm)	535	0.02	0.6	0.3	2.6
Turbidity (NTU)	521	0.3	7.4	15.7	261
Flow Value	534	0	0.1	0.2	1.2
Canopy Cover (%)	543	0	27.8	33.0	100
Cloud Cover (%)	543	0	42.7	41.0	100
Air Temperature (°C)	543	4	16.3	6.2	28
Past 24-hour Precipitation (mm)	543	0	0.6	1.6	26.4

APPENDIX K – COUNT OF SPECIES DETECTED BY SITE, SEASON, AND TAXA GROUP

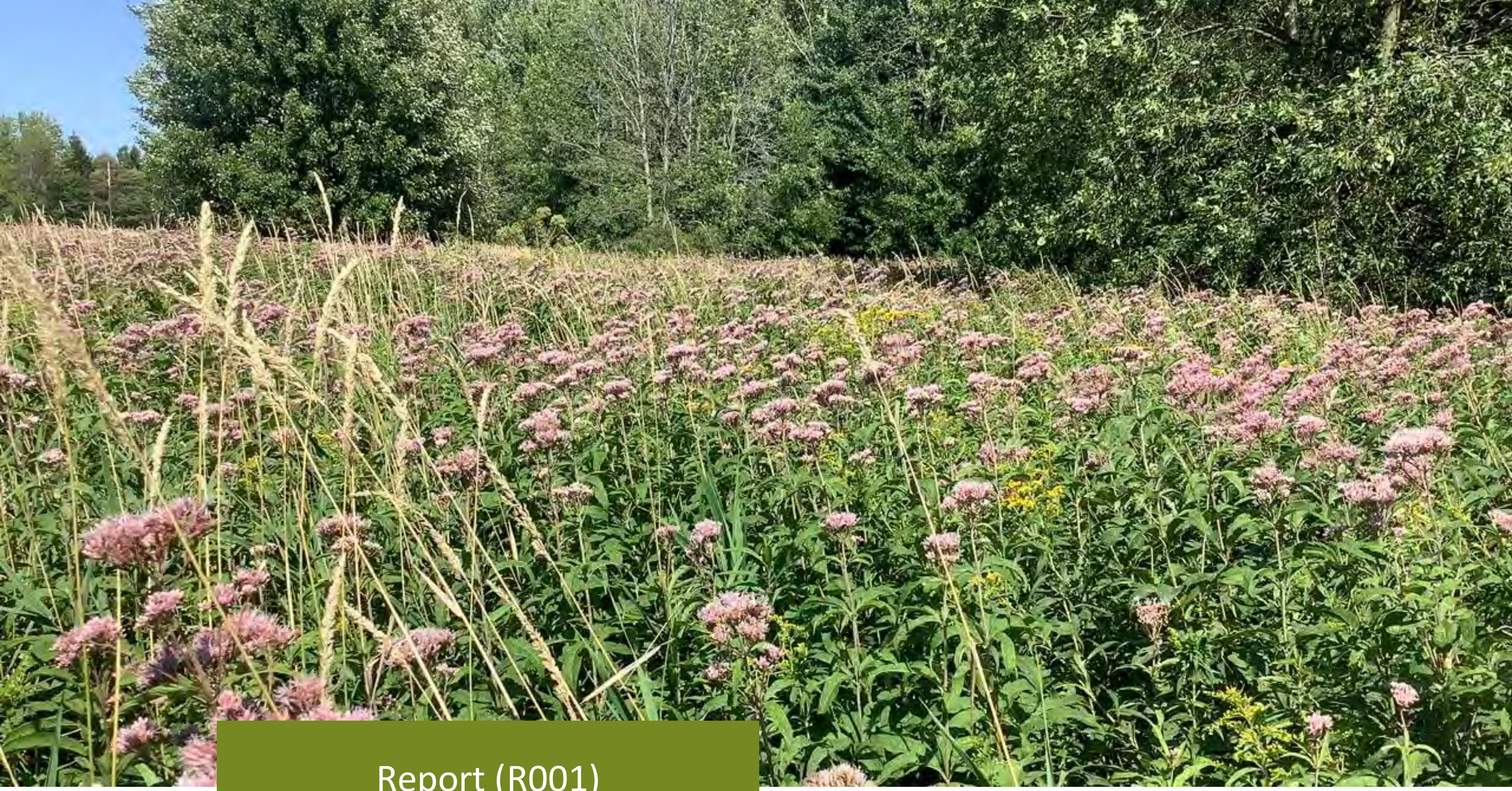
Table K-1. Counts of unique species detected with eDNA by taxa type, season, and site. Counts include all detections to species, before geographic curation and further investigations by the Hanner Lab.

Station ID	Study Area	Fish Species	Mammal Species	Bird Species	Amphibian Species	All Vertebrate Species	Invertebrate Species
Summer							
S006	AOI	3	1	0	0	4	26
S009	AOI	8	1	1	0	10	27
S013	AOI	9	1	1	0	11	38
S014	AOI	3	3	2	0	8	40
S015	AOI	7	0	1	0	8	43
S016	AOI	9	1	1	0	11	33
S029	AOI	8	3	1	0	12	15
S034	AOI	3	2	1	0	6	10
S038	AOI	9	2	2	0	13	13
S040	AOI	9	2	2	0	13	26
S042	AOI	6	1	0	0	7	36
S051	AOI	6	1	2	0	9	30
S056	AOI	6	1	2	0	9	29
S067	AOI	7	1	2	0	10	38
S072	AOI	8	3	2	0	13	34
S073	AOI	6	2	1	0	9	37
S074	AOI	5	1	0	0	6	26
S075	AOI	7	1	0	0	8	26
S076	AOI	10	4	1	0	15	38
S077	AOI	7	1	0	0	8	40
S093	AOI	5	2	2	0	9	45
S094	AOI	4	4	1	0	9	56
S095	AOI	8	4	2	0	14	45
S096	AOI	4	5	3	0	12	44
S099	AOI	1	0	1	0	2	4
S100	AOI	5	3	2	0	10	18
S101	AOI	3	0	1	0	4	23
S102	AOI	3	0	1	0	4	22
S108	AOI	2	0	0	0	2	26
P010	AOI	6	1	0	0	7	9
P002	AOI	1	0	2	0	3	8
P013	AOI	0	1	0	2	3	3
W127	AOI	2	3	2	1	8	16
P012	AOI	0	1	2	1	4	6
P016	AOI	3	2	3	0	8	13
W113	AOI	2	0	1	0	3	6
W124	AOI	2	0	1	0	3	7
W139	AOI	2	2	2	0	6	17
S001	LSA_{AQU}	6	2	1	0	9	10
S002	LSA_{AQU}	9	2	2	0	13	26
S003	LSA_{AQU}	4	1	1	0	6	33
S010	LSA_{AQU}	8	3	2	0	13	15
S021	LSA_{AQU}	6	1	1	0	8	12
S026	LSA_{AQU}	6	3	2	0	11	15
S030	LSA_{AQU}	4	4	0	0	8	17
S037	LSA_{AQU}	8	1	1	0	10	12
S044	LSA_{AQU}	7	1	4	0	12	7

Station ID	Study Area	Fish Species	Mammal Species	Bird Species	Amphibian Species	All Vertebrate Species	Invertebrate Species
S046	LSA_{AQU}	2	0	0	0	2	13
S057	LSA_{AQU}	5	0	0	0	5	14
S058	LSA_{AQU}	5	1	0	0	6	31
S059	LSA_{AQU}	4	3	1	0	8	19
S061	LSA_{AQU}	8	2	2	0	12	27
S063	LSA_{AQU}	7	2	2	0	11	39
S065	LSA_{AQU}	7	2	1	0	10	18
S112	LSA_{AQU}	4	0	2	0	6	9
S126	LSA_{AQU}	4	2	0	0	6	13
L001	LSA_{AQU}	5	1	0	0	6	11
L003	LSA_{AQU}	8	2	1	1	12	9
P007	LSA_{AQU}	4	2	2	1	9	6
P008	LSA_{AQU}	1	2	0	0	3	14
P009	LSA_{AQU}	1	1	1	1	4	18
P015	LSA_{AQU}	4	3	0	0	7	13
W038	LSA_{AQU}	9	2	2	0	13	10
W005	LSA_{AQU}	1	1	0	0	2	12
W006	LSA_{AQU}	1	0	0	0	1	0
W008	LSA_{AQU}	1	0	0	0	1	3
W024	LSA_{AQU}	3	0	0	0	3	7
W033	LSA_{AQU}	1	0	0	0	1	6
W041	LSA_{AQU}	1	0	0	0	1	4
Fall							
S006	AOI	3	1	1	0	5	18
S009	AOI	5	2	1	0	8	14
S013	AOI	7	1	0	0	8	20
S014	AOI	4	3	3	0	10	20
S015	AOI	7	3	5	0	15	26
S016	AOI	8	2	2	0	12	24
S022	AOI	3	2	2	0	7	36
S029	AOI	4	3	0	0	7	9
S034	AOI	3	2	3	0	8	11
S038	AOI	6	1	1	0	8	9
S040	AOI	7	2	0	0	9	28
S042	AOI	9	2	1	0	12	38
S051	AOI	8	2	1	0	11	27
S056	AOI	5	1	0	0	6	18
S067	AOI	6	1	0	0	7	22
S072	AOI	9	1	0	0	10	32
S073	AOI	7	2	2	0	11	34
S074	AOI	8	3	2	0	13	29
S075	AOI	9	4	2	0	15	37
S076	AOI	9	1	1	0	11	26
S077	AOI	8	4	1	0	13	34
S093	AOI	4	4	2	0	10	30
S094	AOI	4	6	1	0	11	52
S095	AOI	3	4	4	0	11	26
S096	AOI	3	5	2	0	10	23
S099	AOI	4	2	4	0	10	12
S100	AOI	5	1	1	0	7	28
S101	AOI	7	2	0	0	9	32
S102	AOI	4	1	0	0	5	20

Station ID	Study Area	Fish Species	Mammal Species	Bird Species	Amphibian Species	All Vertebrate Species	Invertebrate Species
S108	AOI	2	0	2	0	4	11
L006	AOI	3	0	0	1	4	9
P010	AOI	4	1	0	0	5	10
W127	AOI	2	0	0	1	3	7
W132	AOI	2	0	0	1	3	28
W139	AOI	2	3	2	1	8	11
S001	LSA_{AQU}	8	3	1	0	12	19
S002	LSA_{AQU}	9	3	0	0	12	26
S003	LSA_{AQU}	8	5	3	0	16	16
S010	LSA_{AQU}	5	2	3	1	11	18
S011	LSA_{AQU}	8	5	0	0	13	25
S021	LSA_{AQU}	5	4	1	0	10	20
S026	LSA_{AQU}	3	4	0	1	8	34
S030	LSA_{AQU}	6	4	0	1	11	27
S033	LSA_{AQU}	6	4	1	1	12	16
S037	LSA_{AQU}	6	2	2	0	10	32
S044	LSA_{AQU}	4	2	0	0	6	45
S045	LSA_{AQU}	5	5	1	0	11	15
S046	LSA_{AQU}	8	6	3	0	17	37
S049	LSA_{AQU}	8	2	3	0	13	19
S055	LSA_{AQU}	6	3	0	0	9	45
S057	LSA_{AQU}	6	1	0	0	7	30
S058	LSA_{AQU}	4	5	0	1	10	36
S059	LSA_{AQU}	5	2	0	0	7	53
S061	LSA_{AQU}	6	2	3	0	11	58
S063	LSA_{AQU}	10	3	2	1	16	23
S065	LSA_{AQU}	4	1	0	0	5	24
S080	LSA_{AQU}	4	2	2	0	8	23
S081	LSA_{AQU}	4	2	1	1	8	15
S090	LSA_{AQU}	3	3	0	0	6	26
S112	LSA_{AQU}	3	1	0	1	5	25
S126	LSA_{AQU}	5	3	3	1	12	23
L001	LSA_{AQU}	6	3	1	0	10	13
L002	LSA_{AQU}	11	4	1	0	16	16
L003	LSA_{AQU}	8	1	1	0	10	6
L004	LSA_{AQU}	4	3	2	0	9	9
L005	LSA_{AQU}	4	3	1	1	9	11
L007	LSA_{AQU}	6	2	1	0	9	5
P005	LSA_{AQU}	2	2	1	1	6	5
P007	LSA_{AQU}	3	1	0	1	5	17
P008	LSA_{AQU}	3	2	0	0	5	20
P009	LSA_{AQU}	1	2	0	1	4	13
P015	LSA_{AQU}	5	2	1	0	8	29
W061	LSA_{AQU}	4	2	1	0	7	52
W064	LSA_{AQU}	3	3	0	0	6	16
W067	LSA_{AQU}	4	4	0	0	8	28
W005	LSA_{AQU}	3	2	2	0	7	17
W006	LSA_{AQU}	4	2	0	0	6	39
W008	LSA_{AQU}	2	1	3	0	6	33
W009	LSA_{AQU}	2	3	1	0	6	31
W018	LSA_{AQU}	2	3	2	0	7	18
W033	LSA_{AQU}	4	3	3	0	10	13

Station ID	Study Area	Fish Species	Mammal Species	Bird Species	Amphibian Species	All Vertebrate Species	Invertebrate Species
W041	LSA_{AQU}	1	0	1	0	2	13
S113	LSA_{AQU}	2	1	2	0	5	3
S019	RSA_{AQU}	8	4	2	0	14	49
S031	RSA_{AQU}	13	4	1	0	18	53
L012	RSA_{AQU}	8	4	2	0	14	37
S124	Outside RSA_{AQU}	6	2	0	0	8	5
L010	Outside RSA_{AQU}	10	1	0	0	11	11
L011	Outside RSA_{AQU}	6	2	0	0	8	10



Report (R001)

BIODIVERSITY IMPACT STUDIES – SOUTHWESTERN ONTARIO REGION: 2023 BASELINE REPORT (CHAPTER 2: VEGETATION)

December 13, 2023

PREPARED BY Zoetica Environmental Consulting Services

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Cover Image: TEM field work - incidentals 2022

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GLOSSARY AND ABBREVIATIONS

AHM	Aquatic Habitat Mapping
ANSI	Area of Natural and Scientific Interest
AOI	Area of Interest
BIS	Biodiversity Impact Studies
BPD	Biodiversity Impact Studies – Southwestern Ontario Region: Baseline Program Design
BPPA	Biodiversity Impact Studies – Southwestern Ontario Region: Best Practices and Preferred Approach
BV	Biodiversity Value. The biotic environmental components that will be considered for study within The Project's Biodiversity Impact Studies. A subset of biodiversity values will ultimately be scoped into the Biodiversity Impact Assessment as Valued Components.
Critical habitat	Habitat that is necessary for the survival or recovery of a listed wildlife species and that is identified as the species' critical habitat in the recovery strategy or in an action plan for the species (*Species at Risk Act*, S.C. 2002, c. 29). Identification of critical habitat is not a required component of a recovery strategy under the Ontario *Endangered Species Act*. However, the approach used to identify critical habitat, in conjunction with the best scientific information available, is recommended when developing a habitat regulation. A habitat regulation is a legal instrument under the *ESA* that prescribes an area that will be protected as the habitat of the species.
CNSC	Canadian Nuclear Safety Commission
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
EAB	Emerald ash borer
ECCC	Environment and Climate Change Canada
Ecoregion	Second highest level of the ELC hierarchy (Crins et al. 2009). Large geographic areas primarily identified by sub-continental climatic regimes and bedrock geology.
Ecosite	Second lowest level of the ELC hierarchy (Crins et al. 2009). The land within an ecosite will generally contain similar substrate and vegetation.
Ecosite classification dataset	The dataset of ecosite classification created for the BIS using South Western Ontario Orthophotography Project (SWOOP) 2020 imagery.
ECS	Ecoregional Criterion Schedule
EDDMapS	Early Detection and Distribution Mapping System
eDNA	Environmental DNA
ELC	Ecological Land Classification
EMBP	Environmental Media Baseline Program
EO	Element Occurrence. An EO is an area of land and/or water where a species or vegetation community is or was present. EOs represent areas important to the conservation of a species or vegetation community. In Ontario, the NHIC generates each EO from one or

	more observations, based on international standard EO specifications developed by NatureServe (NDMNRF 2021).
ESA	Ontario *Endangered Species Act*
Facultative wetland species	A species that usually occurs in wetlands (estimated probability 67 to 99%), but occasionally found in non-wetlands (estimated probability 1 to 33%).
GBIF	Global Biodiversity Information Facility
GIS	Geographic Information System
GLSE	Great Lakes Shoreline Ecosystem classification system
GSWC	Greenock Swamp Wetland Complex
Habitat suitability / suitable habitat	The ability of the habitat, in its current condition, to provide the life requisites of a species.
IA	Impact Assessment
IUCN	International Union for Conservation of Nature
LSA	Local Study Area LSA_{TER} = Terrestrial Local Study Area LSA_{AQU} = Aquatic Local Study Area LSA_{ECO} = combined LSA_{TER} and LSA_{AQU} for studying ecosystem function and services
MECP	Ontario Ministry of the Environment, Conservation and Parks
MNRF	Ontario Ministry of Natural Resources and Forestry
NHIC	Ontario Natural Heritage Information Centre
NWMO	Nuclear Waste Management Organization
Restricted species/element	Restricted species are commercially exploited or sensitive to disturbance; these species could be harmed if data are not stored and shared securely.
Rights-holders	First Nation and Métis communities who have asserted and or hold recognized treaty and/or Indigenous rights and whose traditional territories include the project location.
RSA	Regional Study Area RSA_{VEG} = Regional Study Area for vegetation
SAR	Species at Risk. For the purposes of the BIS, SAR include species listed under Schedule 1 of the federal *Species at Risk Act* (*SARA*), species designated as Species at Risk in Ontario (SARO) and listed under the provincial *Endangered Species Act, 2007* (*ESA*), and species assessed as Extirpated, Endangered, Threatened, or Special Concern by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC).
SARA	Federal *Species at Risk Act*
SARO	Species at Risk in Ontario
SNA	Species Not Assessed
SOLRIS	Southern Ontario Land Resource Information System

SON	Saugeen Ojibway Nation
SON-South Bruce siting area	Used to describe the broader area surrounding the vdefined area within which the Project may be located. The SON-South Bruce siting area is the general area surrounding the Municipality of South Bruce and includes the traditional territory of Saugeen Ojibway Nation (SON) in southwestern Ontario.
SOP	Standard Operating Procedure
Species of conservation concern	Includes provincially and/or federally listed SAR (Extirpated, Endangered, Threatened, Special Concern) and provincially rare (SRANK S1, S2, S3, SH) species. Regionally rare species may also be scoped in if identified by stakeholders and/or rights-holders as VCs.
Species of interest	Includes species of conservation concern, culturally important species, indicator species, and invasive species (where applicable).
SRANK	Subnational Rank. SRANK is the conservation status of a species or vegetation community within a particular province, territory, or state. In Ontario, the NHIC assigns SRANKs using the best available information and considering factors such as abundance, distribution, population trends, and trends (NDMNRF 2021). Species assigned S1 (Critically Imperiled), S2 (Imperiled), S3 (Vulnerable), and SH (Possibly Extirpated) are considered provincially rare by the NHIC. See the NatureServe website for more information.
SWH	Significant Wildlife Habitat. Defined in the Ontario Provincial Policy Statement, 2020 as: *Wildlife habitat* – areas where plants, animals and other organisms live, and find adequate amounts of food, water, shelter and space needed to sustain their populations. Specific wildlife habitats of concern may include areas where species concentrate at a vulnerable point in their annual life cycle; and areas which are important to migratory and non-migratory species. *Significant* – in regard to wildlife habitat, ecologically important in terms of features, functions, representation or amount, and contributing to the quality and diversity of an identifiable geographic area or natural heritage system. Candidate SWH are areas that meet the ELC ecosite code(s) and/or habitat criteria outlined in the SWH ecoregional criterion schedule (ECS). Confirmed SWH are areas that meet the defining criteria outlined in the SWH ECS. Detailed field investigations are usually needed to confirm SWH.
Taxon	A unit used for biological classification (i.e., taxonomy); can refer to a group of any rank, such as a species, family, class, or order.
TEM	Terrestrial Ecosystem Mapping
The Project	The Adaptive Phased Management Project is the Deep Geological Repository and other required infrastructure for the safe, long-term management of Canada's used nuclear fuel.
TISG	Tailored Impact Statement Guidelines. 'TISG Template' refers to the Tailored Impact Statement Guidelines Template (generic version) (IAAC 2022).
TWC	Teeswater Wetland Complex
VC	Valued Component. For impact assessments of designated projects under the *Impact Assessment Act*, the Agency's Glossary of Terms defines VCs as "environmental, health, social, economic or additional elements or conditions of the natural and human

	environment that may be impacted by a proposed project and are of concern or value to the public, Indigenous peoples, federal authorities and interested parties. Valued components may be identified as having scientific, biological, social, health, cultural, traditional, economic, historical, archaeological and/or aesthetic importance.”
Vegetation	‘True plants’ (e.g., trees, shrubs, herbs, ferns, and mosses), lichens, and fungi
Weed	Species listed as noxious weeds on the Ontario Weed Control Act

1.0 VEGETATION

1.1 Introduction

Ontario has a high species richness of plant life with over 2,000 native plant species (Morton and Venn 1990, Newmaster et al. 1998) that are adapted to a variety of conditions in aquatic, wetland, and terrestrial environments. Within the region of southern Ontario around the Saugeen Ojibway Nation (SON)-South Bruce siting area, there are occurrence records of over 1,200 species of plants ("GBIF Occurrence Download" 2023). For the purposes of the Adaptive Phased Management Project's (hereafter, 'the Project') Biodiversity Impact Studies (BIS), vegetation refers to both 'true plants' (e.g., trees, shrubs, herbs, ferns, and mosses) and lichens and fungi. Plants are primary producers, meaning that they convert sunlight to energy that other organisms can use. People and wildlife depend on plants to provide food and materials (e.g., wood) that sustain life. Plants also provide nutrients to the environment as they decompose, and their leaves provide shade that is vital for thermal regulation of aquatic and terrestrial habitat conditions that support certain species. Plant roots help to stabilize soils, and plant leaves protect against detachment and entrainment of soil particles due to heavy rain, reducing erosion. Fungi are also important components of healthy ecosystems as they can be decomposers which cycle nutrients, minerals, and carbon to make them available for plants and other organisms (Harmon et al. 1994). Fungi can form mutualistic associations with plant roots (i.e., mycorrhizal fungi), which can increase carbon sequestration in the soil (Clemmensen et al. 2013). Lichens are symbionts between fungi and algae or cyanobacteria, which can also fix carbon and nitrogen and provide food and habitat to wildlife (Zedda and Rambold 2015). As such, vegetation is an integral and highly valued component of healthy, functioning ecosystems that provide services to people, fish, wildlife, and invertebrates (see Chapter 9 for more information on ecosystem function and services).

The Canadian Nuclear Safety Commission's (CNSC) *Guidance on Deep Geological Repository Site Characterization* outlines elements of the aquatic and terrestrial environment that should be characterized in the Area of Interest (AOI), including vegetation, soil quality[1], terrestrial habitat, aquatic macrophytes, and species at risk (SAR) (CNSC 2018). In addition, the Tailored Impact Statement Guidelines Template (generic version) ('TISG Template'[2]) identifies vegetation, riparian and wetland environments, and SAR as elements of the biophysical environment that could be scoped into the impact assessment (IA) as valued components (VCs) (IAAC 2022). Such scoping requires a detailed baseline description and project effects assessment (IAAC 2022). A full list of regulatory requirements pertaining to biodiversity is available in Appendix E of the *Biodiversity Impact Studies – Southwestern Ontario Region: Best Practices and Preferred Approach* (BPPA) Report (Zoetica 2021).

Vegetation biodiversity values (BVs) for the BIS include species and communities of conservation concern (including those designated as at-risk and rare), weedy/introduced/invasive species, and species of interest to stakeholders and rights-holders[3]. Species of conservation concern, along with culturally important and invasive species (where applicable), are currently included as "species of interest" for all BVs for the purposes of the BIS. For the current Chapter 2 (Vegetation) of this 2023 BIS Baseline Report,

[1] For the Project, soil quality will be studied through the Environmental Media Baseline Program (EMBP) rather than the BIS.
[2] Please see Chapter 1 for limitations of and planned updates to the TISG Template. (IAAC 2022)
[3]Species of interest to stakeholders and rights holders may include species of conservation concern and weedy/introduced/invasive species but may also include species that do not fall within these categories.

mapping of species observations is limited to SAR, provincially rare, and invasive species. Although vegetation was mentioned during engagement, the cultural importance of species cannot be ascertained by Zoetica™ at this time, as this task requires further coordination with other disciplines studying the potential impacts of the Project. A review of engagement conducted to date that is of relevance to the BIS is presented in Appendix B of the BPPA Report (Zoetica 2021). The scope of species of interest for BIS baseline reporting will be expanded in future years of the BIS baseline program to include culturally important species when more information is gathered through Tier 2 studies and engagement.

For the BIS, both terrestrial and aquatic vegetation have been divided into five sub-categories:

1. **Vegetation Community** – A group of associated vegetation species within a specific area. In Ontario, one current method to delineate vegetation communities is through the Ecological Land Classification (ELC) System (Lee et al. 1998). Using the ELC system, vegetation and substrate type are combined into over 200 ecosite classifications.

2. **Rare and Exemplary Vegetation Community** – A group of associated vegetation species within a specific area that exhibits a suite of factors indicating rare and exemplary status within the province of Ontario. These include rare vegetation communities that are considered Significant Wildlife Habitat (SWH) (OMNR 2000).

3. **Rare Vegetation** – Vegetation species that are naturally rare or have become rare due to other factors including human disturbance. While some rare vegetation populations may be globally or nationally secure, they are still considered more at risk of extinction than common species. Rare species may also be listed as SAR. At-risk vegetation species potentially occurring within the SON-South Bruce siting area are presented in Table 5-3 of the BPPA Report (Zoetica 2021).

4. **Culturally Important Vegetation** – Vegetation species used by Indigenous communities and other local communities for cultural purposes (i.e., food, medicinal, material, or spiritual).

5. **Weeds, Invasive Species, and Introduced Species of Concern** – Weeds are undesirable vegetation species that often occur in cultivated areas. Introduced species are non-native species that have established outside of their natural range. Some introduced vegetation may become invasive. Invasive species can be detrimental to natural ecosystem processes and services, the economy, and human health. Invasive vegetation species may also outcompete and cause declines in native, desired vegetation. The International Union for Conservation of Nature (IUCN) considers invasive species one of the biggest threats to biodiversity (IUCN 2020).

The current Chapter 2 of the 2023 BIS Baseline Program focuses on sub-categories (2) through (5) (i.e., SWH and vegetation species of interest). A discussion of terrestrial vegetation communities (subcategory 1), as determined through desk-based Terrestrial Ecosystem Mapping (TEM), is provided in Appendix B, Chapter 1. Tier 1 Aquatic Habitat Mapping (AHM) studies aimed to collect baseline data for wetland, riparian, and aquatic vegetation communities (see Appendix D, Chapter 1).

1.1.1 Objectives

The objectives of vegetation studies for the BIS are to:

1. Determine the presence, distribution, and abundance of relevant SWH and species of interest, including:

   a. Species of conservation concern, including SAR,
   b. Species of interest and potential importance to local stakeholders and rights-holders,
   c. Weedy, introduced, and invasive species; and,
2. Provide additional baseline data to help inform the Project's biodiversity IA and mitigation measures, and to assist in the potential development of monitoring program(s) to address environmental, regulatory, and stakeholder/rights-holder concerns and adapt the management program accordingly.

The current Chapter 2 on Vegetation begins to fulfill the requirements of the TISG Template required for vegetation (see Appendix C in the BPPA Report (Zoetica 2021)).

1.2 Methods

1.2.1 Study Areas

The BIS study areas for vegetation include the AOI, two local study areas (LSA_{TER} for terrestrial species, LSA_{AQU} for riparian, wetland, and aquatic species), and a regional study area (RSA_{VEG}). See Section 3.0 in Chapter 1 of the 2023 BIS Baseline Report and Section 5.2.1.4 of the BPPA Report (Zoetica 2021) for more details on study area descriptions and rationale.

1.2.2 Collation of Species Observations and Habitat Data

Zoetica began desk-based investigations of vegetation by identifying species of interest and SWH that could occur within the BIS study areas. Appendix D and Section 3.1 in the BPPA Report (Zoetica 2021) provide a comprehensive list of SAR, including at-risk vegetation species, and the methods used to compile this list. Provincially rare vegetation species and communities are indicated by their subnational rank (SRANK; S1, S2, S3, SH) and tracked by the Ontario Natural Heritage Information Centre (NHIC)[4]. Zoetica also compiled a list of regulated and non-regulated invasive species, including vegetation, in Ontario to help direct the BIS program (see **Table A-3**). Zoetica classified species listed as noxious weeds on the Ontario *Weed Control Act* as 'weeds'. For species not listed as invasive or weedy, Zoetica confirmed their status as introduced if their SRANK on the NHIC Ontario Species List was SNA (Species Not Assessed).

Species are designated as noxious weeds in Ontario if they are "difficult to manage on agricultural land once established and will reduce the yield and quality of the crop being grown, negatively affect the health and well-being of livestock, and/or pose a risk to the health and well-being of agricultural workers" (OMAFRA 2022). Invasive species can each have different impacts on the environments to which they are introduced, including modifying the ecosystem physically (e.g., altering water flow, elevation, canopy cover) or chemically (e.g., altering water chemistry or soil nutrient composition), and outcompeting native species to establish a mono-species stand (Simberloff 2010). Introduced species are not expected to have significant negative effects on human health, the economy, or ecosystem functioning at the current time.

[4] For the purposes of this BIS Baseline Report chapter, conservation statuses described in text for at-risk species refer to their Species at Risk in Ontario (SARO) listings unless otherwise indicated. Conservation statuses are from the NHIC's Ontario species list, current to March 1, 2023, and updated for any discrepancies with provincial and federal SAR listings up to August 15, 2023. As such, species and status listings may differ from those presented in Zoetica's 2021 BPPA Report (Zoetica 2021).

Zoetica collated existing data from government, community science (e.g., iNaturalist), and other biodiversity databases. For this 2023 BIS Baseline Report, data on verified species and habitat records were sourced from the NHIC; Ontario Ministry of Natural Resources and Forestry (MNRF); Global Biodiversity Information Facility (GBIF); and Early Detection and Distribution Mapping System (EDDMapS) Ontario. These datasets periodically pull observations from other biodiversity-related projects and programs (e.g., iNaturalist, museum and academic institution records), and so provided a comprehensive desk-based source of data to investigate vegetation species of interest and biodiversity found or likely to be found in the BIS study areas. Zoetica searched the Southern Ontario Land Resource Information System (SOLRIS) and datasets from the Ontario Geological Survey (e.g., Surficial Geology, Physiography) for candidate rare vegetation community SWH. In addition, Zoetica investigated findings from the previous environmental studies conducted for the Project in the SON-South Bruce siting area (Tulloch Environmental 2020, 2021). **Table 1-1** summarizes the desk-based datasets, data layers, and reports investigated and analyzed for vegetation for the 2023 BIS Baseline Report. Data reported on maps were limited to observations from 1970 onward as older observations were considered historic and less reliable. Data on desk-based observations of species of interested are presented in **Table B-1**. See also Appendix A, Chapter 1 for data quality scoring. A full list of the species mentioned in this report, including common and scientific names, is available in **Table A-1** in Appendix A.

Table 1-1. Spatial datasets and reports analyzed for vegetation for the 2023 BIS Baseline Report.

Data Source / Owner	**Dataset**	**Data Format**	**Date Accessed / Received**	**Contains relevant[1] data?**
Tulloch Environmental *Phase 2 preliminary environmental studies for APM Project*	July 2020 Site Reconnaissance (Tulloch Environmental 2020)	Report	10/2020	N
	October 2020 Natural Heritage Features (Tulloch Environmental 2021)	Report	04/2021	N
Ontario Natural Heritage Information Centre (NHIC)	Plant Community Occurrence	Shapefile	12/2020	N
	Plant Community Observation	Shapefile	12/2020	N
	Species Occurrences	Shapefile	12/2020	Y
Ontario Ministry of Natural Resources and Forestry (MNRF)	Wildlife Activity Site	Shapefile	12/2020	N
	Wildlife Activity Area	Shapefile	12/2020	N
	Southern Ontario Land Resource Information System (SOLRIS) 3.0	TIFF (Raster)	08/2022	N
	Karst	PDF Map	08/2022	N
	Surficial Geology	Shapefile	08/2022	N
	Physiography	Shapefile	08/2022	N
	Greenock Swamp ANSI Report (Johnson 1994a, 1994b)	Reports	10/2020	Y
Global Biodiversity Information Facility (GBIF)	Species Occurrences	Comma Separated Values	09/2021	Y
Early Detection and Distribution Mapping System (EDDMapS) Ontario	Invasive Species Observations	Shapefile	01/2022	Y

Environment and Climate Change Canada (ECCC) and Ontario Ministry of the Environment, Conservation and Parks (MECP)[2]	Federal and Provincial SAR Recovery Strategies	Reports	Various	Y

Notes:
1. Zoetica determined dataset relevance based on geographic and temporal relevance as well as relevance to vegetation. For example, data that were not within the relevant BIS study areas, data that were too old to be considered relevant, or data that did not include records of vegetation species were labelled "N" for not containing relevant data.
2. SAR recovery strategies are published by the ECCC and MECP but authors may differ. Refer to Appendix D of the BPPA Report (Zoetica 2021) for a full list of potentially occurring SAR that had provincial and/or federal recovery strategies available at the time of writing the BPPA Report (note: new documents are continually posted on the SARO website and *SARA* Public Registry).

Additional externally sourced datasets for vegetation may be investigated in future years of the BIS baseline program. However, it is likely that additional information on vegetation species that is more spatially and temporally accurate and specific will be obtained on the ground through field studies (see Section 1.2.3) and engagement with knowledgeable stakeholders/rights-holders, such as local field naturalists, regional MNRF staff, rare plant experts, and Indigenous community members.

1.2.3 Tier 1 Studies

Field studies conducted in 2022 focused on collecting Tier 1 foundational habitat data and species detections through TEM and AHM studies and incidental observations. Detailed methods for the Tier 1 studies are available in the *Biodiversity Impact Studies – Southwestern Ontario Region: Baseline Program Design* (BPD) Report and associated Standard Operating Procedures (SOPs) (Zoetica 2022). In addition to the utility of each Tier 1 study outlined below for understanding vegetation in the BIS study areas, incidental observations of vegetation species collected during the terrestrial and aquatic field studies are also informative in describing biodiversity.

The BIS also included eDNA studies that were primarily focused on animals rather than vegetation, and so results are not presented in this chapter (see Appendix E, Chapter 1). Additional years of Tier 1 studies will provide a more comprehensive picture of the vegetation species of interest present at the SON-South Bruce siting area.

1.2.3.1 Terrestrial Ecosystem Mapping

TEM work completed to date is described in Appendix B, Chapter 1. Desk-based data including aerial imagery from the South Western Ontario Orthophotography Project was used to classify and map ecosites according to Ontario's Ecological Land Classification (ELC) and Great Lakes Shoreline Ecosystems (GLSE) systems. The ecosite classification dataset was used to identify candidate SWH. Field contractors surveyed plots in 2022 to ground-truth ecosite identifications and investigate candidate SWH. Field contractors recorded the presence of species of interest identified by Zoetica (see Section 1.2.2) at full and ground plot surveys, and identified additional rare, invasive, introduced, and weedy species.

1.2.3.2 Identification of Candidate SWH

Rare vegetation communities and provincially and regionally rare vegetation species are considered SWH. Zoetica investigated the SWH Ecoregional Criterion Schedule for Ecoregion 6E (hereafter '6E ECS') (OMNRF 2015) and found eight vegetation-related SWH types of potential relevance to the SON-South Bruce siting area:

- Cliffs and Talus Slopes
- Sand Barren
- Alvar
- Old Growth Forest
- Savannah
- Tallgrass Prairie
- Other Rare Vegetation Communities
- Special Concern and Rare Species

Further details about candidate SWH investigations conducted to date and rationale for inclusion (or exclusion) of SWH types listed in the 6E ECS are presented in Appendix C, Chapter 1.

1.2.3.3 Aquatic Habitat Mapping

Aquatic Habitat Mapping (AHM) work completed to date is described in Appendix D, Chapter 1. Surveys included characterizing wetland, riparian, and in-stream (aquatic) vegetation. Results from 2022 AHM studies on the biodiversity of wetland environments, including vegetation, are summarized in Chapter 3. Vegetation species of interest detected in AHM field work are discussed in this chapter. Full species lists of riparian and aquatic vegetation observed during AHM studies are included in Appendix G of Appendix D, Chapter 1.

1.2.4 Mapping Considerations

Due to the sensitivity of at-risk and rare species and nesting/denning habitat features, spatial data from NHIC are represented by a 1 km grid rather than a point, as per the NHIC's Sensitive Data Location Standards (NHIC n.d.). Descriptive reporting will also follow sensitivity standards and will not be detailed enough to allow for precise geolocation. GBIF and EDDMapS data reported on maps were limited to observations from 1970 onward as older observations were considered historic and not as reliable. See also Appendix A, Chapter 1 for data quality scoring.

For GBIF and EDDMapS species observation data, when there were multiple entries with a count of one at the same location, Zoetica assumed the entries were all the same individual. For simplicity, mapped species observations present the cumulative number of observations and counts and do not represent the number of individuals.

Incidental observations were recorded during various Tier 1 baseline field programs and were noted on different data forms (Incidental Observation Form or noted in TEM, AHM, or eDNA survey forms). Incidental observations varied in method of observation (audio, visual, etc.) and life history stage of organisms, and may have been recorded in transit to a site and thus not associated with habitat data. As well, expertise in species identification may have varied among field contractors working on different field programs. Thus, not all pertinent information may have been available (e.g., observation type, demographics) or collected in a directly comparable manner (e.g., quantity). Field-based observations of provincially tracked species (at-risk and/or rare) are also represented by a 1 km grid, rather than a point, on maps to align with the NHIC's Sensitive Data Location Standards (NHIC n.d.). Data associated with mapped incidentals are included in Appendix B.

1.3 Results

1.3.1 Summary of Vegetation Diversity in Field Surveys

Desk-based mapping and field data from the 2022 TEM and AHM surveys provided preliminary descriptions of the vegetation community at the SON-South Bruce siting area. TEM surveys evaluated the vegetation composition in five layers (Tree, Shrub, Herb, Moss-Lichen-Seedling, and Epiphyte Layers). Species were detected in 1–7 plots in each layer. Here, Zoetica outlined the most reported species in each layer within the AOI and LSA_{TER}, and the threshold above which a species is included in this category of "most commonly reported" varied depending on the distribution of data in each species layer. Across the AOI, LSA_{TER}, and LSA_{AQU}, TEM surveys detected 33 taxa in the Tree layer (A). The most reported tree species were red maple, green ash, American elm, yellow birch, black ash, eastern white cedar, sugar maple, and balsam fir. There were 91 taxa in the Shrub layer (B). The most reported species in the AOI and LSA_{TER} (recorded in > three plots) were black ash, green ash, red osier dogwood, American elder, eastern white cedar, and nannyberry. In the Herb layer (C), field crews detected 338 taxa. The most reported taxa in the AOI and LSA_{TER} (> three plots) were common milkweed, sedge species, white turtlehead, broad-leaved enchanter's nightshade, spinulose wood fern, spotted joe-pye weed, spotted jewelweed, harlequin blue flag, northern water-horehound, sensitive fern, reed canarygrass (invasive), giant goldenrod, wrinkleleaf goldenrod, white panicle aster, and purple-stemmed aster. The Moss, Lichen, and Seedling Layer (D) contained 52 taxa. Species were all found in less than three plots in the AOI and LSA_{TER}. The most reported taxa in the LSA_{AQU} were red maple, green ash, and moss species. The Epiphyte layer (E) contained mostly records of unknown mosses and lichens, and five records of taxa identified to species or genus. Taxa listed in each layer are not necessarily unique from one another; for example, red maple was found in layers A, B, C, and D. See Section 4.2.2 and Tables D-2 through D-6 in Appendix B, Chapter 1 for a complete discussion of the vegetation found in each layer.

As milkweed species were detected in the herb layer during TEM studies, and monarch (Special Concern) breeding habitat depends on the presence of milkweed, Zoetica cross-checked the 2022 incidental observations for presence of monarch within the AOI and LSA_{TER}. Field contractors recorded monarch in seven grid cells that are within or overlap the AOI. Two TEM plots with milkweed species in the southwestern AOI were within or very close to grid cells containing incidental observations of monarch (see Figure B-1 in Chapter 6).

TEM surveys also revealed that vegetation cover, particularly in the tree and shrub layers, was generally lower in the AOI and LSA_{TER} than in the broader LSA_{ECO} (a study area encompassing the outer limits of the LSA_{TER} and the LSA_{AQU}; see Section 3.0 in Chapter 1). Structural stage of plots in the AOI was generally lower in the north and west regions and higher in the eastern region. See Section 4.2.2 in Appendix B, Chapter 1 for a fuller discussion of vegetation structure and cover. Appendix B, Chapter 1 also presents results on tree attributes for wildlife use (in Section 4.2.3.2) and forest health (in Section 4.3), which are relevant to vegetation.

In AHM surveys, each aquatic/riparian vegetation species was detected in 1–35 survey sites in a given dataset (waterbodies, wetlands, or watercourses). Here, Zoetica outlines the most reported species in each aquatic habitat type within the AOI and LSA_{AQU}, and the threshold above which a species is included in this category of "most reported" varied depending on the distribution of data in each dataset. AHM surveys of waterbodies detected 66 riparian vegetation taxa, 13 emergent taxa, five floating taxa, and 18 taxa of submergent vegetation. The most reported riparian species in waterbodies (> 10 plots) were eastern white cedar, tamarack, reed canarygrass, sedge species, and willow species**.** The most reported emergent taxon was cattail species (nine plots), followed by softstem bulrush and bur-reed species in three and four plots, respectively. Commonly reported floating taxa (> three plots) were duckweed species, spatterdock species, and water-lily species. The most reported submergent taxon was water-milfoil in ten plots, followed by waterweed species, coontail species, sago pondweed, and stonewort species in three plots each. In wetlands, field crews detected 41 riparian taxa, nine emergent taxa, five floating taxa, and five submergent taxa. Most riparian species in wetlands were found in only one or two plots; the most reported species (three or four plots) were reed canarygrass, red osier dogwood, silver maple, sensitive fern, and ostrich fern. The most reported emergent taxa (> two plots) were reed canarygrass, sedge species, and cattail species. Floating duckweed species were found in six plots, with the other four floating taxa found in only one plot each. Submergent bladderwort species were found in two plots, with the other four submergent species found in only one plot each. In watercourses, field crews detected 20 submergent taxa, 23 emergent taxa, nine floating taxa, and 72 taxa on the watercourse banks. Commonly reported emergent species (> seven plots) were reed canarygrass, eastern burreed, arrowhead species, and water speedwell. The most reported floating taxa (> seven plots) were duckweed species, marsh speedwell, spatterdock species, and water speedwell. Commonly reported submergent taxa (> four plots) were watercress species, American eelgrass, water-milfoil species, and largeleaf pondweed. See Appendix G of Appendix D, Chapter 1 for full tables of vegetation species detected in AHM surveys.

Incidental observations from AHM, TEM, and eDNA field surveys included 168 taxa of vegetation (**Table A-4**). Of these, 106 were identified to at least the species level, and 47 to the genus level. Incidental observations recorded many species of interest, including one that was not detected in the desk-based or TEM/AHM survey data: green dragon (Special Concern, S3).

Further discussion of vegetation species detected in field surveys in this iteration of Chapter 2 of the 2023 BIS Baseline Report will be limited to indicators of important habitat (Section 1.3.2), species of interest (Section 1.3.3), and a brief presentation of community characterization based on ecosite mapping (Section 1.3.4).

1.3.2 Presence, Distribution, and Abundance of Important Habitat

1.3.2.1 Significant Wildlife Habitat

A summary of the candidate SWH identified to date and of relevance to vegetation is presented in Appendix C, Chapter 1. Based on ecosite analyses, Old Growth Forest could potentially occur within the AOI and LSA_{TER}. In contrast, ecosites where Alvars may occur are relatively rare compared to other habitat types. To date, there has been no evidence of Cliffs and Talus Slopes, Sand Barren, Savannah, or Tallgrass Prairie SWHs within the SON-South Bruce siting area. Determining the presence of other rare vegetation communities will require further discussion with NHIC and MNRF. Two Special Concern and/or rare vegetation species were detected in 2022 field data: eastern green-violet (S2) and green dragon. Field contractors noted thousands of eastern green-violet individuals at two sites in forests containing sugar maple in the AOI, which likely constitutes SWH for this species. Field contractors observed single individuals of green dragon at two sites in the LSA_{AQU} south of the AOI. If SON-South Bruce is selected, Tier 2 Studies may examine the habitat surrounding these observations to determine whether it constitutes SWH for green dragon.

Desk-based SWH ecosite analyses have not been completed to the extent of the RSA_{VEG} due to limited coverage of the refined ecosite dataset. However, Tier 1 TEM studies were completed across the LSA_{ECO} (combined LSA_{TER} and LSA_{AQU} for studying ecosystem function and services, see Chapter 9) which encompassed a portion of the RSA_{VEG}. Thus, limited SWH ecosite analyses within the RSA_{VEG} are reported in Appendix C, Chapter 1 and future studies will complete SWH analyses to the extent of the RSA_{VEG}. Additional rare and at-risk vegetation species (not communities) are discussed below in Section 1.3.3.1.

1.3.2.2 *Critical Habitat*

As of August 2023, there are two at-risk vegetation species with federal recovery strategies where critical habitat (represented by 100 x 100 km squares) has been identified within the BIS study areas for vegetation (see Table 5-3 in the BPPA Report (Zoetica 2021)). As shown in **Figure B-1**, there are known critical habitat squares for goldenseal (Special Concern, S2; ECCC 2020) and American ginseng (Endangered, S2; ECCC 2018) that overlap with the AOI, LSA_{TER}, LSA_{AQU}, and RSA_{VEG}. American ginseng and goldenseal also have provincial recovery strategies (Jolly 2016, MECP 2019a) and provincial government response statements (MECP 2017, 2020) available. Further discussions with Environment and Climate Change Canada (ECCC) and/or the Ontario Ministry of the Environment, Conservation and Parks (MECP) are needed to determine whether critical habitat for these at-risk plants occur within the BIS study areas, as spatial masking of the data makes this impossible to know at present. In addition, it is possible that new critical habitat will be identified by ECCC recovery practitioners during the timeline of the BIS baseline program and Project IA; should this occur, relevant critical habitat will be discussed in this section in future iterations of the BIS Baseline Report.

American ginseng was listed as Endangered in 2008 when the Ontario *Species at Risk Act* came into effect. American ginseng is a long-lived perennial herb that grows in deciduous forest understories. Individuals take a long time to mature, and grow in very small populations, which makes the species very susceptible to habitat loss and degradation from deforestation. The roots are known to be illegally harvested, which also threatens this species (MECP 2019b).

Other federally listed species at risk found in the BIS study areas (see Section 1.3.3.1) do not currently have federal definitions of their critical habitat. For black ash (Endangered), no federal recovery strategy has been issued and thus there is no outline of critical habitat. For butternut (Endangered, S2?), a federal recovery strategy issued in 2014 stated that it was difficult to determine critical habitat because habitat loss is not the main threat to butternut. Green dragon does not have a federal recovery strategy or identified critical habitat, though habitat loss and degradation are the most significant threats to its populations (Donley et al. 2013). Notably, its known distribution in Ontario is restricted to the area southwest of a line from Hamilton to the Maitland River in Huron County (Donley et al. 2013), and the BIS study areas are north of that line. Therefore, these incidental observations fall outside of the known range of green dragon.

1.3.3 Presence, Distribution, and Abundance of Species of Interest

A total of 66 vegetation species of interest have been detected within the BIS study areas based on desk-based and field-based investigations conducted to date (**Table 1-2**). See **Table B-1** for details (count) of desk-based observations and **Table B-2** for details (count, observation type, Tier 1 survey source) of field-based incidental observations. Thirty-six of these species have occurred within the AOI (**Table 1-2**; **Figure B-2**; **Figure B-3**; **Figure B-4**). Terrestrial vegetation (as identified in **Table A-1**) is only studied within the AOI and LSA_{TER}, while aquatic and wetland/riparian vegetation is studied in the AOI and LSA_{AQU}. Therefore, for mapping and reporting, Zoetica disregarded observations of terrestrial vegetation at sites in the LSA_{AQU} outside of the LSA_{TER}, and observations of aquatic and wetland/riparian vegetation at sites outside of the LSA_{AQU}. Field observations of species of interest included GPS coordinates, some of which appear overlapping on the map (**Figure B-3**) but may have been slightly different. Therefore, Zoetica quantified the number of sites that a species of interest occurred at (i.e., in Sections 1.3.3.1 and 1.3.3.3) using QGIS instead of visual inspection of the map.

1.3.3.1 Species of Conservation Concern

Note: an element occurrence (EO) for restricted species V1[5] *was included in the NHIC dataset received by Zoetica. The EO is relevant to the BIS. However, because restricted species V1 is considered a restricted species/element in terms of sharing and presenting spatial data, the record is neither mapped nor described in detail in this Chapter.*

Desk- and field-based data from 2022 indicate five at-risk vegetation species and 14 provincially rare species have been recorded within the BIS study areas (see **Table 1-2**; **Figure B-2**; **Figure B-3**). The SAR are black ash, restricted species V1, butternut, green dragon, and Hill's pondweed (Special Concern, S2S3). Hill's pondweed is an aquatic species, and black ash and green dragon are facultative wetland species; thus, these SAR will be studied in the LSA_{AQU} (see Section 1.2.1). As a terrestrial plant, butternut will be studied in the LSA_{TER}.

Black ash was added to SARO as an Endangered species in January 2022 due to its high susceptibility to the invasive emerald ash borer (COSEWIC 2018); and a provincial recovery strategy for black ash was published in September 2022 (Catling et al. 2022). Federally, black ash was assessed as Threatened by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in November 2018, and this species is still under consideration for a status change (listing) under Schedule 1 of the federal *Species at Risk Act* at the time of preparing this report (September 2023). As such, no federal recovery strategy has been developed for black ash (as of August 2023). Butternut is a widespread but uncommon tree that was listed as Endangered in Ontario in 2008 and reconfirmed as Endangered in 2017. Butternut populations have declined over recent decades due to butternut canker, a fast-spreading fungus that can kill a tree within a few years (Poisson and Ursic 2013). A federal recovery strategy has been issued for butternut, but it does not include maps of critical habitat because the main threat is not habitat loss, but rather disease from the canker (EC 2010). Butternut hybridizes with introduced species of the same genus (*Juglans*), and such hybrids are not considered at-risk. Green dragon has been listed as Special Concern in both Ontario and Canada since the 1980s. It grows in moist deciduous forests and floodplains, often along rivers or creeks. To disperse offspring, adults release vegetative offshoots that disperse via flooding upstream or downstream. Green dragon is primarily threatened by habitat loss and degradation, threats that are exacerbated by its small and isolated populations. Within Ontario, it occurs only in southwestern Ontario where development pressure contributes to habitat loss and degradation. Many of its historical populations are now extirpated (Donley et al. 2013). The two incidental observations of green dragon in 2022 were north of its known distribution in Ontario. See Chapter 3 (Wetlands and Riparian Environments) for a full assessment of the aquatic plant Hill's pondweed.

[5] Due to their sensitive nature, detections of restricted species are not described in detail nor made discernable on maps.

Of the species at risk, black ash was detected throughout all three study areas. Field contractors incidentally recorded black ash in 54 grid squares across the AOI and the LSA_{AQU} north and south of the AOI (**Table B-2**; **Figure B-3**). Black ash was also recorded on GBIF at a site on Schmidt Lake in the northern LSA_{AQU} (**Figure B-2**). Butternut was the only other SAR incidentally observed in the AOI, in one grid square in the southwestern quadrat. Field contractors incidentally observed green dragon in two grid squares in the southern LSA_{AQU} (**Table B-2**; **Figure B-3**). Hill's pondweed was detected on GBIF at one site in the GSWC in the northern LSA_{AQU} (**Figure B-2**).

One provincially rare vegetation species, eastern green-violet, was incidentally observed in the AOI during 2022 field surveys (**Figure B-3**). Field contractors detected populations of eastern green-violet in two grid squares in the northeastern AOI. No provincially rare vegetation species were observed in the LSA_{TER} during 2022 field studies. Three provincially rare vegetation species potentially occur in the LSA_{TER}, outside the AOI, based on desk-based point locations and NHIC 1 km grids[6] (**Figure B-2**): Bush's pocket moss (S3), beaked spikerush (S3), and rigid sedge (S3?). However, these observations, along with most of the NHIC and GBIF records for at-risk and rare vegetation species, are quite old, with each species last observed in 1977, 1976, and 1987, respectively. For the latter two species, both records have been designated as "Historical" EOs by the NHIC due to lack of observations for at least 20 years (when NHIC last ranked the EOs in 2009). None of these three species were detected during 2022 field surveys. During TEM surveys, field contractors recorded the provincially rare American tree moss (S3) in the LSA_{AQU} north of the AOI (**Figure B-3**a; **Table B-3**). Four provincially rare species have observations in the LSA_{AQU} outside the LSA_{TER} on GBIF: beaked spikerush at a site west of McGlinn Lake, large-leaved leafy moss (S3) and floating crystalwort (S3) at the same site in the GSWC, slender mountain-mint (S3) at a site near Schmidt Lake, and tubercled orchid (S3) at a site in the GSWC (**Table 1-2**; **Figure B-2**). Greater round-leaved orchid (S2) has an NHIC 1 km grid observation in the GSWC north of the AOI (**Figure B-2**).

Within the LSA_{AQU}, there were GBIF records of occurrence of two SAR (black ash and Hill's pondweed), and eight provincially rare vegetation species in the GSWC (**Table B-1**; **Figure B-2**). Black ash was the only recent observation from 2018; all other records were from 1987 when specimens were collected for the Canadian Museum of Nature and University of Michigan. Similarly, the NHIC has designated the EOs for rigid sedge, beaked spikerush, and greater round-leaved orchid as "Historical". The Greenock Swamp Area of Natural and Scientific Interest (ANSI) Life Science Inventory report identified eight provincially rare vegetation species within the Greenock Swamp ANSI: Hill's pondweed, rigid sedge, beaked spikerush, restricted species V1, greater round-leaved orchid, green arrow arum (S3), eastern green-violet, and scarlet beebalm (S3) (Johnson 1994a). The first five species listed were also found within the BIS study areas through collation of NHIC and/or GBIF data (see **Table 1-2**; **Figure B-2**). Zoetica added green arrow arum, a rare wetland species, to this list of vegetation species of interest based on the Greenock Swamp ANSI Life Science Inventory findings. Eastern green-violet was also incidentally observed in the AOI during 2022 field studies (**Table B-2**). Scarlet beebalm is a terrestrial plant, but as there are no spatial data associated with the Greenock Swamp ANSI report, Zoetica cannot determine whether this species was observed within or outside the LSA_{TER}. Green arrow arum and scarlet beebalm are not mapped in this BIS Baseline Report due to the lack of spatial data associated with the Greenock Swamp ANSI report.

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[6] Due to the sensitivity of at-risk and rare species, spatial data from NHIC are represented by a 1 km grid rather than a point, as per the NHIC's Sensitive Data Location Standards. Descriptive reporting follows sensitivity standards and are not detailed enough to allow for precise geolocation.

Table 1-2. List of vegetation species of interest with records within the AOI, LSA_{TER}, and LSA_{AQU}, as identified through desk-based and Tier 1 field-based research. Species of conservation concern (at-risk and provincially rare), species mentioned during engagement, and weedy/introduced/invasive species are noted, where applicable. Incid. = incidental species observations from AHM, TEM, and eDNA field work in 2022. In study area columns, '-' means not detected, whereas '/' means not applicable to that study area (i.e., terrestrial species do not apply to the LSA_{AQU} and aquatic/wetland/riparian species do not apply to the LSA_{TER}).

	Reason for Interest						Dataset Detected In				Study Area[1]		
Species Common Name	**SAR**	**Rare**	**Engage.**	**Weed**	**Introd.**	**Invasive**	**Desk-based**	**TEM**	**AHM**	**Incid.**	**AOI**	**LSA_{TER}**	**LSA_{AQU}**
Vascular Plants													
Alder buckthorn	-	-	-	-	-	Y	-	Y	-	-	-	/	Y
Beaked spikerush	-	Y	-	-	-	-	Y	-	-	-	-	/	Y
Bittersweet nightshade	-	-	-	-	Y	-	Y	Y	Y	Y	Y	/	Y
Black ash	Y	-	-	-	-	-	Y	Y	-	Y	Y	/	Y
Bladder campion	-	-	-	-	Y	-	Y	Y	-	-	-	/	Y
Broad-leaved cattail	-	-	-	-	-	Y	-	-	-	Y	-	/	Y
Broad-leaved helleborine	-	-	-	-	Y	-	-	Y	-	-	Y	-	/
Bull thistle	-	-	-	Y	-	-	Y	-	Y	-	Y	-	/
Butternut	Y	-	-	-	-	-	-	-	-	Y	Y	-	/
Canada thistle	-	-	-	Y	-	-	-	-	Y	-	Y	-	/
Coltsfoot	-	-	-	Y	-	-	Y	Y	-	-	Y	-	/
Common buttercup	-	-	-	-	Y	-	-	Y	-	-	-	/	Y
Common dandelion	-	-	-	-	Y	-	-	Y	-	-	Y	-	/
Common timothy	-	-	-	-	Y	-	-	Y	-	-	Y	-	/
Curled dock	-	-	-	-	Y	-	-	Y	-	-	-	/	Y
Eastern green-violet	-	Y	-	-	-	-	Y	-	-	Y	-	Y	/
Eastern poison ivy	-	-	-	Y	-	-	-	Y	-	-	Y	/	Y
English plantain	-	-	-	-	Y	-	Y	Y	-	-	Y	-	/
European buckthorn	-	-	-	Y	-	Y	Y	Y	Y	Y	Y	/	Y
European common reed	-	-	-	-	-	Y	Y	-	-	Y	-	/	Y
European water-horehound	-	-	-	-	Y	-	Y	-	-	-	-	/	Y
Garden bird's-foot trefoil	-	-	-	-	Y	-	-	Y	-	-	Y	-	/
Goutweed	-	-	-	-	-	Y	Y	-	-	-	-	/	Y
Greater round-leaved orchid	-	Y	-	-	-	-	Y	-	-	-	-	/	Y

Species Common Name	Reason for Interest						Dataset Detected In				Study Area[1]		
	SAR	Rare	Engage.	Weed	Introd.	Invasive	Desk-based	TEM	AHM	Incid.	AOI	LSA_{TER}	LSA_{AQU}
Greek anemone	-	-	-	-	Y	-	Y	-	-	-	-	Y	/
Green arrow arum	-	Y	-	-	-	-	Y	-	-	-	-	/	Y
Green dragon	Y	Y	-	-	-	-	-	-	-	Y	-	/	Y
Hill's pondweed	Y	Y	-	-	-	-	Y	-	-	-	-	/	Y
Knapweed spp.	-	-	-	Y	-	-	-	Y	-	-	Y	-	Y
Lesser burdock	-	-	-	-	Y	-	-	Y	-	-	Y	-	/
Manitoba maple	-	-	-	-	-	Y	-	-	-	Y	-	/	Y
Meadow fescue	-	-	-	-	Y	-	-	Y	-	-	Y	-	/
Multiflora rose	-	-	-	-	-	Y	-	Y	-	-	-	Y	/
Narrow-leaved cattail	-	-	-	-	Y	-	-	Y	Y	-	Y	/	Y
Norway maple	-	-	-	-	-	Y	Y	-	Y	-	Y	-	/
Norway spruce	-	-	-	-	Y	-	-	Y	-	-	Y	-	/
Orchard grass	-	-	-	-	Y	-	-	Y	-	Y	Y	-	/
Oxeye daisy	-	-	-	-	Y	-	-	-	-	Y	-	Y	/
Poison-ivy	-	-	-	Y	-	-	Y	Y	-	Y	Y	/	Y
Purple loosestrife	-	-	-	-	-	Y	Y	-	-	Y	Y	/	-
Queen Anne's lace / wild carrot	-	-	-	-	Y	-	-	Y	-	Y	Y	-	/
Red clover	-	-	-	-	Y	-	-	Y	-	-	Y	-	/
Redtop	-	-	-	-	Y	-	-	-	-	Y	Y	/	Y
Reed canarygrass	-	-	-	-	-	Y	Y	Y	Y	Y	Y	/	Y
Restricted species V1	Y	Y	-	-	-	-	Y	-	-	-	RESTRICTED SPECIES		
Rigid sedge	-	Y	-	-	-	-	Y	-	-	-	-	/	Y
Rough bluegrass	-	-	-	-	Y	-	Y	-	-	-	-	/	Y
Scarlet beebalm		Y	-	-	-	-	Y	-	-	-	Unclear[2]		
Scots pine	-	-	-	-	-	Y	Y	-	Y	Y	Y	-	/
Slender mountain-mint	-	Y	-	-	-	-	Y	-	-	-	-	/	Y
Small-flowered hairy willowherb	-	-	-	-	Y	-	Y	-	-	-	-	/	Y
Smooth bedstraw	-	-	-	Y	-	-	-	Y	-	-	Y	-	/
Soybean	-	-	-	-	Y	-	-	-	Y	Y	Y	-	/

Species Common Name	Reason for Interest						Dataset Detected In				Study Area[1]		
	SAR	Rare	Engage.	Weed	Introd.	Invasive	Desk-based	TEM	AHM	Incid.	AOI	LSA_{TER}	LSA_{AQU}
Spotted lady's-thumb	-	-	-	-	Y	-	-	Y	-	-	-	/	Y
Stinging nettle	-	-	-	-	Y	-	-	-	Y	Y	Y	/	Y
Sulphur cinquefoil	-	-	-	-	Y	-	-	Y	-	-	Y	-	/
Swamp dodder	-	-	-	Y	-	-	-	Y	-	-	-	/	Y
Sweet cherry	-	-	-	-	Y	-	-	-	-	Y	Y	-	/
Tubercled orchid	-	Y	-	-	-	-	Y	-	-	-	-	/	Y
Water speedwell	-	-	-	-	Y	-	-	-	Y	-	Y	/	Y
Western poison ivy	-	-	-	Y	-	-	-	Y	-	-	Y	/	Y
White clover	-	-	-	-	Y	-	-	Y	-	-	Y	-	/
White sweet-clover	-	-	-	-	-	Y	-	Y	-	-	Y	Y	/
White willow	-	-	-	-	Y	-	Y	-	Y	-	Y	/	Y
Mosses & Liverworts													
American tree moss	-	Y	-	-	-	-	-	Y	-	-	-	/	Y
Bush's pocket moss	-	Y	-	-	-	-	Y	-	-	-	-	Y	/
Floating crystalwort	-	Y	-	-	-	-	Y	-	-	-	-	/	Y
Large-leaved leafy moss	-	Y	-	-	-	-	Y	-	-	-	-	/	Y

Notes:
[1]For the purposes of this table, the indicated study area excludes overlap with other study area(s) that may be encompassed within its boundaries.
[2]Scarlet beebalm was reported in the Greenock Swamp ANSI, but as there were no spatial data associated with the report, Zoetica cannot determine whether the species was found within or outside of the relevant study areas (AOI and LSA_{TER}).

1.3.3.2 Species of Interest to Stakeholders and Rights-Holders, and Species of Potential Socio-economic Importance

Community concerns relevant to vegetation were expressed during engagement conducted for the Project (see Table 5-5 and Appendix B of the BPPA Report (Zoetica 2021)). The need for rare plant inventories and studies of forest health was mentioned. There is great concern for forest health in the region; several invasive terrestrial species, including emerald ash borer (EAB), were noted to have a huge impact on the health and diversity of forests in the region. Studies of forest health are included in the BIS design (see Section 5.2.1 in the BPD Report (Zoetica 2022)) and work began in 2022 as part of Tier 1 TEM studies (see Appendix B, Chapter 1). These studies rated tree health as "fair" in most plots, largely due to signs of EAB, and to a lesser extent due to beech bark disease, fungus, cankers, and severe canopy decline. Field crews also evaluated the presence of standing snag trees as an indicator of a healthy ecosystem, and evidence of deer overbrowsing which can negatively impact forest health. See Chapter 9 for a discussion of EAB and other forest pests and diseases.

Concerns were raised during engagement regarding the protection of agricultural crops. The scope of the BIS focuses on vegetation as a component of biodiversity and does not include the study of agricultural crops or contaminants in vegetation. However, the Environmental Media Baseline Program (EMBP) will assess contaminant concentration in both traditionally harvested vegetation (e.g., roots and berries, medicinal and edible species) and agricultural vegetation deemed important to stakeholders and rights-holders (CanNorth 2021).

Existing observations of provincially rare vegetation were discussed in Section 1.3.3.1. No other specific vegetation species have been mentioned by stakeholders or rights-holders to date. However, the socio-economic or socio-ecological importance of additional vegetation species to local communities and/or Indigenous communities will be sought through future engagement.

1.3.3.2.1 Merchantable Timber

This section will be included in future BIS Baseline Reports after Tier 2 and Tier 3 data collection have been completed and analyzed.

1.3.3.3 Weedy, Introduced, and Invasive Species

A total of 48 weedy, introduced, or invasive vegetation species (all vascular plants) were detected within the BIS study areas in desk- and/or field-based observations (see **Table 1-2**; **Figure B-2**; **Figure B-4**). These include one provincially regulated species (European common reed – restricted), eight noxious weeds regulated under the Ontario *Weed Control Act* (knapweed species, Canada thistle, bull thistle, swamp dodder, smooth bedstraw, poison ivy (inc. eastern and western varieties), coltsfoot, and European buckthorn), 11 non-regulated invasive species (i.e., identified as species of concern by the Ontario Invading Species Awareness Program, Invasive Species Centre, and/or the Ontario Invasive Plant Council), and 29 species that are not considered invasive but are designated as exotic/introduced by the NHIC (SRANK: SNA) (see **Table A-3**). No prohibited invasive vegetation species (under the Ontario *Invasive Species Act*) have been reported within the BIS study areas for vegetation. The non-regulated species that are considered invasive are alder buckthorn, broad-leaved cattail, Manitoba maple, Norway maple, goutweed, purple loosestrife, white sweet-clover, reed canarygrass, Scots pine, European buckthorn, and multiflora rose (**Table 1-2**). All invasive vegetation records from EDDMapS and GBIF are recent (2014 – 2021). Only three exotic/introduced species (bladder campion, rough bluegrass, white willow) consisted of older museum specimen collection records from the 1980s, but bladder campion and white willow were both detected by field contractors in 2022 in the LSA_{ECO} (**Table B-3**) and AOI (**Table B-6**), respectively.

In desk-based data, there were no observations of weedy/introduced/invasive vegetation species within the AOI, but there were several observations by field teams in 2022. Field contractors incidentally observed bittersweet nightshade at five sites in the central and western AOI, broad-leaved helleborine at one site in the northeastern AOI and one in the western AOI, bull thistle and Canada thistle at one site in the northern AOI, coltsfoot at a site in the north-central AOI, common dandelion at a site in the northern AOI, common Timothy at two sites in the western AOI, eastern poison ivy at one sites in the north-central AOI, English plantain at three sites in the northern and western AOI, European buckthorn at four sites in the northern and western AOI, European reed at three sites in the southwestern AOI, garden bird's-foot trefoil at a site in the northwestern AOI, knapweed sp. at one site in the western AOI, narrow-leaved cattail at three sites in the southwestern AOI, Norway maple at a sites in the central AOI, orchard grass at two sites in the northern AOI, poison ivy at a site in the eastern AOI, purple loosestrife at one site in the central AOI and one in the northeastern AOI, redtop at one site in the north-central AOI, reed canarygrass at 63 sites throughout the AOI (except for the southeastern area), Scots pine at three sites in the northern AOI, soybean at two sites in the western AOI, stinging nettle at 15 sites throughout the AOI (except the southeastern area), sweet cherry at one site in the northeastern AOI, water speedwell at ten sites throughout the central AOI, western poison ivy at two sites in the western AOI, white willow at three sites in the north and western AOI, wild carrot at four sites in the northern and western AOI, and lesser burdock, meadow fescue, Norway spruce, red clover, smooth bedstraw, sulphur cinquefoil, white clover, and white sweet-clover all at one site in the northern AOI (**Figure B-4** – Map 4; **Table B-3**; **Table B-4**; **Table B-5**; **Table B-6**).

Desk-based data included one weedy/introduced/invasive observation within the LSA_{TER}: introduced Greek anemone was recorded at a site south of the AOI (**Figure B-2**). Field contractors observed reed canarygrass at six locations in the northern and eastern LSA_{TER}, oxeye daisy and redtop at a site in the northwestern LSA_{TER}, orchard grass and stinging nettle each at one site in the northeastern LSA_{TER}, and multiflora rose and white sweet-clover at a site in the eastern LSA_{TER} (**Figure B-4** – Map 4).

In desk-based data in the LSA_{AQU}, weedy/introduced/invasive vegetation was most frequently observed near Schmidt Lake in the GSWC (**Figure B-2**), which is likely due to increased disturbance as this lake is a popular recreational area. European buckthorn (weedy and invasive), broad-leaved cattail (invasive), and four introduced species (European highbush cranberry, bittersweet nightshade, European water-horehound, and small-flowered hairy willowherb) were found at Schmidt Lake in the desk-based data. Invasive goutweed was detected in EDDMapS data east of the AOI in the LSA_{AQU}. Introduced species rough bluegrass, bladder campion, and white willow were found elsewhere in the GSWC. No weedy, invasive, or introduced species were detected in the LSA_{AQU} south of the LSA_{TER} in desk-based data.

Field contractors detected several weedy/introduced/invasive species in the LSA_{AQU} outside of the AOI. Just north of the AOI, redtop was observed at the same site as oxeye daisy. In and around Schmidt Lake (northeastern LSA_{AQU}), field contractors detected bittersweet nightshade, bladder campion, broad-leaved cattail, broad-leaved helleborine, coltsfoot, common buttercup, common dandelion, English plantain, multiflora rose, orchard grass, poison ivy, red clover, reed canarygrass, stinging nettle, western poison ivy, white clover, and wild carrot across several sites (**Figure B-4** – Map 1). Elsewhere in the far northern LSA_{AQU}, field contractors detected European buckthorn at two sites, poison ivy at three sites, and broad-leaved helleborine, bittersweet nightshade, and eastern poison ivy at one site each. Clustered in the GSWC east of Cunningham Lake, field contractors found western poison ivy and poison ivy at seven sites each, European buckthorn and reed canarygrass at six sites each, bittersweet nightshade at four sites, common dandelion at three sites, broad-leaved helleborine at two sites, and common buttercup, English plantain, European reed, garden bird's-foot trefoil, knapweed sp., lesser burdock, orchard grass, spotted lady's-thumb, water speedwell, white sweet-clover, and wild carrot at one site each (**Figure B-4** – Map 1). In the east-central GSWC, field contractors recorded eight detections of reed canarygrass, seven poison ivy, four broad-leaved helleborine, three stinging nettle, three European buckthorn, two water speedwell, two European reed, and one each of common buttercup, common dandelion, bittersweet nightshade, and western poison ivy (**Figure B-4** – Map 2). Around Silver Lake in the west-central LSA_{AQU}, field contractors recorded reed canarygrass, Scots pine, and European buckthorn at one site, and reed canarygrass at another site (**Figure B-4** – Map 2). In the LSA_{AQU} north of the LSA_{TER}, field contractors recorded European buckthorn at 13 sites, reed canarygrass at seven sites, bittersweet nightshade at five sites, broad-leaved helleborine at four sites, western poison ivy at four sites, common dandelion at three sites, and Manitoba maple, lesser burdock, swamp dodder, eastern poison ivy, common buttercup, and water speedwell at one site each (**Figure B-4** – Map 3).

In the LSA_{AQU} south of the AOI, field contractors detected reed canarygrass at 11 sites, European buckthorn at seven sites, water speedwell at six sites, broad-leaved cattail at four sites, alder buckthorn, bittersweet nightshade, broad-leaved helleborine, narrow-leaved cattail, and stinging nettle at three sites each, and bull thistle, Canada thistle, common dandelion, curled dock, English plantain, poison ivy, and wild carrot at one site each (**Figure B-4** – Maps 4 and 5; **Table B-3**; **Table B-4**; **Table B-6**).

1.3.4 Additional Baseline Data to Inform the IA

1.3.4.1 Community Characterization

A detailed discussion of ELC mapping and ecosite-level analyses, including maps, is available in Appendix B, Chapter 1. These ecosite summaries provide a high-level overview of terrestrial vegetation communities in the AOI, LSA_{TER}, and the LSA_{ECO}. A summary of ecosite groupings within the BIS study areas for vegetation – AOI, LSA_{TER}, and LSA_{AQU}– is presented in Appendix B, Chapter 1. The RSA_{VEG} has not been studied yet, but data from this area will be included in future iterations of the BIS Baseline Report.

The Greenock Swamp ANSI Life Science Inventory report provides some insight into wetland vegetation communities within the BIS study areas, as the ANSI overlaps with the LSA_{AQU} and northern parts of the LSA_{TER} (see Section 1.3.1.2, Chapter 9). Approximately 680 vascular plants from 108 families, and over 125 species of non-vascular plants (including bryophytes, lichens, fungi, and algae), have been identified within the Greenock Swamp ANSI (Johnson 1994a). However, the list of non-vascular plants is admittedly "*quite incomplete, due to the surveyor's limited familiarity in the field with many genera and species of non-vascular plants*" (Johnson 1994a). A summary of the Greenock Swamp ANSI vascular plant inventory is provided in **Table A-2**.

1.4 Discussion

This Chapter 2 (Vegetation) of the 2023 BIS Baseline Report focused on desk- and field-based analyses of rare vegetation communities and species of interest observations. This iteration of the report includes one field season of Tier 1 data. Preliminary examinations of the vegetation community within the BIS study areas conducted through TEM and AHM surveys revealed the presence of a diversity of vegetation species (see Appendices B and D, Chapter 1). Additional years of study will provide a more comprehensive picture of the vegetation community. Complete results from additional Tier 1 terrestrial and aquatic habitat assessments and incidental observations, along with results from any future Tier 2 studies, will be reported in future iterations of the BIS Baseline Report.

To date, 16 vegetation species of conservation concern have been detected through desk- and/or field-based methods within the AOI, LSA_{TER}, and LSA_{AQU} (**Table 1-2**). These include at-risk black ash, green dragon, restricted species V1, butternut, and Hill's pondweed. Where a species has only been detected using desk-based data (i.e., restricted species V1, Bush's pocket moss, beaked spikerush, rigid sedge, large-leaved leafy moss, floating crystalwort, slender mountain-mint, and tubercled orchid), caution should be taken as those data could be as old as 1970, and the conditions supporting the species' presence in the area may have changed. In addition to habitats for provincially rare beaked spikerush, rigid sedge, and Bush's pocket moss, candidate SWH have been identified for Alvar and Old Growth Forest within the LSA_{TER}. Critical habitat for American ginseng and goldenseal overlaps the BIS study areas. If endangered American ginseng is found within the AOI and/or LSA_{TER} and could be directly or indirectly impacted by the Project, mitigation must consider the general habitat description for American ginseng (MECP 2021a) that is protected under the Ontario *Endangered Species Act* (*ESA*):

- Category 1 habitat (lowest tolerance to alteration) is the area occupied by American ginseng and the area of forest or treed swamp ELC community classes within 100 m of the occupied area.
- Category 2 habitat (moderate tolerance to alteration) is the area of forest or treed swamp ELC community classes between 100 m and 150 m of the occupied area, and contiguous with Category 1.

Ontario's general habitat description for American ginseng is also consistent with identification of critical habitat for this species as per the federal recovery strategy; namely, "areas of suitable habitat within a 150 m critical function zone around existing occurrence records of American ginseng" (ECCC 2018). Further discussions with knowledgeable stakeholders and rights-holders, along with additional baseline data collection through Tier 2 field studies, will help determine the locations of sensitive habitats for American ginseng, goldenseal, and other at-risk and rare vegetation species and communities.

The observation of butternut was not confirmed to be definitively the native species, as this must be determined by a Butternut Health Expert per the MECP (MECP 2021b). If SON-South Bruce is selected for Tier 2 studies, Zoetica will plan for Butternut Health Assessments following MECP guidelines within the AOI, which include guidance for field identification of butternut hybrids (MECP 2021b). The field location with the butternut observation in 2022, which was in the AOI (**Figure B-3**), would be revisited at this point to confirm the species identification.

The observations of green dragon were further north than the known species' range in Ontario, described as "southwest of a line from Hamilton to the Maitland River in Huron County" in the Management Plan (Donley et al. 2013). Green dragon releases vegetative offshoots into the water and relies on flooding to disperse these offshoots either up or downstream (Donley et al. 2013). The Maitland River flows through the Wingham Wetland Complex area in the southern LSA_{AQU} before emptying into Lake Huron at the town of Goderich. The green dragon observations were in the southern LSA_{AQU} around the TWC. Therefore, it may be feasible for offshoots to have dispersed upstream from the known range into the LSA_{AQU}. However, additional years of observation would confirm that these individuals survive and/or recruit offspring in the area. These individuals could represent a population “sink” where offspring disperse to an area but do not establish a successful population due to poor survival and/or reproduction. It is also possible that the species is spreading further north as climate change warms the areas north of its historically known range. The Management Plan states: "Since Green Dragon is conspicuous at its peak and often sought after by botanists, it is unlikely that the species has merely been overlooked at historical sites” (Donley et al. 2013). Therefore, searches for green dragon around the locations of the 2022 observations in future years should indicate whether the species is persisting in this area outside of its known range.

Forty-eight weedy/introduced/invasive species have been detected through desk- and/or field-based methods within the AOI, LSA_{TER}, and LSA_{AQU}. These include eight noxious weeds regulated under the Ontario *Weed Control Act*, one regulated invasive species, and 11 species listed as “of concern” (i.e., non-regulated invasive species) by the Ontario Invading Species Awareness Program, Invasive Species Centre, and/or the Ontario Invasive Plant Council (**Table 1-2**). The remaining 29 species are not noxious weeds or invasive, but are classified as exotic / introduced / non-native by the NHIC. Such species may currently be less of a concern than noxious weeds or invasive species, which are differentiated by their negative impacts on the environment, economy, and/or human health.

Methods for Tier 2 field studies planned for vegetation may include a combination of floristic inventory and intuitive meander techniques to detect rare species, culturally important species, and weeds, introduced, and invasive species within the LSA_{TER} and LSA_{AQU}. Depending on the rarity of candidate SWH ecosites (polygons) in the LSA_{TER} (see Appendix C, Chapter 1), surveys for potential rare and exemplary vegetation communities will be conducted as per the *Standard for Terrestrial Ecosystem Mapping in British Columbia* (RIC 1998). Refer to Section 5.2.1 of the BPPA Report (Zoetica 2021) for more information.

A more complete discussion of vegetation will be included in future iterations of the BIS Baseline Report after additional years of Tier 1 field data have been collected and analyzed. Tier 2 studies will be completed if the SON-South Bruce siting area is selected for additional baseline investigations for the Project.

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APPENDIX A – SPECIES NAMES & VEGETATION SPECIES DETECTED

Table A-1. Common and scientific names for species mentioned in this report. Species names follow the NHIC's Ontario species lists (current to March 1, 2023). Habitat is classified as terrestrial if the species is an Upland (UPL) or Facultative Upland (FACU) species, wetland/riparian if the species is a Facultative Wetland (FACW), or Facultative (FAC; meaning occurs in wetlands and non-wetlands) species, and aquatic if the species is an Obligate Wetland (OBL) species (Lichvar et al. 2012) as listed on the USDA Plants Database (USDA and NRCS 2023) - Northcentral & Northeast region. For species without wetland codes, the habitat was gathered from species' profiles on Go Botany ("Native Plant Trust Go Botany" 2023), unless otherwise cited in a footnote.

Common Name	Scientific Name	Habitat
VEGETATION		
Balsam fir	*Abies balsamea*	Wetland/Riparian (FAC)
Fir	*Abies* sp.	N/A
Manitoba maple	*Acer negundo*	Wetland/Riparian (FAC)
Black maple	*Acer nigrum*	Terrestrial (FACU)
Norway maple	*Acer platanoides*	Terrestrial (UPL)
Red maple	*Acer rubrum*	Wetland/Riparian (FAC)
Silver maple	*Acer saccharinum*	Wetland/Riparian (FACW)
Sugar maple	*Acer saccharum*	Terrestrial (FACU)
Maple	*Acer* sp.	N/A
Freeman's maple	*Acer x freemanii*	N/A
Jointed goatgrass	*Aegilops cylindrica*	Terrestrial
Goutweed	*Aegopodium podagraria*	Wetland/Riparian (FAC)
Redtop	*Agrostis gigantea*	Wetland/Riparian (FACW)
Tree-of-heaven	*Ailanthus altissima*	Terrestrial (UPL)
Garlic mustard	*Alliaria petiolata*	Terrestrial (FACU)
European black alder	*Alnus glutinosa*	Wetland/Riparian (FACW)
Slender meadow foxtail	*Alopecurus myosuroides*	Wetland/Riparian (FACW)
Common ragweed	*Ambrosia artemisiifolia*	Terrestrial (FACU)
Ragweed spp.	*Ambrosia* spp.	N/A
Great ragweed	*Ambrosia trifida*	Wetland/Riparian (FAC)
Greek anemone	*Anemone blanda*	Terrestrial
Wild chervil	*Anthriscus sylvestris*	Terrestrial
Lesser burdock	*Arctium minus*	Terrestrial (FACU)
Green dragon	*Arisaema dracontium*	Wetland/Riparian (FACW)
Giant reed	*Arundo donax*	Terrestrial
Common milkweed	*Asclepias syriaca*	Terrestrial (UPL)
Milkweed	*Asclepias* sp.	N/A
Mountain grape	*Mahonia aquifolium*	Terrestrial (UPL)
Japanese barberry	*Berberis thunbergii*	Terrestrial (FACU)
Common barberry	*Berberis vulgaris*	Terrestrial (FACU)
Yellow birch / swamp birch	*Betula alleghaniensis*	Wetland/Riparian (FAC)
White birch / paper birch	*Betula papyrifera*	Terrestrial (FACU)
Birch	*Betula* sp.	N/A

Common Name	**Scientific Name**	**Habitat**
Small-spike false nettle	*Boehmeria cylindrica*	Aquatic (OBL)
Flowering-rush	*Butomus umbellatus*	Aquatic (OBL)
Carolina fanwort	*Cabomba caroliniana*	Aquatic (OBL)
Bluejoint reedgrass	*Calamagrostis canadensis*	Aquatic (OBL)
Fringed sedge	*Carex crinita*	Aquatic (OBL)
Lake sedge	*Carex lacustris*	Aquatic (OBL)
Woolly-fruit sedge	*Carex lasiocarpa*	Aquatic (OBL)
Sedge species	*Carex* spp.	N/A
Tussock sedge	*Carex stricta*	Aquatic (OBL)
Rigid sedge	*Carex tetanica*	Wetland/Riparian (FACW)
Eastern rough sedge	*Carex scabrata*	Aquatic (OBL)
Blue beech	*Carpinus caroliniana*	Wetland/Riparian (FAC)
Diffuse knapweed	*Centaurea diffusa*	Terrestrial
Iberian starthistle	*Centaurea iberica*	Terrestrial
Brown knapweed	*Centaurea jacea*	Terrestrial (FACU)
Black knapweed	*Centaurea nigra*	Terrestrial
Yellow starthistle	*Centaurea solstitialis*	Terrestrial
Knapweed spp.	*Centaurea* spp.	N/A
Spotted knapweed	*Centaurea stoebe*	Terrestrial
Spotted knapweed	*Centaurea stoebe* ssp. *micranthos*	Terrestrial
Coontail species	*Ceratophyllum* spp.	N/A
Leatherleaf	*Chamaedaphne calyculata*	Aquatic (OBL)
Stonewort species	Charales	N/A
White turtlehead	*Chelone glabra*	Aquatic (OBL)
Woodreed	*Cinna* sp.	N/A
Broad-leaved enchanter's nightshade	*Circaea canadensis*	Terrestrial (FACU)
Canada thistle	*Cirsium arvense*	Terrestrial (FACU)
Bull thistle	*Cirsium vulgare*	Terrestrial (FACU)
Clematis	*Clematis* sp.	N/A
American tree moss	*Climacium americanum*	Wetland/Riparian[7]
Yellow clintonia	*Clintonia borealis*	Wetland/Riparian (FAC)
Poison-hemlock	*Conium maculatum*	Wetland/Riparian (FACW)
Bunchberry	*Cornus canadensis*	Wetland/Riparian (FAC)
Silky dogwood	*Cornus obliqua*	Wetland/Riparian (FACW)
Red-osier dogwood	*Cornus sericea*	Wetland/Riparian (FACW)
Dogwood	*Cornus* sp.	N/A
Hawthorn	*Crataegus* sp.	N/A
Common crupina	*Crupina vulgaris*	Terrestrial
Smallseed alfalfa dodder	*Cuscuta approximata*	Terrestrial
Compact dodder	*Cuscuta compacta*	Terrestrial

[7] See description of habitat at ("American Tree Moss" n.d.)

Common Name	Scientific Name	Habitat
Flax dodder	*Cuscuta epilinum*	Terrestrial
Clover dodder	*Cuscuta epithymum*; *C. epithymum* var. *epithymum*	Terrestrial
Swamp dodder	*Cuscuta gronovii*	Wetlands/Riparian
Japanese dodder	*Cuscuta japonica*	Terrestrial[8]
Dodder spp.	*Cuscuta* spp.	N/A
Showy lady's slipper	*Cypripedium reginae*	Wetland/Riparian (FACW)
Orchard grass	*Dactylis glomerata*	Terrestrial (FACU)
Wild carrot / Queen Anne's lace	*Daucus carota*	Terrestrial (UPL)
Swamp loosestrife	*Decodon verticillatus*	Aquatic (OBL)
Chinese yam	*Dioscorea polystachya*	Terrestrial
Spinulose wood fern	*Dryopteris carthusiana*	Wetland/Riparian (FACW)
Paterson's curse	*Echium plantagineum*	Terrestrial
Brazilian elodea	*Egeria densa*	Aquatic (OBL)
Common water-hyacinth	*Eichhornia crassipes*	Aquatic (OBL)
Autumn olive	*Elaeagnus umbellata*	Terrestrial
Beaked spikerush	*Eleocharis rostellata*	Aquatic (OBL)
Waterweed species	*Elodea* spp.	N/A
Small-flowered hairy willowherb	*Epilobium parviflorum*	Wetland/Riparian (FACW)
Broad-leaved helleborine	*Epipactis helleborine*	Terrestrial (UPL)
Horsetail	*Equisetum* sp.	N/A
Woolly cupgrass	*Eriochloa villosa*	Terrestrial[9]
Tawny cottongrass	*Eriophorum virginicum*	Aquatic (OBL)
Winged euonymus	*Euonymus alatus*	Terrestrial
Boneset	*Eupatorium* sp.	N/A
Cypress spurge	*Euphorbia cyparissias*	Terrestrial
Leafy spurge	*Euphorbia esula; E. virgata*	Terrestrial
Large-leaf aster	*Eurybia macrophylla*	Terrestrial (UPL)
Grass-leaved goldenrod	*Euthamia graminifolia*	Wetland/Riparian (FAC)
Spotted joe-pye weed	*Eutrochium maculatum*	Aquatic (OBL)
Joe-pye weed	*Eutrochium* sp.	N/A
American beech	*Fagus grandifolia*	Terrestrial (FACU)
Bush's pocket moss	*Fissidens bushii*	Terrestrial
Alder / glossy buckthorn	*Frangula alnus*	Wetland/Riparian (FAC)
White ash	*Fraxinus americana*	Territorial (FACU)
Black ash	*Fraxinus nigra*	Wetland/Riparian (FACW)
Green ash / red ash	*Fraxinus pennsylvanica*	Wetland/Riparian (FACW)
Ash	*Fraxinus* sp.	N/A
Smooth bedstraw	*Galium mollugo*	Terrestrial (FACU)
Fowl mannagrass	*Glyceria striata*	Aquatic (OBL)

[8] (DiTomaso et al. 2013)
[9] (Minnesota Wildflowers 2023)

Common Name	Scientific Name	Habitat
Soybean	*Glycine max*	Terrestrial
English ivy	*Hedera helix*	Terrestrial (FACU)
Giant hogweed	*Heracleum mantegazzianum*	Wetland/Riparian (FAC)
Hawkweed	*Hieracium* sp.	N/A
Eastern green-violet	*Hybanthus concolor*	Terrestrial (FACU)
Goldenseal	*Hydrastis canadensis*	Terrestrial
Hydrilla	*Hydrilla verticillata*	Aquatic (OBL)
European frog-bit	*Hydrocharis morsus-ranae*	Aquatic (OBL)
Common winterberry	*Ilex verticillata*	Wetland/Riparian (FACW)
Spotted jewelweed	*Impatiens capensis*	Wetland/Riparian (FACW)
Purple jewelweed	*Impatiens glandulifera*	Wetland/Riparian (FAC)
Yellow iris	*Iris pseudacorus*	Aquatic (OBL)
Harlequin blue flag	*Iris versicolor*	Aquatic (OBL)
Tansy ragwort	*Jacobaea vulgaris*	Terrestrial (UPL)
Twinleaf	*Jeffersonia diphylla*	Terrestrial
Butternut	*Juglans cinerea*	Terrestrial (FACU)
Black walnut	*Juglans nigra*	Terrestrial (FACU)
Himalayan knotweed	*Koenigia polystachya*	Wetland/Riparian[10]
Canada wood nettle	*Laportea canadensis*	Wetland/Riparian (FACW)
European larch	*Larix decidua*	Terrestrial
Tamarack	*Larix laricina*	Wetland/Riparian (FACW)
Duckweed species	Lemnaceae spp.	N/A
Oxeye daisy	*Leucanthemum vulgare*	Terrestrial (UPL)
Northern spicebush	*Lindera benzoin*	Wetland/Riparian (FACW)
Loesel’s twayblade	*Liparis loeselii*	Wetland/Riparian (FACW)
Cardinal flower	*Lobelia cardinalis*	Aquatic (OBL)
Meadow fescue	*Lolium pratense*	Terrestrial (FACU)
Japanese honeysuckle	*Lonicera japonica*	Terrestrial (FACU)
Maack’s honeysuckle	*Lonicera maackii*	Terrestrial
Morrow’s honeysuckle	*Lonicera morrowii*	Terrestrial (FACU)
Bush honeysuckle spp. (exotic)	*Lonicera* spp.	N/A
Tatarian honeysuckle	*Lonicera tatarica*	Terrestrial (FACU)
Bell’s honeysuckle	*Lonicera x bella*	N/A
Dwarf honeysuckle	*Lonicera xylosteum*	Terrestrial
Garden bird’s-foot trefoil	*Lotus corniculatus*	Terrestrial (FACU)
European water-horehound	*Lycopus europaeus*	Aquatic (OBL)
Northern water-horehound	*Lycopus uniflorus*	Aquatic (OBL)
Purple loosestrife	*Lythrum salicaria*	Aquatic (OBL)
Barberry	*Mahoberberis* spp.; *Mahonia* spp.	N/A
Apple	*Malus* sp.	N/A

[10] (Invasive Species Centre 2023)

Common Name	Scientific Name	Habitat
Ostrich fern	*Matteuccia struthiopteris*	Wetland/Riparian (FAC)
White sweet-clover	*Melilotus albus*	Terrestrial (FACU)
Japanese stiltgrass	*Microstegium vimineum*	Wetland/Riparian (FAC)
Amur silvergrass	*Miscanthus sacchariflorus*	Terrestrial
Chinese silvergrass	*Miscanthus sinensis*	Terrestrial (UPL)
Miscanthus spp.	*Miscanthus* spp.	N/A
Scarlet beebalm	*Monarda didyma*	Terrestrial (FACU)
White mulberry	*Morus alba*	Terrestrial (FACU)
Sweet gale	*Myrica gale*	Aquatic (OBL)
Brazilian water-milfoil / parrot feather	*Myriophyllum aquaticum*	Aquatic (OBL)
Eurasian water-milfoil	*Myriophyllum spicatum*	Aquatic (OBL)
Water-milfoil	*Myriophyllum* spp.	N/A
Serrated tussock	*Nassella trichotoma*	Terrestrial[11]
Watercress species	*Nasturtium* or *Rorippa* spp.	N/A
Starry stonewort	*Nitellopsis obtusa*	Aquatic[12]
Yellow pond-lily / spatterdock	*Nuphar* spp.	N/A
Water-lily species	Nymphaeaceae	N/A
Yellow floatingheart	*Nymphoides peltata*	Aquatic (OBL)
Sensitive fern	*Onoclea sensibilis*	Wetland/Riparian (FACW)
Broomrape	*Orobanche* spp.	N/A
Royal fern	*Osmunda regalis*	Wetland/Riparian
Ironwood / eastern hop-hornbeam	*Ostrya virginiana*	Terrestrial (FACU)
American ginseng	*Panax quinquefolius*	Wetland/Riparian[13]
Dallisgrass	*Paspalum dilatatum*	Wetland/Riparian (FAC)
Wild parsnip	*Pastinaca sativa*	Terrestrial
Green arrow arum	*Peltandra virginica*	Aquatic (OBL)
Spotted lady's-thumb	*Persicaria maculosa*	Wetland/Riparian (FAC)
Mile-a-minute vine	*Persicaria perfoliata*	Wetland/Riparian (FAC)
Reed canarygrass	*Phalaris arundinacea*	Wetland/Riparian (FACW)
Canarygrass	*Phalaris* sp.	N/A
Common Timothy	*Phleum pratense*	Terrestrial (FACU)
European (common) reed	*Phragmites australis* ssp. *australis*	Wetland/Riparian (FACW)
Ninebark	*Physocarpus* sp.	N/A
Norway Spruce	*Picea abies*	Terrestrial
White spruce	*Picea glauca*	Terrestrial (FACU)
Black spruce	*Picea mariana*	Wetland/Riparian (FACW)
Spruce	*Picea* sp.	N/A
Red pine	*Pinus resinosa*	Terrestrial (FACU)

[11] (CABI 2019)
[12] (Kipp et al. 2020)
[13] (Crowley et al. 2023)

Common Name	Scientific Name	Habitat
Pine	*Pinus* sp.	N/A
Eastern white pine	*Pinus strobus*	Terrestrial (FACU)
Scots pine	*Pinus sylvestris*	Terrestrial
Water lettuce	*Pistia stratiotes*	Aquatic (OBL)
English plantain	*Plantago lanceolata*	Terrestrial (FACU)
Club-spur orchid	*Platanthera clavellata*	Wetland/Riparian (FACW)
Tubercled orchid	*Platanthera flava*	Wetland/Riparian (FACW)
Greater round-leaved orchid	*Platanthera macrophylla*	Wetland/Riparian (FAC)
Canada bluegrass	*Poa compressa*	Terrestrial (FACU)
Rough bluegrass	*Poa trivialis*	Wetland/Riparian (FACW)
Ferns	Polypodiopsida	N/A
Pickerelweed	*Pontederia cordata*	Aquatic (OBL)
Balsam poplar	*Populus balsamifera*	Wetland/Riparian (FACW)
Aspen	*Populus* sp.	N/A
Poplar	*Populus* sp.	N/A
Trembling aspen	*Populus tremuloides*	Terrestrial (FACU)
Largeleaf pondweed	*Potamogeton amplifolius*	Aquatic (OBL)
Hill's pondweed	*Potamogeton hillii*	Aquatic (OBL)
Sulphur cinquefoil	*Potentilla recta*	Terrestrial
Sweet cherry	*Prunus avium*	Terrestrial (FACU)
Black cherry	*Prunus serotina*	Terrestrial (FACU)
Cherry	*Prunus* sp.	N/A
Chokecherry	*Prunus virginiana*	Terrestrial (FACU)
Kudzu	*Pueraria montana*	Terrestrial (UPL)
Slender mountain-mint	*Pycnanthemum tenuifolium*	Wetland/Riparian (FAC)
White oak	*Quercus alba*	Terrestrial (FACU)
Bur oak	*Quercus macrocarpa*	Terrestrial (FACU)
Northern red oak	*Quercus rubra*	Terrestrial (FACU)
Oak	*Quercus* sp.	N/A
Common buttercup	*Ranunculus acris*	Wetland/Riparian (FAC)
Japanese knotweed	*Reynoutria japonica* var. *japonica*	Terrestrial (FACU)
Giant knotweed	*Reynoutria sachalinensis*	Terrestrial (UPL)
Bohemian knotweed	*Reynoutria x bohemica*	Terrestrial (FACU)
European buckthorn	*Rhamnus cathartica*	Wetland/Riparian (FAC)
Buckthorn	*Rhamnus* sp.	N/A
Russian knapweed	*Rhaponticum repens*	Terrestrial[14]
Large-leaved leafy moss	*Rhizomnium magnifolium*	Wetland/riparian[15]
Floating crystalwort	*Riccia fluitans*	Aquatic
Black locust	*Robinia pseudoacacia*	Terrestrial (FACU)

[14] (Washington State Noxious Weed Control Board n.d.)
[15] (Karanosky 2023)

Common Name	Scientific Name	Habitat
Watercress	*Rorippa* sp.	N/A
Multiflora rose	*Rosa multiflora*	Terrestrial (FACU)
Dwarf raspberry	*Rubus pubescens*	Wetland/Riparian (FACW)
Raspberry	*Rubus* sp.	N/A
Curled dock	*Rumex crispus*	Wetland/Riparian (FAC)
Dock	*Rumex* sp.	N/A
Arrowhead species	*Sagittaria* spp.	N/A
White willow	*Salix alba*	Wetland/Riparian (FACW)
Peach-leaf willow	*Salix amygdaloides*	Wetland/Riparian (FACW)
Willow species	*Salix spp.*	N/A
American elder	*Sambucus canadensis*	Wetland/Riparian
Elderberry	*Sambucus* sp.	N/A
Northern pitcher plant	*Sarracenia purpurea*	Aquatic (OBL)
Dark-green bulrush	*Scirpus atrovirens*	Aquatic (OBL)
Common woolly bulrush	*Scirpus cyperinus*	Aquatic (OBL)
South African ragwort	*Senecio inaequidens*	Terrestrial
Madagascar ragwort	*Senecio madagascariensis*	Terrestrial
Bladder campion	*Silene vulgaris*	Wetland/Riparian
Common water-parsnip	*Sium suave*	Aquatic (OBL)
Bittersweet nightshade	*Solanum dulcamara*	Wetland/Riparian (FAC)
Silverleaf nightshade	*Solanum elaeagnifolium*	Terrestrial
Tall goldenrod	*Solidago altissima*	Terrestrial (FACU)
Canada goldenrod	*Solidago canadensis*	Terrestrial (FACU)
Giant goldenrod	*Solidago gigantea*	Wetland/Riparian (FACW)
Grey-stemmed goldenrod	*Solidago nemoralis*	Terrestrial
Wrinkleleaf goldenrod	*Solidago rugosa*	Wetland/Riparian (FAC)
Goldenrod	*Solidago* sp.	N/A
Perennial sowthistle	*Sonchus arvensis*	Terrestrial (FACU)
Spiny sowthistle	*Sonchus asper*	Terrestrial (FACU)
Annual sowthistle	*Sonchus oleraceus*	Terrestrial (FACU)
Sow-thistle spp.	*Sonchus spp.*	N/A
Eastern burreed / American burreed	*Sparganium americanum*	Aquatic (OBL)
Burreed	*Sparganium* sp.	N/A
Sphagnum	*Sphagnum* sp.	N/A
Meadowsweet	*Spiraea* sp.	N/A
Sheathed dropseed	*Sporobolus vaginiflorus*	Terrestrial
American bladdernut	*Staphylea trifolia*	Wetland/Riparian (FAC)
Water soldier	*Stratiotes aloides*	Aquatic
Witchweed	*Striga* spp.	N/A
Sago pondweed	*Stuckenia pectinata*	Aquatic (OBL)
White panicle aster / panicled aster	*Symphyotrichum lanceolatum*	Wetland/Riparian (FACW)
New England aster	*Symphyotrichum novae-angliae*	Wetland/Riparian (FACW)

Common Name	Scientific Name	Habitat
Old field aster	*Symphyotrichum pilosum*	Terrestrial (FACU)
Purple-stemmed aster	*Symphyotrichum puniceum*	Aquatic (OBL)
Common dandelion	*Taraxacum officinale*	Terrestrial (FACU)
Canada yew	*Taxus canadensis*	Terrestrial (FACU)
Eastern white cedar	*Thuja occidentalis*	Wetland/Riparian (FACW)
Cedar	*Thuja* sp.	N/A
Basswood	*Tilia americana*	Terrestrial (FACU)
Erect hedge-parsley	*Torilis japonica*	Terrestrial
Poison-ivy	*Toxicodendron radicans*	Wetland/Riparian (FAC)
Eastern poison ivy	*Toxicodendron radicans* var. *radicans*	Wetland/Riparian (FAC)
Western poison ivy	*Toxicodendron radicans* var. *rydbergii*	Wetland/Riparian (FAC)
Toxicodendron	*Toxicodendron* sp.	N/A
(European) water chestnut	*Trapa natans*	Aquatic (OBL)
Red clover	*Trifolium pratense*	Terrestrial (FACU)
White clover	*Trifolium repens*	Terrestrial (FACU)
Wheat	*Triticum* sp.	N/A
Eastern hemlock	*Tsuga canadensis*	Terrestrial (FACU)
Hemlock	*Tsuga* sp.	N/A
Coltsfoot	*Tussilago farfara*	Terrestrial (FACU)
Narrow-leaved cattail	*Typha angustifolia*	Aquatic (OBL)
Broad-leaved cattail	*Typha latifolia*	Aquatic (OBL)
Cattail species	*Typha* spp.	N/A
American elm / white elm	*Ulmus americana*	Wetland/Riparian (FACW)
Siberian elm	*Ulmus pumila*	Terrestrial (FACU)
Elm	*Ulmus* sp.	N/A
Stinging nettle	*Urtica dioica*	Wetland/Riparian (FAC)
Bladderwort species	*Utricularia* spp.	N/A
American eelgrass	*Vallisneria americana*	Aquatic (OBL)
Water speedwell	*Veronica anagallis-aquatica*	Aquatic (OBL)
Marsh speedwell	*Veronica scutellata*	Aquatic (OBL)
Nannyberry	*Viburnum lentago*	Wetland/Riparian (FAC)
European highbush cranberry	*Viburnum opulus*	Wetland/Riparian (FACW)
Lesser periwinkle	*Vinca minor*	Terrestrial
Black swallowwort / black dog-strangling vine	*Vincetoxicum nigrum*	Terrestrial
European (pale) swallowwort	*Vincetoxicum rossicum*	Terrestrial
Riverbank grape	*Vitis riparia*	Wetland/Riparian (FAC)
Wild grape	*Vitis* sp.	N/A
Corn	*Zea mays*	Terrestrial
Syrian bean-caper	*Zygophyllum fabago*	Terrestrial[16]

[16] (CFIA 2016)

Common Name	Scientific Name	Habitat
OTHER SPECIES		
Emerald ash borer	*Agrilus planipennis*	N/A
Beech bark disease	*Neonectria faginata*	N/A

Table A-2. Vascular plants of the Greenock Swamp ANSI (Johnson 1994a).

Family[1]	Common Name	No. Species
Equisetaceae	Horsetail Family	5
Lycopodiaceae	Clubmoss Family	5
Selaginellaceae	Spikemoss Family	1
Ophioglossaceae	Adder's Tongue Family	4
Osmundaceae	Flowering Fern Family	3
Dennstaedtiaceae	Bracken Family	2
Pteridaceae	Maidenhair Fern Family	1
Dryopteridaceae	Wood Fern Family	13
Thelypteridaceae	Beech Fern Family	3
Taxaceae	Yew Family	1
Pinaceae	Pine Family	6
Cupressaceae	Cypress Family	1
Typhaceae	Cat-tail Family	2
Sparganiaceae	Bur-reed Family	4
Potamogetonaceae	Pondweed Family	9
Najadaceae	Naiad Family	1
Juncaginaceae	Arrow-grass Family	1
Alismataceae	Water-plantain Family	3
Hydrocharitaceae	Frog's-bit Family	1
Gramineae (Poaceae)	Grass Family	54
Cyperaceae	Sedge Family	80
Araceae	Arum Family	3
Lemnaceae	Duckweed Family	4
Pontederiaceae	Pickerel-weed Family	1
Juncaceae	Rush Family	8
Liliaceae	Lily Family	19
Smilacaceae	Greenbrier Family	2
Iridaceae	Iris Family	2
Orchidaceae	Orchid Family	22
Salicaceae	Willow Family	18
Myricaceae	Wax-myrtle Family	1
Juglandaceae	Walnut Family	1
Betulaceae	Birch Family	6
Fagaceae	Beech Family	3
Ulmaceae	Elm Family	2
Urticaceae	Nettle Family	4
Aristolochiaceae	Birthwort Family	1
Polygonaceae	Buckwheat Family	13
Chenopodiaceae	Goosefoot Family	2
Amaranthaceae	Amaranth Family	2
Portulacaceae	Purslane Family	2

Family[1]	Common Name	No. Species
Caryophyllaceae	Pink Family	7
Ceratophyllaceae	Hornwort Family	2
Cabombaceae	Cabomba Family	1
Nymphaeaceae	Water Lily Family	2
Ranunculaceae	Crowfoot Family	21
Berberidaceae	Barberry Family	2
Menispermaceae	Moonseed Family	1
Lauraceae	Laurel Family	1
Papaveraceae	Poppy Family	1
Fumariaceae	Fumitory Family	2
Cruciferae (Brassicaceae)	Mustard Family	10
Sarraceniaceae	Pitcher Plant Family	1
Droseraceae	Sundew Family	1
Saxifragaceae	Saxifrage Family	6
Grossulariaceae	Gooseberry Family	6
Rosaceae	Rose Family	41
Leguminosae (Fabaceae)	Pea Family	13
Linaceae	Flax Family	1
Oxalidaceae	Wood-sorrel Family	2
Geraniaceae	Geranium Family	1
Rutaceae	Rue Family	1
Polygalaceae	Milkwort Family	1
Euphorbiaceae	Spurge Family	5
Callitrichaceae	Water Starwort Family	1
Anacardiaceae	Cashew Family	2
Aquifoliaceae	Holly Family	2
Celastraceae	Staff-tree Family	1
Aceraceae	Maple Family	5
Balsaminaceae	Touch-me-not Family	1
Rhamnaceae	Buckthorn Family	2
Vitaceae	Vine Family	2
Tiliaceae	Basswood Family	1
Malvaceae	Mallow Family	1
Guttiferae (Clusiaceae)	St. John's-wort Family	2
Violaceae	Violet Family	13
Thymelaeaceae	Mezereum Family	2
Lythraceae	Loosestrife Family	2
Onagraceae	Evening Primrose Family	10
Haloragaceae	Water Milfoil Family	2
Araliaceae	Ginseng Family	4
Umbelliferae (Apiaceae)	Carrot Family	11
Cornaceae	Dogwood Family	5

Family[1]	Common Name	No. Species
Pyrolaceae	Wintergreen Family	4
Monotropaceae	Indian Pipe Family	1
Ericaceae	Heath Family	11
Primulaceae	Primrose Family	6
Oleaceae	Olive Family	3
Gentianaceae	Gentian Family	2
Menyanthaceae	Buckbean Family	1
Apocynaceae	Dogbane Family	3
Asclepiadaceae (Apocynaceae)	Milkweed Family	2
Convolvulaceae	Morning Glory Family	3
Polemoniaceae	Phlox Family	1
Hydrophyllaceae	Waterleaf Family	2
Boraginaceae	Borage Family	5
Verbenaceae	Vervain Family	3
Labiatae (Lamiaceae)	Mint Family	15
Solanaceae	Nightshade Family	3
Scrophulariaceae	Figwort Family	13
Orobanchaceae	Broom-rape Family	1
Lentibulariaceae	Bladderwort Family	4
Plantaginaceae	Plantain Family	3
Rubiaceae	Madder Family	11
Caprifoliaceae	Honeysuckle Family	13
Dipsacaceae	Teasel Family	1
Cucurbitaceae	Gourd Family	1
Campanulaceae	Bluebell Family	5
Compositae (Asteraceae)	Composite Family	61

Notes:
1. Taxonomic family names from the Greenock Swamp ANSI report are presented. Updated family names from the NHIC's Ontario species list (current to April 11, 2022) are provided in parentheses, where applicable.

Table A-3. List of regulated and non-regulated invasive and noxious weed species of concern in Ontario. This list does not imply potential occurrence in the SON-South Bruce siting area, as several invasive species “on the radar” have not yet been found in Ontario or even Canada; however, these species are known to have significant ecological, social, health, and/or economic impacts in other areas of North America and worldwide, where they have been introduced.

Subgroup	**Common Name**	**Scientific Name**	**Ontario *ISA*[1]**		**Noxious Weed[2]**	**CFIA[3]**	**Ont. ISAP[4]**	**ISC[5]**	**Ont. IPC[6]**
			Prohibited	**Restricted**					
Terrestrial	Norway Maple	*Acer platanoides*							X
Terrestrial	Jointed Goatgrass	*Aegilops cylindrica*			X	X			
Terrestrial	Goutweed	*Aegopodium podagraria*					X		X
Terrestrial	Tree-of-heaven	*Ailanthus altissima*						X	
Terrestrial	Garlic Mustard	*Alliaria petiolata*					X	X	X
Terrestrial	European Black Alder	*Alnus glutinosa*							X
Terrestrial	Slender Meadow Foxtail	*Alopecurus myosuroides*				X			
Terrestrial	Common Ragweed	*Ambrosia artemisiifolia*			X				
Terrestrial	Ragweed spp.	*Ambrosia* spp.			X				
Terrestrial	Great Ragweed	*Ambrosia trifida*			X				
Terrestrial	Wild Chervil	*Anthriscus sylvestris*			X		X		
Terrestrial	Giant Reed	*Arundo donax*				X			
Terrestrial	Mountain Grape	*Berberis aquifolium*				X			
Terrestrial	Japanese Barberry	*Berberis thunbergii*				X	X		
Terrestrial	Common Barberry	*Berberis vulgaris*			X	X			
Aquatic	Flowering-rush	*Butomus umbellatus*					X	X	X
Aquatic	Carolina Fanwort	*Cabomba caroliniana*		X			X	X	
Terrestrial	Diffuse Knapweed	*Centaurea diffusa*			X				
Terrestrial	Iberian starthistle	*Centaurea iberica*				X			
Terrestrial	brown knapweed	*Centaurea jacea*			X				
Terrestrial	black knapweed	*Centaurea nigra*			X				
Terrestrial	Yellow starthistle	*Centaurea solstitialis*				X			
Terrestrial	Knapweed spp.	*Centaurea* spp.			X				
Terrestrial	Spotted knapweed	*Centaurea stoebe*			X				X
Terrestrial	Spotted Knapweed	*Centaurea stoebe* ssp. *micranthos*			X				X

Subgroup	Common Name	Scientific Name	Ontario *ISA*[1]		Noxious Weed[2]	CFIA[3]	Ont. ISAP[4]	ISC[5]	Ont. IPC[6]
			Prohibited	Restricted					
Terrestrial	Canada Thistle	*Cirsium arvense*			X				
Terrestrial	Bull Thistle	*Cirsium vulgare*			X				
Terrestrial	Poison-hemlock	*Conium maculatum*			X				
Terrestrial	Common Crupina	*Crupina vulgaris*			X	X			
Terrestrial	Smallseed Alfalfa Dodder	*Cuscuta approximata*			X	X			
Terrestrial	Compact Dodder	*Cuscuta compacta*			X	X			
Terrestrial	Flax Dodder	*Cuscuta epilinum*			X	X			
Terrestrial	Clover Dodder	*Cuscuta epithymum*			X	X			
Terrestrial	Clover Dodder	*Cuscuta epithymum* var. *epithymum*			X	X			
Terrestrial	Japanese Dodder	*Cuscuta japonica*			X	X			
Terrestrial	Dodder spp.	*Cuscuta* spp.			X	X			
Terrestrial	Chinese yam	*Dioscorea polystachya*				X			
Terrestrial	Paterson's curse	*Echium plantagineum*				X			
Aquatic	Brazilian Elodea	*Egeria densa*	X				X		
Aquatic	Common Water-hyacinth	*Eichhornia crassipes*					X		
Terrestrial	Autumn Olive	*Elaeagnus umbellata*							X
Terrestrial	Woolly Cupgrass	*Eriochloa villosa*			X	X			
Terrestrial	Winged Euonymus	*Euonymus alatus*					X		
Terrestrial	Cypress Spurge	*Euphorbia cyparissias*			X				
Terrestrial	Leafy Spurge	*Euphorbia esula*			X				
Terrestrial	Leafy Spurge	*Euphorbia virgata*			X				
Wetland	Glossy Buckthorn	*Frangula alnus*							X
Terrestrial	Smooth Bedstraw	*Galium mollugo*			X				
Terrestrial	English Ivy	*Hedera helix*					X		
Terrestrial	Giant Hogweed	*Heracleum mantegazzianum*			X		X	X	X
Aquatic	Hydrilla	*Hydrilla verticillata*	X				X	X	
Aquatic	European Frog-bit	*Hydrocharis morsus-ranae*		X			X	X	X
Terrestrial	Purple Jewelweed	*Impatiens glandulifera*					X	X	
Aquatic	Yellow Iris	*Iris pseudacorus*					X		

Subgroup	Common Name	Scientific Name	Ontario *ISA*[1]		Noxious Weed[2]	CFIA[3]	Ont. ISAP[4]	ISC[5]	Ont. IPC[6]
			Prohibited	Restricted					
Terrestrial	Tansy Ragwort	*Jacobaea vulgaris*			X				
Terrestrial	Himalayan Knotweed	*Koenigia polystachya*		X				X	
Terrestrial	Japanese Honeysuckle	*Lonicera japonica*							X
Terrestrial	Maack's Honeysuckle	*Lonicera maackii*					X	X	X
Terrestrial	Morrow's Honeysuckle	*Lonicera morrowii*					X	X	X
Terrestrial	Bush honeysuckle spp. (exotic)	*Lonicera* spp.					X		X
Terrestrial	Tatarian Honeysuckle	*Lonicera tatarica*					X	X	X
Terrestrial	Bell's Honeysuckle	*Lonicera x bella*						X	X
Terrestrial	dwarf honeysuckle	*Lonicera xylosteum*							X
Terrestrial	Purple Loosestrife	*Lythrum salicaria*					X	X	X
Terrestrial	Barberry	*Mahoberberis* spp.; *Mahonia* spp.				X			
Terrestrial	White Sweet-clover	*Melilotus albus*							X
Terrestrial	Japanese Stiltgrass	*Microstegium vimineum*				X	X	X	
Terrestrial	Amur Silvergrass	*Miscanthus sacchariflorus*					X		
Terrestrial	Chinese Silvergrass	*Miscanthus sinensis*					X		
Terrestrial	Miscanthus spp.	*Miscanthus* spp.					X		
Terrestrial	White Mulberry	*Morus alba*							X
Aquatic	Brazilian Water-milfoil / Parrot feather	*Myriophyllum aquaticum*	X				X		
Aquatic	Eurasian Water-milfoil	*Myriophyllum spicatum*					X	X	X
Terrestrial	Serrated Tussock	*Nassella trichotoma*			X	X			
Aquatic	Starry Stonewort	*Nitellopsis obtusa*					X	X	
Aquatic	Yellow Floatingheart	*Nymphoides peltata*		X			X	X	
Terrestrial	Broomrape	*Orobanche* spp.				X			
Terrestrial	Dallisgrass	*Paspalum dilatatum*				X			
Terrestrial	Wild Parsnip	*Pastinaca sativa*			X		X	X	X
Terrestrial	Mile-a-minute Vine	*Persicaria perfoliata*				X			
Terrestrial	Reed Canarygrass	*Phalaris arundinacea*							X

Subgroup	Common Name	Scientific Name	Ontario *ISA*[1]		Noxious Weed[2]	CFIA[3]	Ont. ISAP[4]	ISC[5]	Ont. IPC[6]
			Prohibited	Restricted					
Terrestrial	European Reed	*Phragmites australis* ssp. *australis*		X			X	X	X
Terrestrial	Scots Pine	*Pinus sylvestris*							X
Aquatic	Water Lettuce	*Pistia stratiotes*					X		
Terrestrial	Kudzu	*Pueraria montana*			X	X	X	X	
Terrestrial	Japanese Knotweed	*Reynoutria japonica* var. *japonica*		X			X	X	X
Terrestrial	Giant Knotweed	*Reynoutria sachalinensis*		X				X	
Terrestrial	Bohemian Knotweed	*Reynoutria x bohemica*		X				X	
Terrestrial	European Buckthorn	*Rhamnus cathartica*			X	X	X	X	X
Terrestrial	Russian Knapweed	*Rhaponticum repens*			X				
Terrestrial	Black Locust	*Robinia pseudoacacia*							X
Terrestrial	Multiflora Rose	*Rosa multiflora*							X
Terrestrial	perennial sowthistle	*Sonchus arvensis*			X				
Terrestrial	spiny sowthistle	*Sonchus asper*			X				
Terrestrial	annual sowthistle	*Sonchus oleraceus*			X				
Terrestrial	Sow-thistle spp.	*Sonchus spp.*			X				
Terrestrial	South African ragwort	*Senecio inaequidens*				X			
Terrestrial	Madagascar ragwort	*Senecio madagascariensis*				X			
Terrestrial	Silverleaf nightshade	*Solanum elaeagnifolium*				X			
Aquatic	Water Soldiers	*Stratiotes aloides*	X				X	X	
Terrestrial	Witchweed	*Striga* spp.				X			
Terrestrial	Erect Hedge-parsley	*Torilis japonica*							X
Terrestrial	Poison Ivy	*Toxicodendron radicans*			X				
Terrestrial	Eastern Poison Ivy	*Toxicodendron radicans* var. *radicans*			X				
Terrestrial	Western Poison Ivy	*Toxicodendron radicans* var. *rydbergii*			X				
Aquatic	(European) Water Chestnut	*Trapa natans*	X				X	X	
Terrestrial	Coltsfoot	*Tussilago farfara*			X				
Terrestrial	Lesser Periwinkle	*Vinca minor*					X		
Terrestrial	Black Swallowwort	*Vincetoxicum nigrum*		X	X		X		X

Subgroup	Common Name	Scientific Name	Ontario *ISA*[1]		Noxious Weed[2]	CFIA[3]	Ont. ISAP[4]	ISC[5]	Ont. IPC[6]
			Prohibited	Restricted					
Terrestrial	European (Pale) Swallowwort	*Vincetoxicum rossicum*		X	X		X	X	X
Terrestrial	Syrian bean-caper	*Zygophyllum fabago*				X			

Notes:
1. Prohibited and Restricted species regulated under the Ontario Invasive Species Act (ISA) are presented on the Ontario Ministry of Natural Resources and Forestry's (MNRF) website, accessed on September 18, 2023: https://www.ontario.ca/page/managing-invasive-species-ontario
2. Noxious weeds regulated under the Ontario Weed Control Act are presented on the Ontario Ministry of Agriculture, Food and Rural Affairs website, last updated January 1, 2015 and accessed on September 18, 2023: http://www.omafra.gov.on.ca/english/crops/facts/noxious_weeds.htm
3. The Canadian Food Inspection Agency (CFIA) maintains a "List of pests regulated by Canada" under the authority of the federal Plant Protection Act and the attendant Plant Protection Regulations. This comprehensive list of pests is not included in Table D-2; rather, the regulatory status is noted for invasive species of concern identified by other sources/organizations. The CFIA website was last modified on July 26, 2023; accessed on September 18, 2023: https://inspection.canada.ca/plant-health/plant-pests-invasive-species/regulated-pests/eng/1363317115207/1363317187811
4. Ontario's Invading Species Awareness Program (ISAP) is a partnership between the MNRF and the Ontario Federation of Anglers and Hunters. The webpages for Invasive Aquatic Plants and Invasive Terrestrial Plants were accessed on September 18, 2023: http://www.invadingspecies.com/invaders/
5. The Invasive Species Centre (ISC) is a resource for Ontario and the rest of Canada. Based in Sault Ste. Marie, Ontario, the Board of Directors Organizations include the Great Lakes Fishery Commission, Grand Council Treaty #3, City of Ottawa, International Joint Commission, Wildlife Habitat Canada, University of Waterloo, BioForest, Nature Conservancy of Canada, Natural Resources Canada, Fisheries and Oceans Canada, and the CFIA. The webpages for Invasive Plants and Invasive Aquatic Plants were accessed on September 18, 2023: https://www.invasivespeciescentre.ca/invasive-species/
6. The Ontario Invasive Plant Council (IPC) is a multi-sector, non-profit group committed to the collaboration of organizations and citizens in order to effectively respond to the threat of invasive plants in Ontario. Their invasive plant list/website was accessed on September 18, 2023: https://www.ontarioinvasiveplants.ca/invasive-plants/species/

Table A-4. Incidental observations of vegetation, including vascular plants, moss, lichens, and fungi, during TEM, AHM, and eDNA field surveys within the AOI, LSA_{TER}, and/or LSA_{AQU} in 2022.

Common Name	Scientific Name	SAR	Rare	Introd./Invasive
American beech	*Fagus grandifolia*	N	N	N
American bladdernut	*Staphylea trifolia*	N	N	N
American elm / white elm	*Ulmus americana*	N	N	N
Apple	*Malus* sp.	NA	NA	NA
Arrowhead	*Sagittaria* sp.	NA	NA	NA
Ash	*Fraxinus* sp.	NA	NA	NA
Aspen	*Populus* sp.	NA	NA	NA
Asters	Asteraceae spp.	NA	NA	NA
Balsam[1]	*Abies balsamea* OR *Populus balsamifera*	NA	NA	NA
Balsam fir	*Abies balsamea*	N	N	N
Balsam poplar	*Populus balsamifera*	N	N	N
Basswood	*Tilia americana*	N	N	N
Beech	*Fagus* sp.	NA	NA	NA
Birch	*Betula* sp.	NA	NA	NA
Bittersweet nightshade	*Solanum dulcamara*	N	NA	Y
Black ash	*Fraxinus nigra*	Y	N	N
Black cherry	*Prunus serotina*	N	N	N
Black maple	*Acer nigrum*	N	N	N
Black spruce	*Picea mariana*	N	N	N
Black walnut	*Juglans nigra*	N	N	N
Bladderwort	*Utricularia* sp.	NA	NA	NA
Blue beech	*Carpinus caroliniana*	N	N	N
Bluejoint reedgrass	*Calamagrostis canadensis*	N	N	N
Boneset	*Eupatorium* sp.	N	N	N
Broad-leaf cattail	*Typha latifolia*	N	N	N
Buckthorn	*Rhamnus* sp.	NA	NA	NA
Bunchberry	*Cornus canadensis*	N	N	N
Bur Oak	*Quercus macrocarpa*	N	N	N
Bur-reed	*Sparganium* sp.	NA	NA	NA
Butternut	*Juglans cinerea*	Y	Y	N
Canada bluegrass	*Poa compressa*	N	N	Y
Canada goldenrod	*Solidago canadensis*	N	N	N
Canada wood nettle	*Laportea canadensis*	N	N	N
Canada yew	*Taxus canadensis*	N	N	N
Canarygrass	*Phalaris* sp.	NA	NA	NA
Cardinal flower	*Lobelia cardinalis*	N	N	N
Cattail	*Typha* sp.	NA	NA	NA
Cedar	*Thuja* sp.	NA	NA	NA
Cherry	*Prunus* sp.	NA	NA	NA

Common Name	**Scientific Name**	**SAR**	**Rare**	**Introd./Invasive**
Chokecherry	*Prunus virginiana*	N	N	N
Clematis	*Clematis* sp.	NA	NA	NA
Club-spur orchid	*Platanthera clavellata*	N	N	N
Common water-parsnip	*Sium suave*	N	N	N
Common winterberry	*Ilex verticillata*	N	N	N
Common woolly bulrush	*Scirpus cyperinus*	NA	NA	NA
Corn	*Zea mays*	NA	NA	NA
Dark-green bulrush	*Scirpus atrovirens*	N	N	N
Dock	*Rumex* sp.	NA	NA	NA
Dogwood	*Cornus* sp.	NA	NA	NA
Duckweed	Lemnaceae spp.	NA	NA	NA
Dwarf raspberry	*Rubus pubescens*	N	N	N
Eastern green-violet	*Hybanthus concolor*	N	Y	N
Eastern hemlock	*Tsuga canadensis*	N	N	N
Eastern rough sedge	*Carex scabrata*	NA	NA	NA
Eastern white cedar	*Thuja occidentalis*	N	N	N
Eastern white pine	*Pinus strobus*	N	N	N
Elderberry	*Sambucus* sp.	NA	NA	NA
Elm	*Ulmus* sp.	NA	NA	NA
European buckthorn	*Rhamnus cathartica*	N	N	Y
European larch	*Larix decidua*	N	N	Y
European reed	*Phragmites australis* ssp. *australis*	N	N	Y
Ferns	Polypodiopsida	NA	NA	NA
Fescue	*Festuca* sp.	NA	NA	NA
Fir	*Abies* sp.	NA	NA	NA
Fowl mannagrass	*Glyceria striata*	N	N	N
Freeman's maple	*Acer x freemanii*	N	N	N
Fringed sedge	*Carex crinita*	N	N	N
Fungus	Fungi	NA	NA	NA
Giant goldenrod	*Solidago gigantea*	N	N	N
Goldenrod	*Solidago* sp.	NA	NA	NA
Grass-leaved goldenrod	*Euthamia graminifolia*	N	N	N
Green ash / red ash	*Fraxinus pennsylvanica*	N	N	N
Green dragon	*Arisaema dracontium*	Y	Y	N
Grey-stemmed goldenrod	*Solidago nemoralis*	N	N	N
Hawkweed	*Hieracium* sp.	NA	NA	NA
Hawthorn	*Crataegus* sp.	NA	NA	NA
Hemlock	*Tsuga* sp.	NA	NA	NA
Horsetail	*Equisetum* sp.	NA	NA	NA
Iris	*Iris* sp.	NA	NA	NA
Ironwood / eastern hop-hornbeam	*Ostrya virginiana*	N	N	N

Common Name	Scientific Name	SAR	Rare	Introd./Invasive
Joe-pye weed	*Eutrochium* sp.	NA	NA	NA
Lake sedge	*Carex lacustris*	N	N	N
Large-leaf aster	*Eurybia macrophylla*	N	N	N
Leatherleaf	*Chamaedaphne calyculata*	N	N	N
Lichens	NA	NA	NA	NA
Loesel's twayblade	*Liparis loeselii*	N	N	N
Loosestrife	Dicotyledonaeae sp.	NA	NA	NA
Manitoba maple	*Acer negundo*	N	N	N
Maple	*Acer* sp.	NA	NA	NA
Meadowsweet	*Spiraea* sp.	NA	NA	NA
Milkweed	*Asclepias* sp.	NA	NA	NA
Moss	Bryophyta	NA	NA	NA
Nannyberry	*Viburnum lentago*	N	N	N
Nettle	Dicotyledonaeae sp.	NA	NA	NA
New England aster	*Symphyotrichum novae-angliae*	N	N	N
Ninebark	*Physocarpus* sp.	NA	NA	NA
Northern pitcher plant	*Sarracenia purpurea*	NA	NA	NA
Northern red oak	*Quercus rubra*	N	N	N
Northern spicebush	*Lindera benzoin*	N	N	N
Oak	*Quercus* sp.	NA	NA	NA
Old field aster	*Symphyotrichum pilosum*	N	N	N
Orchard grass	*Dactylis glomerata*	N	N	Y
Ostrich fern	*Matteuccia struthiopteris*	N	N	N
Ox-eye daisy	*Leucanthemum vulgare*	N	N	Y
Panicled aster	*Symphyotrichum lanceolatum*	N	N	N
Parsnip	Apiaceae sp.	NA	NA	NA
Peach-leaf willow	*Salix amygdaloides*	N	N	N
Pickerelweed	*Pontederia cordata*	N	N	N
Pine	*Pinus* sp.	NA	NA	NA
Poison ivy	*Toxicodendron radicans*	N	N	N
Pond lily	Nymphaeaceae sp.	NA	NA	NA
Poplar	*Populus* sp.	NA	NA	NA
Purple loosestrife	*Lythrum salicaria*	N	N	Y
Purple-stemmed aster	*Symphyotrichum puniceum*	N	N	N
Queen Anne's lace / wild carrot	*Daucus carota*	N	N	Y
Raspberry	*Rubus* sp.	NA	NA	NA
Red maple	*Acer rubrum*	N	N	N
Red osier dogwood	*Cornus sericea*	N	N	N
Red pine	*Pinus resinosa*	N	N	N
Redtop	*Agrostis gigantea*	N	N	Y
Reed canarygrass	*Phalaris arundinacea*	N	N	N
Reeds	Poaceae sp.	NA	NA	NA

Common Name	Scientific Name	SAR	Rare	Introd./Invasive
Riverbank grape	*Vitis riparia*	N	N	N
Royal fern	*Osmunda regalis*	N	N	N
Rubus	*Rubus* sp.	NA	NA	NA
Scots pine	*Pinus sylvestris*	N	N	Y
Sedges	*Carex* spp.	NA	NA	NA
Sensitive fern	*Onoclea sensibilis*	N	N	N
Sheathed dropseed	*Sporobolus vaginiflorus*	NA	NA	NA
Showy lady's slipper	*Cypripedium reginae*	N	N	N
Siberian elm	*Ulmus pumila*	N	N	Y
Silky dogwood	*Cornus obliqua*	N	N	N
Silver maple	*Acer saccharinum*	N	N	N
Small-spike false nettle	*Boehmeria cylindrica*	NA	NA	NA
Soybean	*Glycine max*	N	N	Y
Sphagnum	*Sphagnum* sp.	NA	NA	NA
Spotted jewelweed	*Impatiens capensis*	N	N	N
Spotted joe-pye weed	*Eutrochium maculatum*	N	N	N
Spruce	*Picea* sp.	NA	NA	NA
Stinging nettle	*Urtica dioica*	N	N	Y
Sugar maple	*Acer saccharum*	N	N	N
Swamp loosestrife	*Decodon verticillatus*	N	N	N
Sweet cherry	*Prunus avium*	N	N	Y
Sweet gale	*Myrica gale*	N	N	N
Tall goldenrod	*Solidago altissima*	N	N	N
Tamarack	*Larix laricina*	N	N	N
Tawny cottongrass	*Eriophorum virginicum*	N	N	N
Thistle	Dicotyledonaeae sp.	NA	NA	NA
Toxicodendron	*Toxicodendron* sp.	NA	NA	NA
Trembling aspen	*Populus tremuloides*	N	N	N
Tussock sedge	*Carex stricta*	N	N	N
Twinleaf	*Jeffersonia diphylla*	N	N	N
Vines	Dicotyledonaeae sp.	NA	NA	NA
Watercress	*Nasturtium* or *Rorippa* sp.	NA	NA	NA
Wheat	*Triticum* sp.	NA	NA	NA
Wheatgrass	Poaceae sp.	NA	NA	NA
White ash	*Fraxinus americana*	N	N	N
White birch / paper birch	*Betula papyrifera*	N	N	N
White oak	*Quercus alba*	N	N	N
White spruce	*Picea glauca*	N	N	N
Wild grape	*Vitis* sp.	NA	NA	NA
Wild parsnip	*Pastinaca sativa*	N	N	Y
Willow	*Salix* sp.	NA	NA	NA
Woodreed	*Cinna* sp.	NA	NA	NA

Common Name	Scientific Name	SAR	Rare	Introd./Invasive
Woolly-fruit sedge	*Carex lasiocarpa*	N	N	N
Yellow birch	*Betula alleghaniensis*	N	N	N
Yellow clintonia	*Clintonia borealis*	N	N	N
Yellow pond-lily	*Nuphar* sp.	NA	NA[2]	NA

APPENDIX B – DETECTIONS OF VEGETATION SPECIES OF INTEREST

Table B-1. Desk-based observations of vegetation species of interest within the BIS study areas.

Grid	Source	Species	Count	Coordinates	AOI	LSA_{TER}	LSA_{AQU}
6682	GBIF	Bladder Campion	U	466132, 4882230	0	/	1
6777	GBIF	Beaked Spikerush	U	-	0	/	1
6984	GBIF	Floating Crystalwort	1	-	0	/	1
6984	GBIF	Large-leaved Leafy Moss	1	-	0	/	1
6986	GBIF	Tubercled Orchid	U	-	0	/	1
6988	GBIF	Hill's Pondweed	1	-	0	/	1
7083	GBIF	Rough Bluegrass	U	470652, 4883045	0	/	1
7270	GBIF	Bush's Pocket Moss	1	-	0	1	/
7370	GBIF	Greek Anemone	U	473159, 4870312	0	1	/
7377	GBIF	White Willow	1	473298, 4877480	0	/	1
7574	EDDMapS	Goutweed	U	475363, 4874307	0	/	1
7590	GBIF	European Highbush Cranberry	U	475318, 4890945	0	/	1
7590	GBIF	Black Ash	U	-	0	/	1
7590	EDDMapS	European Buckthorn	U	475315, 4890950	0	/	1
7590	EDDMapS	Broad-leaved Helleborine	U	475318, 4890945	0	0	/
7590	EDDMapS	Bittersweet Nightshade	U	475084, 4890970	0	0	1
7590	EDDMapS	Small-flowered Hairy Willowherb	U	475318, 4890945	0	/	1
7590	EDDMapS	European Highbush Cranberry	U	475431, 4890862	0	/	1
7591	GBIF	Broad-leaved Cattail	U	475041, 4891238	0	/	1
7591	EDDMapS	Coltsfoot	U	475172, 4891128	0	0	/
7591	EDDMapS	European Water-horehound	U	475172, 4891128	0	/	1
7690	GBIF	Slender Mountain-mint	1	-	0	/	1

Notes:
Refer to **Figure B-2** for the grid locations. Coordinates are not provided for SAR or provincially rare species due to their sensitive nature.
For the purposes of this table, the indicated study area includes overlap with other study area(s) that may be encompassed within its boundaries. 1 = detected, 0 = not detected. '/' = study area does not apply to that species.
Count of 'U' = unspecified.

Table B-2. Field-based incidental observations of vegetation species of interest within the BIS study areas in 2022.

Grid	Species	Observation Type	Count	Source Type	Coordinates	AOI	LSA_{TER}	LSA_{AQU}
6779	Black Ash	Visual	low density	Incidental	-	0	/	1
6779	European Buckthorn	Visual	high density	TEM	467603, 4879509	0	/	1
6878	Manitoba Maple	Visual	high density	TEM	468136, 4878721	0	/	1
6883	Black Ash	Visual	med density	Incidental	-	0	/	1
6978	Black Ash	Visual	low density	Incidental	-	0	/	1
6978	Black Ash	Visual	>1	TEM	-	0	/	1
6980	European Buckthorn	Visual	med density	Incidental	469996, 4880644	0	/	1
6983	Black Ash	Visual	med density	Incidental	-	0	/	1
6983	Black Ash	Visual	low density	Incidental	-	0	/	1
6983	Black Ash	Visual	low density	Incidental	-	0	/	1
6983	Black Ash	Visual	low density	Incidental	-	0	/	1
6983	Black Ash	Visual	high density	TEM	-	0	/	1
6984	Black Ash	Visual	med density	Incidental	-	0	/	1
6984	Black Ash	Visual	low density	TEM	-	0	/	1
6987	Black Ash	Visual	1	Incidental	-	0	/	1
6987	Black Ash	Visual	low density	Incidental	-	0	/	1
6992	Black Ash	Visual	1	Incidental	-	0	/	1
6992	Black Ash	Visual	med density	Incidental	-	0	/	1
7066	Black Ash	Visual	med density	Incidental	-	0	/	1
7067	Black Ash	Visual	low density	Incidental	-	0	/	1
7067	Broad-leaved Cattail	Visual	med density	TEM	470652, 4867712	0	/	1
7067	Reed Canarygrass	Visual	med density	TEM	470652, 4867712	0	/	1
7068	Bittersweet Nightshade	Visual	1	TEM	470585, 4868014	0	/	1
7068	Broad-leaved Cattail	Visual	>1	TEM	470585, 4868014	0	/	1
7068	Reed Canarygrass	Visual	>1	TEM	470585, 4868014	0	/	1
7073	Reed Canarygrass	Visual	high density	AHM	470676, 4873571	1	/	1
7077	Black Ash	Visual	med density	Incidental	-	0	/	1
7077	Black Ash	Visual	low density	Incidental	-	0	/	1

Grid	Species	Observation Type	Count	Source Type	Coordinates	AOI	LSA_{TER}	LSA_{AQU}
7077	Black Ash	Visual	low density	Incidental	-	0	/	1
7077	Black Ash	Visual	med density	Incidental	-	0	/	1
7077	Black Ash	Visual	high density	Incidental	-	0	/	1
7077	Black Ash	Visual	1	TEM	-	0	/	1
7078	Black Ash	Visual	med density	Incidental	-	0	/	1
7081	Black Ash	Visual	med density	Incidental	-	0	/	1
7081	Black Ash	Visual	med density	Incidental	-	0	/	1
7081	Black Ash	Visual	high density	TEM	-	0	/	1
7082	Black Ash	Visual	high density	Incidental	-	0	/	1
7082	Black Ash	Visual	high density	TEM	-	0	/	1
7082	Black Ash	Visual	low density	TEM	-	0	/	1
7082	European Reed	Visual	1	TEM	470403, 4882665	0	/	1
7082	European Reed	Visual	high density	TEM	470403, 4882665	0	/	1
7085	Black Ash	Visual	high density	Incidental	-	0	/	1
7085	Black Ash	Visual	high density	TEM	-	0	/	1
7085	Black Ash	Visual	low density	TEM	-	0	/	1
7087	Black Ash	Visual	med density	Incidental	-	0	/	1
7087	Black Ash	Visual	low density	Incidental	-	0	/	1
7088	Black Ash	Visual	low density	Incidental	-	0	/	1
7088	Black Ash	Visual	low density	Incidental	-	0	/	1
7088	Black Ash	Visual	1	TEM	-	0	/	1
7090	Black Ash	Visual	low density	Incidental	-	0	/	1
7090	Black Ash	Visual	high density	Incidental	-	0	/	1
7090	Black Ash	Visual	high density	Incidental	-	0	/	1
7091	Black Ash	Visual	med density	Incidental	-	0	/	1
7163	European Buckthorn	Visual	med density	Incidental	471669, 4863559	0	/	1
7164	Black Ash	Visual	low density	Incidental	-	0	/	1
7164	Black Ash	Visual	1	SWH	-	0	/	1
7165	Black Ash	Visual	low density	Incidental	-	0	/	1
7168	Black Ash	Visual	1	Incidental	-	0	/	1

Grid	Species	Observation Type	Count	Source Type	Coordinates	AOI	LSA_{TER}	LSA_{AQU}
7168	Black Ash	Visual	low density	Incidental	-	0	/	1
7169	Black Ash	Visual	low density	Incidental	-	0	/	1
7169	Black Ash	Visual	med density	Incidental	-	0	/	1
7169	Black Ash	Visual	med density	Incidental	-	0	/	1
7169	European Buckthorn	Visual	>1	TEM	471723, 4869229	0	/	1
7169	European Buckthorn	Visual	high density	TEM	471654, 4869561	0	/	1
7171	Reed Canarygrass	Visual	>1	AHM	471620, 4871965	1	/	1
7172	European Reed	Visual	high density	Incidental	471555, 4872207	1	/	1
7172	European Reed	Visual	high density	Incidental	471620, 4872128	1	/	1
7172	European Reed	Visual	med density	Incidental	471509, 4872314	1	/	1
7172	Stinging Nettle	Visual	>1	AHM	471965, 4872042	1	/	1
7172	Stinging Nettle	Visual	>1	eDNA	471567, 4872220	1	/	1
7172	Stinging Nettle	Visual	>1	TEM	471780, 4872825	1	/	1
7172	Butternut	Visual	low density	Incidental	-	1	1	/
7172	Reed Canarygrass	Visual	>1	TEM	471780, 4872825	1	/	1
7172	Reed Canarygrass	Visual	>1	TEM	471524, 4872315	1	/	1
7173	Black Ash	Visual	med density	Incidental	-	1	/	1
7173	Black Ash	Visual	med density	Incidental	-	1	/	1
7173	Black Ash	Visual	med density	Incidental	-	1	/	1
7173	Black Ash	Visual	1	TEM	-	1	/	1
7173	Reed Canarygrass	Visual	>1	AHM	471632, 4873124	1	/	1
7173	Stinging Nettle	Visual	>1	eDNA	471570, 4873310	1	/	1
7173	Reed Canarygrass	Visual	high density	TEM	471633, 4873111	1	/	1
7174	Black Ash	Visual	med density	Incidental	-	1	/	1
7174	Black Ash	Visual	med density	Incidental	-	1	/	1
7174	Black Ash	Visual	med density	Incidental	-	1	/	1
7174	Black Ash	Visual	low density	Incidental	-	1	/	1
7174	Black Ash	Visual	low density	Incidental	-	1	/	1
7174	Black Ash	Visual	low density	Incidental	-	1	/	1
7174	European Buckthorn	Visual	low density	Incidental	471911, 4874469	1	/	1

Grid	Species	Observation Type	Count	Source Type	Coordinates	AOI	LSA_{TER}	LSA_{AQU}
7174	Reed Canarygrass	Visual	>1	eDNA	471641, 4874450	1	/	1
7174	European Buckthorn	Visual	1	TEM	471447, 4874552	1	/	1
7175	Oxeye Daisy	Visual	1	TEM	471128, 4875017	0	1	/
7175	Redtop	Visual	1	TEM	471128, 4875017	0	/	1
7184	Black Ash	Visual	med density	Incidental	-	0	/	1
7184	Black Ash	Visual	med density	Incidental	-	0	/	1
7184	Black Ash	Visual	med density	Incidental	-	0	/	1
7184	Black Ash	Visual	med density	Incidental	-	0	/	1
7184	Black Ash	Visual	med density	Incidental	-	0	/	1
7184	Black Ash	Visual	med density	Incidental	-	0	/	1
7184	Black Ash	Visual	low density	Incidental	-	0	/	1
7184	Black Ash	Visual	med density	Incidental	-	0	/	1
7184	Black Ash	Visual	med density	TEM	-	0	/	1
7184	Black Ash	Visual	low density	TEM	-	0	/	1
7184	Black Ash	Visual	high density	TEM	-	0	/	1
7184	Poison Ivy	Visual	med density	Incidental	471069, 4884932	0	/	1
7185	Black Ash	Visual	med density	Incidental	-	0	/	1
7185	Black Ash	Visual	med density	Incidental	-	0	/	1
7185	Black Ash	Visual	low density	Incidental	-	0	/	1
7185	Black Ash	Visual	med density	Incidental	-	0	/	1
7185	Black Ash	Visual	low density	TEM	-	0	/	1
7185	Black Ash	Visual	1	SWH	-	0	/	1
7186	Black Ash	Visual	high density	Incidental	-	0	/	1
7186	Black Ash	Visual	med density	Incidental	-	0	/	1
7186	Black Ash	Visual	high density	Incidental	-	0	/	1
7186	Black Ash	Visual	low density	Incidental	-	0	/	1
7186	Black Ash	Visual	high density	TEM	-	0	/	1
7186	Poison Ivy	Visual	high density	Incidental	471693, 4886004	0	/	1
7187	Black Ash	Visual	low density	Incidental	-	0	/	1
7188	Black Ash	Visual	low density	Incidental	-	0	/	1

Grid	Species	Observation Type	Count	Source Type	Coordinates	AOI	LSA_{TER}	LSA_{AQU}
7188	Black Ash	Visual	med density	Incidental	-	0	/	1
7188	Black Ash	Visual	med density	Incidental	-	0	/	1
7188	Black Ash	Visual	med density	Incidental	-	0	/	1
7188	Black Ash	Visual	med density	Incidental	-	0	/	1
7188	Black Ash	Visual	high density	Incidental	-	0	/	1
7188	Black Ash	Visual	1	SWH	-	0	/	1
7188	European Reed	Visual	high density	Incidental	471455, 4888221	0	/	1
7188	Reed Canarygrass	Visual	high density	TEM	471545, 4888514	0	/	1
7189	Black Ash	Visual	med density	Incidental	-	0	/	1
7190	Black Ash	Visual	med density	Incidental	-	0	/	1
7190	Black Ash	Visual	med density	Incidental	-	0	/	1
7190	Black Ash	Visual	med density	Incidental	-	0	/	1
7190	Black Ash	Visual	med density	Incidental	-	0	/	1
7190	Black Ash	Visual	med density	Incidental	-	0	/	1
7190	Black Ash	Visual	low density	Incidental	-	0	/	1
7190	Black Ash	Visual	>1	SWH	-	0	/	1
7263	Black Ash	Visual	low density	Incidental	-	0	/	1
7264	Black Ash	Visual	med density	Incidental	-	0	/	1
7266	Green Dragon	Visual	1	Incidental	-	0	/	1
7269	Broad-leaved Cattail	Visual	high density	TEM	472057, 4869322	0	/	1
7269	Broad-leaved Cattail	Visual	high density	SWH	472057, 4869322	0	/	1
7269	Green Dragon	Visual	1	Incidental	-	0	/	1
7269	Reed Canarygrass	Visual	>1	eDNA	472635, 4869767	0	/	1
7269	Stinging Nettle	Visual	>1	eDNA	472721, 4869288	0	/	1
7272	Bittersweet Nightshade	Visual	med density	eDNA	472410, 4872793	1	/	1
7272	Reed Canarygrass	Visual	>1	AHM	472820, 4872954	1	/	1
7272	Purple Loosestrife	Visual	1	AHM	472820, 4872954	1	/	1
7273	Black Ash	Visual	low density	Incidental	-	1	/	1
7273	Orchard Grass	Visual	high density	TEM	472750, 4873946	1	1	/
7273	Queen Anne's Lace/Wild Carrot	Visual	1	TEM	472750, 4873946	1	1	/

Grid	Species	Observation Type	Count	Source Type	Coordinates	AOI	LSA_{TER}	LSA_{AQU}
7273	Redtop	Visual	1	TEM	472750, 4873946	1	/	1
7273	Reed Canarygrass	Visual	high density	TEM	472750, 4873946	1	/	1
7274	Reed Canarygrass	Visual	>1	AHM	472613, 4874349	1	/	1
7274	Scots Pine	Visual	>1	AHM	472936, 4874506	1	1	/
7274	Stinging Nettle	Visual	>1	eDNA	472619, 4874359	1	/	1
7274	Reed Canarygrass	Visual	high density	TEM	472774, 4874308	1	/	1
7275	Reed Canarygrass	Visual	high density	TEM	472938, 4875735	0	/	1
7277	Black Ash	Visual	high density	Incidental	-	0	/	1
7278	Black Ash	Visual	med density	Incidental	-	0	/	1
7278	Black Ash	Visual	med density	Incidental	-	0	/	1
7278	Black Ash	Visual	low density	Incidental	-	0	/	1
7278	Black Ash	Visual	low density	Incidental	-	0	/	1
7279	Black Ash	Visual	low density	Incidental	-	0	/	1
7279	Black Ash	Visual	low density	Incidental	-	0	/	1
7279	European Buckthorn	Visual	low density	Incidental	472258, 4879830	0	/	1
7279	Reed Canarygrass	Visual	>1	TEM	472555, 4879980	0	/	1
7280	Black Ash	Visual	low density	Incidental	-	0	/	1
7280	European Buckthorn	Visual	med density	Incidental	472710, 4880128	0	/	1
7280	European Buckthorn	Visual	low density	Incidental	472345, 4880244	0	/	1
7280	European Buckthorn	Visual	med density	Incidental	472188, 4880031	0	/	1
7284	Black Ash	Visual	low density	Incidental	-	0	/	1
7284	Black Ash	Visual	1	TEM	-	0	/	1
7284	Stinging Nettle	Visual	>1	TEM	472596, 4884989	0	/	1
7285	Black Ash	Visual	low density	Incidental	-	0	/	1
7286	Black Ash	Visual	high density	Incidental	-	0	/	1
7286	Black Ash	Visual	low density	Incidental	-	0	/	1
7286	Black Ash	Visual	low density	Incidental	-	0	/	1
7286	Black Ash	Visual	low density	Incidental	-	0	/	1
7286	Black Ash	Visual	>1	SWH	-	0	/	1
7286	Black Ash	Visual	>1	SWH	-	0	/	1

Grid	Species	Observation Type	Count	Source Type	Coordinates	AOI	LSA_{TER}	LSA_{AQU}
7288	Black Ash	Visual	low density	Incidental	-	0	/	1
7289	Black Ash	Visual	med density	Incidental	-	0	/	1
7289	Black Ash	Visual	low density	Incidental	-	0	/	1
7289	Black Ash	Visual	med density	Incidental	-	0	/	1
7289	Black Ash	Visual	med density	Incidental	-	0	/	1
7373	Black Ash	Visual	med density	Incidental	-	1	/	1
7373	Black Ash	Visual	med density	Incidental	-	1	/	1
7373	Eastern Green-violet	Visual	high density	Incidental	-	1	1	/
7374	Black Ash	Visual	med density	Incidental	-	1	/	1
7374	Black Ash	Visual	low density	Incidental	-	1	/	1
7374	Black Ash	Visual	1	eDNA	-	1	/	1
7374	Eastern Green-violet	Visual	high density	Incidental	-	1	1	/
7374	Purple Loosestrife	Visual	med density	eDNA	473708, 4874843	1	/	1
7375	Orchard Grass	Visual	high density	TEM	473132, 4875376	0	1	/
7375	Scots Pine	Visual	high density	TEM	473310, 4875032	1	1	/
7375	Stinging Nettle	Visual	>1	eDNA	473408, 4875191	1	/	1
7375	Stinging Nettle	Visual	low density	TEM	473421, 4875348	0	/	1
7375	Stinging Nettle	Visual	>1	TEM	473462, 4875100	1	/	1
7375	Sweet Cherry	Visual	low density	TEM	473310, 4875032	1	1	/
7375	Reed Canarygrass	Visual	high density	TEM	473421, 4875348	0	/	1
7375	Reed Canarygrass	Visual	high density	TEM	473462, 4875100	1	/	1
7375	Reed Canarygrass	Visual	high density	TEM	473370, 4875229	1	/	1
7375	European Buckthorn	Visual	high density	TEM	473310, 4875032	1	/	1
7375	Reed Canarygrass	Visual	high density	TEM	473435, 4875002	1	/	1
7375	Reed Canarygrass	Visual	high density	TEM	473421, 4875348	0	/	1
7375	Reed Canarygrass	Visual	high density	TEM	473462, 4875100	1	/	1
7375	Reed Canarygrass	Visual	high density	TEM	473370, 4875229	1	/	1
7375	Reed Canarygrass	Visual	high density	SWH	473421, 4875348	0	/	1
7385	Black Ash	Visual	med density	Incidental	-	0	/	1
7385	Black Ash	Visual	med density	Incidental	-	0	/	1

Grid	Species	Observation Type	Count	Source Type	Coordinates	AOI	LSA_{TER}	LSA_{AQU}
7385	Black Ash	Visual	low density	Incidental	-	0	/	1
7385	Black Ash	Visual	low density	Incidental	-	0	/	1
7385	Black Ash	Visual	med density	Incidental	-	0	/	1
7388	Black Ash	Visual	low density	Incidental	-	0	/	1
7388	Black Ash	Visual	low density	Incidental	-	0	/	1
7388	Black Ash	Visual	low density	Incidental	-	0	/	1
7389	Black Ash	Visual	med density	Incidental	-	0	/	1
7389	Black Ash	Visual	med density	Incidental	-	0	/	1
7389	Black Ash	Visual	low density	Incidental	-	0	/	1
7389	Black Ash	Visual	low density	Incidental	-	0	/	1
7477	Black Ash	Visual	med density	Incidental	-	0	/	1
7490	Black Ash	Visual	med density	Incidental	-	0	/	1
7490	Black Ash	Visual	1	Incidental	-	0	/	1
7490	Black Ash	Visual	med density	Incidental	-	0	/	1
7490	Black Ash	Visual	med density	Incidental	-	0	/	1
7490	Black Ash	Visual	low density	Incidental	-	0	/	1
7490	Black Ash	Visual	1	TEM	-	0	/	1
7490	Black Ash	Visual	med density	TEM	-	0	/	1
7490	Broad-leaved Cattail	Visual	>1	eDNA	474900, 4890402	0	/	1
7490	Bittersweet Nightshade	Visual	1	eDNA	474900, 4890402	0	/	1
7490	Reed Canarygrass	Visual	>1	eDNA	474900, 4890402	0	/	1
7490	Stinging Nettle	Visual	>1	eDNA	474900, 4890402	0	/	1
7490	Stinging Nettle	Visual	>1	eDNA	474900, 4890402	0	/	1
7490	Stinging Nettle	Visual	>1	eDNA	474900, 4890402	0	/	1
7493	Black Ash	Visual	high density	Incidental	-	0	/	1
7576	Black Ash	Visual	med density	Incidental	-	0	/	1
7577	Black Ash	Visual	high density	Incidental	-	0	/	1
7589	Black Ash	Visual	med density	Incidental	-	0	/	1
7589	Black Ash	Visual	high density	TEM	-	0	/	1
7589	Black Ash	Visual	med density	TEM	-	0	/	1

Grid	Species	Observation Type	Count	Source Type	Coordinates	AOI	LSA_{TER}	LSA_{AQU}
7590	Stinging Nettle	Visual	>1	eDNA	475131, 4890532	0	/	1
7591	Black Ash	Visual	high density	Incidental	-	0	/	1

Notes:
See **Figure B-3** for Grid locations of masked observations. Coordinates are not provided for some observations due to the sensitive nature of SAR and provincially rare species.
For the purposes of this table, the indicated study area includes overlap with other study area(s) that may be encompassed within its boundaries. 1 = detected, 0 = not detected. '/' = study area does not apply to that species.
All 2022 field species observations are considered incidental; however, the source type is presented to allow interpretation of field effort and visited locations. "eDNA" refers to field observations and not the results of metabarcoding analyses.

Table B-3. Vegetation species of interest detected in the TEM field data from 2022. I = introduced; W = Weed; IV = invasive; R = provincially rare; SAR= Species at Risk.

Site	Study Area	Lesser burdock – I	Knapweed sp. – W	American tree moss – R	Swamp dodder – W	Orchard grass – I	Wild carrot – I	Broad-leaved helleborine – I	Alder buckthorn – IV	Black ash – SAR	Smooth bedstraw – W	Meadow fescue – I	Garden bird's-foot trefoil – I	White sweet-clover – IV	Spotted lady's-thumb – I	Reed canarygrass – IV	Common Timothy – I	Norway spruce – I	English plantain – I	Sulphur cinquefoil – I	Common buttercup – I	European buckthorn – IV, W	Multiflora rose – IV	Curled dock – I	Bladder campion – I	Bittersweet nightshade – I	Common dandelion – I	Poison ivy – W	Eastern poison ivy – W	Western poison ivy – W	Red clover – I	White clover – I	Coltsfoot – W	Narrow-leaved cattail – I
TEM_001	**LSA_{ECO}**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0
TEM_002	**LSA_{ECO}**	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
TEM_003	**AOI**	1	0	0	0	1	1	0	0	0	1	1	0	1	0	0	0	1	1	1	0	0	0	0	0	0	1	0	0	0	1	1	0	0
TEM_004	**LSA_{ECO}**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TEM_005	**LSA_{ECO}**	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TEM_006	**LSA_{ECO}**	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
TEM_007	**LSA_{ECO}**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TEM_008	**LSA_{ECO}**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
TEM_009	**LSA_{ECO}**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
TEM_010	**LSA_{ECO}**	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	1	0	0	0	0
TEM_011	**LSA_{ECO}**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
TEM_012	**LSA_{ECO}**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
TEM_013	**LSA_{ECO}**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
TEM_014	**LSA_{ECO}**	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
TEM_015	**LSA_{ECO}**	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TEM_016	**LSA_{ECO}**	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TEM_017	**LSA_{ECO}**	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	0	0	0	0	0	0
TEM_018	**LSA_{ECO}**	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0
TEM_019	**LSA_{ECO}**	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0
TEM_020	**LSA_{ECO}**	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
TEM_021	**LSA_{ECO}**	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TEM_022	**LSA_{ECO}**	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TEM_023	**LSA_{ECO}**	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
TEM_024	**LSA_{ECO}**	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0
TEM_025	**LSA_{ECO}**	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
TEM_026	**LSA_{ECO}**	1	0	0	0	1	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	1	1	0	0	0	0	0	0
TEM_027	**LSA_{ECO}**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
TEM_028	**LSA_{ECO}**	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
TEM_029	**LSA_{ECO}**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0
TEM_030	**LSA_{ECO}**	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TEM_031	**LSA_{ECO}**	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TEM_032	**LSA_{ECO}**	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0

Site	Study Area	Lesser burdock – I	Knapweed sp. – W	American tree moss – R	Swamp dodder – W	Orchard grass – I	Wild carrot – I	Broad-leaved helleborine – I	Alder buckthorn – IV	Black ash – SAR	Smooth bedstraw – W	Meadow fescue – I	Garden bird's-foot trefoil – I	White sweet-clover – IV	Spotted lady's-thumb – I	Reed canarygrass – IV	Common Timothy – I	Norway spruce – I	English plantain – I	Sulphur cinquefoil – I	Common buttercup – I	European buckthorn – IV, W	Multiflora rose – IV	Curled dock – I	Bladder campion – I	Bittersweet nightshade – I	Common dandelion – I	Poison ivy – W	Eastern poison ivy – W	Western poison ivy – W	Red clover – I	White clover – I	Coltsfoot – W	Narrow-leaved cattail – I
TEM_033	LSA_{ECO}	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	0	0	1	0	0	0	0
TEM_034	LSA_{ECO}	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
TEM_035	AOI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
TEM_036	LSA_{TER}	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TEM_037	LSA_{ECO}	0	1	0	0	0	1	0	0	0	0	0	1	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
TEM_038	LSA_{ECO}	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
TEM_039	LSA_{ECO}	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TEM_040	AOI	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TEM_041	AOI	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0	0	0	0
TEM_042	LSA_{ECO}	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0
TEM_043	LSA_{ECO}	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	0
TEM_044	LSA_{ECO}	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0
TEM_045	LSA_{ECO}	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
TEM_046	LSA_{ECO}	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
TEM_047	LSA_{ECO}	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0
TEM_048	LSA_{ECO}	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TEM_049	LSA_{TER}	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
TEM_050	LSA_{ECO}	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	0	0	1	0	0	0	0
TEM_051	LSA_{ECO}	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
TEM_052	LSA_{ECO}	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
TEM_053	LSA_{ECO}	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TEM_054	LSA_{ECO}	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	1	0	0	0	0
TEM_055	LSA_{ECO}	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0
TEM_056	LSA_{ECO}	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0
TEM_057	AOI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TEM_058	LSA_{ECO}	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
TEM_059	LSA_{ECO}	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
TEM_060	AOI	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
TEM_061	LSA_{ECO}	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TEM_062	LSA_{ECO}	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1	0	1	0	1	0	0	0	1	1	0	0
TEM_063	AOI	0	1	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
TEM_064	LSA_{ECO}	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TEM_065	LSA_{ECO}	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0

Site	Study Area	Lesser burdock – I	Knapweed sp. – W	American tree moss – R	Swamp dodder – W	Orchard grass – I	Wild carrot – I	Broad-leaved helleborine – I	Alder buckthorn – IV	Black ash – SAR	Smooth bedstraw – W	Meadow fescue – I	Garden bird's-foot trefoil – I	White sweet-clover – IV	Spotted lady's-thumb – I	Reed canarygrass – IV	Common Timothy – I	Norway spruce – I	English plantain – I	Sulphur cinquefoil – I	Common buttercup – I	European buckthorn – IV, W	Multiflora rose – IV	Curled dock – I	Bladder campion – I	Bittersweet nightshade – I	Common dandelion – I	Poison ivy – W	Eastern poison ivy – W	Western poison ivy – W	Red clover – I	White clover – I	Coltsfoot – W	Narrow-leaved cattail – I
TEM_066	**LSA$_{ECO}$**	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
TEM_067	**LSA$_{ECO}$**	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0
TEM_068	**LSA$_{ECO}$**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
TEM_069	**LSA$_{ECO}$**	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	1	0	0	0	0
TEM_070	**LSA$_{ECO}$**	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TEM_071	**LSA$_{ECO}$**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TEM_072	**LSA$_{ECO}$**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0
TEM_073	**LSA$_{ECO}$**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TEM_074	**LSA$_{ECO}$**	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	0
TEM_075	**AOI**	0	0	0	0	0	1	0	0	0	0	0	1	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TEM_076	**LSA$_{ECO}$**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TEM_077	**AOI**	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0
TEM_078	**LSA$_{ECO}$**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0
TEM_079	**AOI**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
TEM_080	**LSA$_{ECO}$**	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
TEM_081	**LSA$_{ECO}$**	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TEM_082	**LSA$_{ECO}$**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TEM_083	**AOI**	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0
TEM_084	**LSA$_{ECO}$**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table B-4. Vegetation species of interest detected at waterbody sites within the BIS study areas relevant to vegetation during AHM field surveys in 2022.

Site	Study Area	Bull thistle – W	Canada thistle – W	European buckthorn – IV, W	Narrow-leaved cattail – I	Reed canarygrass – IV	Scots pine - IV
SB_L001	LSA_{AQU}	0	0	1	0	1	1
SB_L003	LSA_{AQU}	0	0	0	0	1	0
SB_L004	LSA_{AQU}	1	0	1	0	1	0
SB_L005	LSA_{AQU}	0	0	1	0	1	0
SB_L006	AOI	1	1	0	0	1	0
SB_L007	LSA_{AQU}	0	0	0	0	0	0
SB_P003	LSA_{AQU}	0	0	0	0	0	0
SB_P005	LSA_{AQU}	0	0	0	0	0	0
SB_P007	LSA_{AQU}	0	0	0	0	0	0
SB_P008	LSA_{AQU}	0	1	0	1	0	0
SB_P009	LSA_{AQU}	0	0	0	1	1	0
SB_P010	AOI	0	0	0	0	1	0
SB_P015	LSA_{AQU}	0	0	0	1	0	0

<u>Note:</u>
Includes species classified as emergent, submergent, and floating and those observed in the riparian zones.
I = introduced; W = Weed; IV = invasive; R = provincially rare; SAR= Species at Risk.

Table B-5. Vegetation species of interest detected at wetland sites within the BIS study areas relevant to vegetation during AHM field surveys in 2022. I = introduced; W = Weed; IV = invasive; R = provincially rare; SAR= Species at Risk.

Site	Study Area	Bittersweet nightshade – I	Norway maple - IV	Reed canarygrass - IV	Stinging nettle – I
SB_P002	AOI	1	1	1	0
SB_P004	LSA_{AQU}	0	0	0	0
SB_P006	LSA_{AQU}	0	0	0	0
SB_P011	LSA_{AQU}	0	0	0	0
SB_P012	AOI	0	0	1	1
SB_P013	AOI	0	0	1	0
SB_P014	AOI	0	0	0	0
SB_P016	AOI	0	0	1	0
SB_S113	LSA_{AQU}	0	0	0	0
SB_W002	LSA_{AQU}	0	0	0	0
SB_W003	LSA_{AQU}	0	0	0	0
SB_W005	LSA_{AQU}	0	0	0	0
SB_W006	LSA_{AQU}	0	0	0	0
SB_W008	LSA_{AQU}	0	0	0	0
SB_W009	LSA_{AQU}	0	0	0	0
SB_W011	LSA_{AQU}	0	0	0	0
SB_W013	LSA_{AQU}	0	0	0	0
SB_W017	LSA_{AQU}	0	0	0	0
SB_W018	LSA_{AQU}	0	0	0	0
SB_W023	LSA_{AQU}	0	0	0	0
SB_W024	LSA_{AQU}	0	0	0	0
SB_W025	LSA_{AQU}	0	0	0	0
SB_W028	LSA_{AQU}	0	0	0	0
SB_W032	LSA_{AQU}	0	0	0	0
SB_W033	LSA_{AQU}	0	0	0	0
SB_W035	LSA_{AQU}	0	0	0	0
SB_W037	LSA_{AQU}	0	0	0	0
SB_W038	LSA_{AQU}	0	0	1	0
SB_W041	LSA_{AQU}	0	0	0	0
SB_W044	LSA_{AQU}	0	0	0	0
SB_W045	LSA_{AQU}	0	0	0	0
SB_W046	LSA_{AQU}	0	0	0	0
SB_W051	LSA_{AQU}	0	0	0	0
SB_W053	LSA_{AQU}	0	0	1	0
SB_W054	LSA_{AQU}	0	0	0	0
SB_W055	LSA_{AQU}	0	0	0	0
SB_W056	LSA_{AQU}	0	0	0	0

Site	Study Area	Bittersweet nightshade – I	Norway maple - IV	Reed canarygrass - IV	Stinging nettle – I
SB_W057	LSA_{AQU}	0	0	0	0
SB_W058	LSA_{AQU}	0	0	0	0
SB_W059	LSA_{AQU}	0	0	0	0
SB_W060	LSA_{AQU}	0	0	0	0
SB_W062	LSA_{AQU}	0	0	0	0
SB_W065	LSA_{AQU}	0	0	0	0
SB_W066	LSA_{AQU}	0	0	0	0
SB_W067	LSA_{AQU}	0	0	0	0
SB_W068	LSA_{AQU}	0	0	0	0
SB_W069	LSA_{AQU}	0	0	0	0
SB_W071	LSA_{AQU}	0	0	0	0
SB_W073	LSA_{AQU}	0	0	0	0
SB_W075	LSA_{AQU}	0	0	0	0
SB_W076	LSA_{AQU}	0	0	0	0
SB_W112	LSA_{AQU}	0	0	0	0
SB_W113	AOI	0	0	0	0
SB_W114	AOI	0	0	0	0
SB_W115	AOI	0	0	0	0
SB_W116	AOI	0	0	0	0
SB_W117	AOI	0	0	0	0
SB_W118	AOI	0	0	0	0
SB_W119	AOI	0	0	0	0
SB_W120	AOI	0	0	0	0
SB_W121	AOI	0	0	0	0
SB_W122	AOI	0	0	0	0
SB_W123	AOI	0	0	0	0
SB_W124	AOI	0	0	0	0
SB_W125	AOI	0	0	0	0
SB_W126	AOI	0	0	0	0
SB_W127	AOI	0	0	0	0
SB_W128	AOI	0	0	0	0
SB_W129	AOI	0	0	0	0
SB_W130	AOI	0	0	0	0
SB_W131	AOI	0	0	0	0
SB_W132	AOI	0	0	1	0
SB_W133	AOI	0	0	0	0
SB_W134	AOI	0	0	0	0
SB_W135	AOI	0	0	0	0
SB_W136	AOI	0	0	0	0
SB_W137	AOI	0	0	0	0

Site	Study Area	Bittersweet nightshade – I	Norway maple - IV	Reed canarygrass - IV	Stinging nettle – I
SB_W138	AOI	0	0	0	0
SB_W164	AOI	0	0	0	0
SB_W165	AOI	0	0	0	0
SB_W166	AOI	0	0	0	0

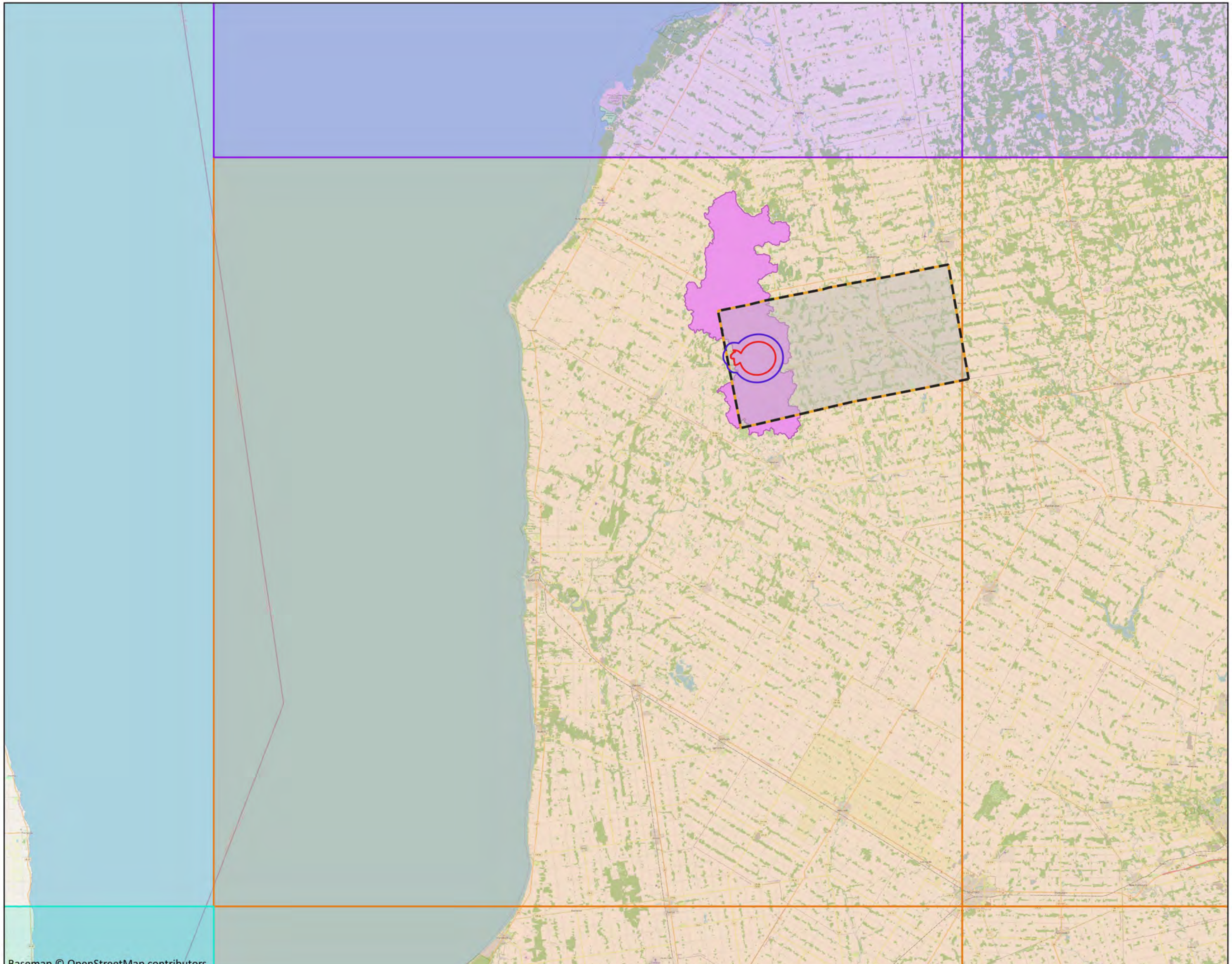
Table B-6. Vegetation species of interest detected at watercourse sites within the BIS study areas relevant to vegetation during AHM field surveys in 2022. I = introduced; W = Weed; IV = invasive; R = provincially rare; SAR= Species at Risk.

Site	Study Area	Narrow-leaved cattail – I	Reed canarygrass – IV	Scot's pine – IV	Soybean – I	Stinging nettle – I	Water speedwell – I	White willow – I
SB_S001	LSA_{AQU}	0	0	0	0	0	0	0
SB_S002	LSA_{AQU}	0	1	0	0	0	1	0
SB_S003	LSA_{AQU}	0	1	0	0	0	0	0
SB_S004	AOI	0	1	0	0	0	0	1
SB_S006	AOI	1	1	0	0	0	1	0
SB_S007	AOI	0	1	0	0	1	1	0
SB_S008	AOI	0	1	0	0	0	0	1
SB_S009	AOI	0	0	0	0	0	0	0
SB_S010	LSA_{AQU}	0	1	0	0	0	0	0
SB_S011	LSA_{AQU}	0	0	0	0	0	0	0
SB_S012	AOI	0	0	0	0	0	0	0
SB_S013	AOI	0	1	0	0	1	0	0
SB_S014	AOI	0	0	0	0	0	0	0
SB_S015	AOI	0	1	0	0	0	1	0
SB_S016	AOI	0	1	0	0	1	1	0
SB_S018	LSA_{AQU}	0	1	0	0	0	0	0
SB_S021	LSA_{AQU}	0	0	0	0	0	0	0
SB_S026	LSA_{AQU}	0	1	0	0	0	0	0
SB_S029	AOI	0	1	0	0	0	0	0
SB_S030	LSA_{AQU}	0	1	0	0	0	0	0
SB_S032	AOI	0	0	0	0	0	0	0
SB_S033	LSA_{AQU}	0	0	0	0	0	1	0
SB_S034	AOI	0	1	0	1	0	0	0
SB_S035	AOI	0	1	1	0	0	0	0
SB_S037	LSA_{AQU}	0	1	0	0	0	1	0
SB_S038	AOI	0	1	0	0	0	0	0

Site	Study Area	Narrow-leaved cattail – I	Reed canarygrass – IV	Scot's pine – IV	Soybean – I	Stinging nettle – I	Water speedwell – I	White willow – I
SB_S039	AOI	0	1	0	0	0	0	0
SB_S040	AOI	0	1	0	0	0	0	0
SB_S042	AOI	0	1	0	0	1	1	0
SB_S044	LSA_{AQU}	0	0	0	0	0	0	0
SB_S045	LSA_{AQU}	0	0	0	0	0	1	0
SB_S046	LSA_{AQU}	0	0	0	0	1	0	0
SB_S047	LSA_{AQU}	0	1	0	0	1	1	0
SB_S048	AOI	0	0	0	0	0	0	0
SB_S049	LSA_{AQU}	0	1	0	0	0	0	0
SB_S050	AOI	0	0	0	0	0	0	0
SB_S051	AOI	0	1	0	0	0	0	0
SB_S052	LSA_{AQU}	0	1	0	0	0	0	0
SB_S053	AOI	0	1	0	1	0	0	0
SB_S056	AOI	0	1	0	0	1	0	0
SB_S057	LSA_{AQU}	0	0	0	0	0	0	0
SB_S058	LSA_{AQU}	0	1	0	0	0	0	0
SB_S059	LSA_{AQU}	0	0	0	0	0	0	0
SB_S061	LSA_{AQU}	0	0	0	0	1	0	0
SB_S062	LSA_{AQU}	0	0	0	0	0	0	0
SB_S063	LSA_{AQU}	0	1	0	0	0	0	0
SB_S064	LSA_{AQU}	0	1	0	0	0	1	0
SB_S065	LSA_{AQU}	0	1	0	0	0	0	0
SB_S067	AOI	0	1	0	0	0	0	0
SB_S068	AOI	0	1	0	0	0	1	0
SB_S069	AOI	0	0	0	0	0	0	0
SB_S070	AOI	0	1	0	0	0	0	0
SB_S071	AOI	0	1	0	0	0	0	0
SB_S072	AOI	0	1	0	0	1	0	0

Site	Study Area	Narrow-leaved cattail – I	Reed canarygrass – IV	Scot's pine – IV	Soybean – I	Stinging nettle – I	Water speedwell – I	White willow – I
SB_S073	AOI	0	1	0	0	0	0	0
SB_S074	AOI	0	1	0	0	0	0	0
SB_S075	AOI	0	1	0	0	1	0	0
SB_S076	AOI	0	1	0	0	0	0	0
SB_S077	AOI	0	1	0	0	1	0	0
SB_S079	LSA_{AQU}	0	0	0	0	0	0	0
SB_S080	LSA_{AQU}	0	0	0	0	0	0	0
SB_S081	LSA_{AQU}	0	0	0	0	1	1	0
SB_S089	LSA_{AQU}	0	1	0	0	0	1	0
SB_S090	LSA_{AQU}	0	1	0	0	0	1	0
SB_S093	AOI	0	1	0	0	0	1	0
SB_S094	AOI	0	1	0	0	0	1	0
SB_S095	AOI	0	1	0	0	0	1	0
SB_S096	AOI	0	1	0	0	0	0	1
SB_S099	AOI	0	0	0	0	0	0	0
SB_S100	AOI	0	1	0	0	0	0	0
SB_S101	AOI	0	1	0	0	0	0	0
SB_S102	AOI	0	0	0	0	0	0	0
SB_S103	AOI	0	1	0	0	0	0	0
SB_S104	AOI	0	0	0	0	0	0	0
SB_S105	AOI	0	1	0	0	0	0	0
SB_S106	AOI	0	0	0	0	0	0	0
SB_S107	AOI	0	0	0	0	0	0	0
SB_S108	AOI	1	1	0	0	0	1	0
SB_S109	AOI	0	0	0	0	0	0	0
SB_S110	LSA_{AQU}	0	0	0	0	0	0	0
SB_S112	LSA_{AQU}	0	0	0	0	0	0	0
SB_S114	LSA_{AQU}	0	0	0	0	0	0	0

Site	Study Area	Narrow-leaved cattail – I	Reed canarygrass – IV	Scot's pine – IV	Soybean – I	Stinging nettle – I	Water speedwell – I	White willow – I
SB_S115	LSA_{AQU}	0	0	0	0	0	0	0
SB_S117	AOI	0	0	0	0	0	0	0
SB_S120	LSA_{AQU}	0	0	0	0	0	0	0
SB_S121	AOI	0	0	0	0	0	0	0
SB_S126	LSA_{AQU}	0	1	0	0	0	1	0
SB_W061	LSA_{AQU}	0	0	0	0	0	0	0
SB_W064	LSA_{AQU}	0	0	0	0	0	0	0
SB_W139	AOI	0	0	0	0	0	0	0



NWMO Biodiversity Impact Studies

Critical Habitat for Goldenseal and American Ginseng

Figure B-1

- Area of Interest (AOI)
- Local Study Area (LSA_{TER})
- Local Study Area (LSA_{AQU})
- South Bruce Boundary

100 x 100 km standardized UTM grid squares within which critical habitat is found

- Goldenseal and American Ginseng
- American Ginseng
- Goldenseal

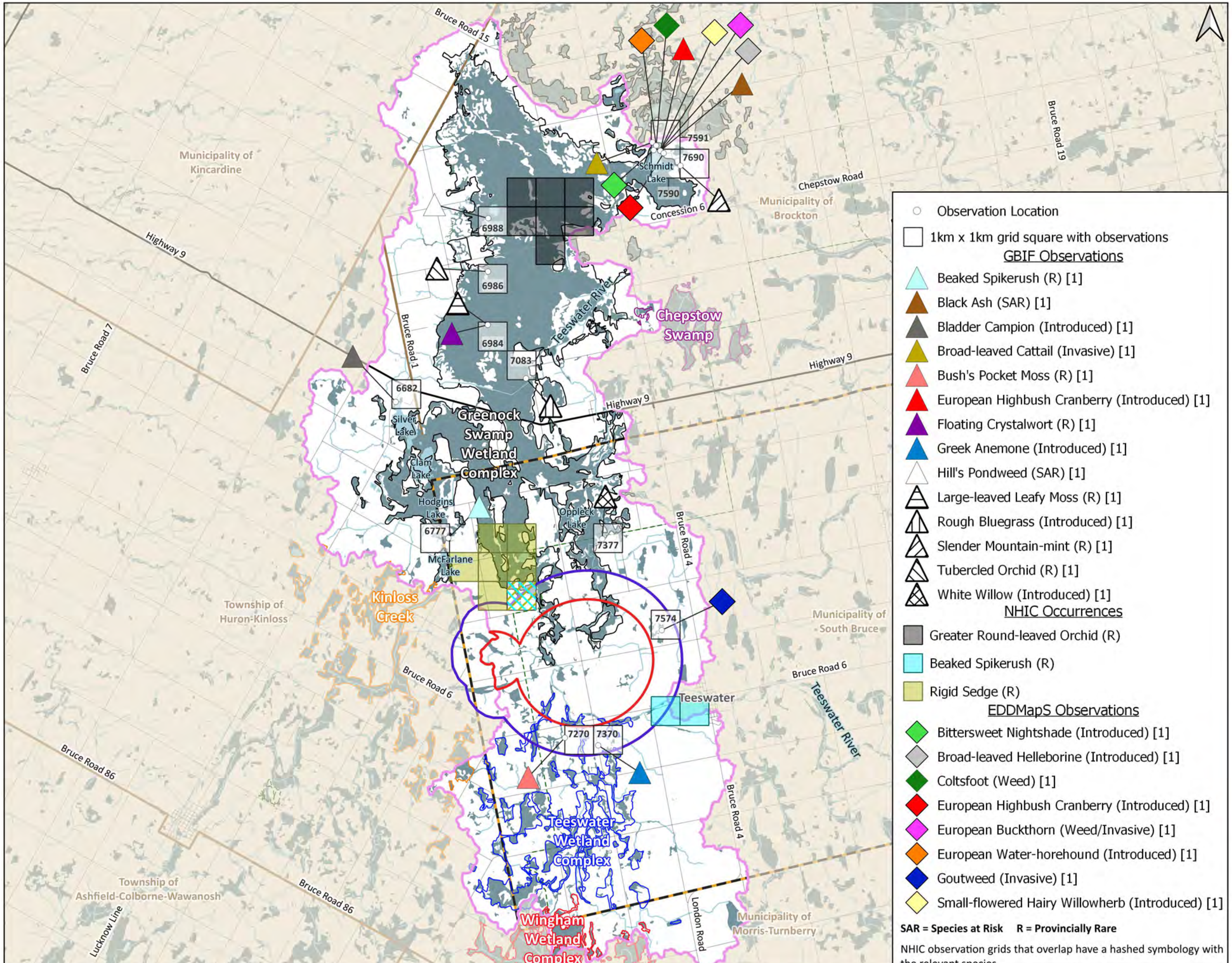
This map shows the extent of known critical habitat for goldenseal and American ginseng. Other critical habitat for these species and other at risk species may be present and not yet identified.

1:500,000

0 10 20 km

Data received from:
Ontario GeoHub — Municipal Boundary - Lower Tier (MMAH); UTM (Universal Transverse Mercator) 100 KM Grid (MNRF)
NWMO — AOI

Project CRS: NAD83 / UTM zone 17N		
Author: DM	Reviewed by: RC	Approved by: HB
October 16, 2023	Map ID: NWMO_BIS_D116b	



NWMO Biodiversity Impact Studies

Species of Interest Desk-based Observations: Vegetation

Figure B-2

- Area of Interest (AOI)
- Local Study Area (LSA_{TER})
- Local Study Area (LSA_{AQU})
- Lake
- Wetland
- Watercourse
- Highway
- Local Road
- South Bruce Boundary
- Municipal Boundary

Of all wetlands shown, only Provincially Significant Wetlands (PSWs) are labelled. The colour of the outline surrounding PSWs matches the colour of the respective PSW label.

PSW boundaries may not match wetland boundaries due to changes in aquatic habitat coverage since their creation compared to 2022.

1:130,000

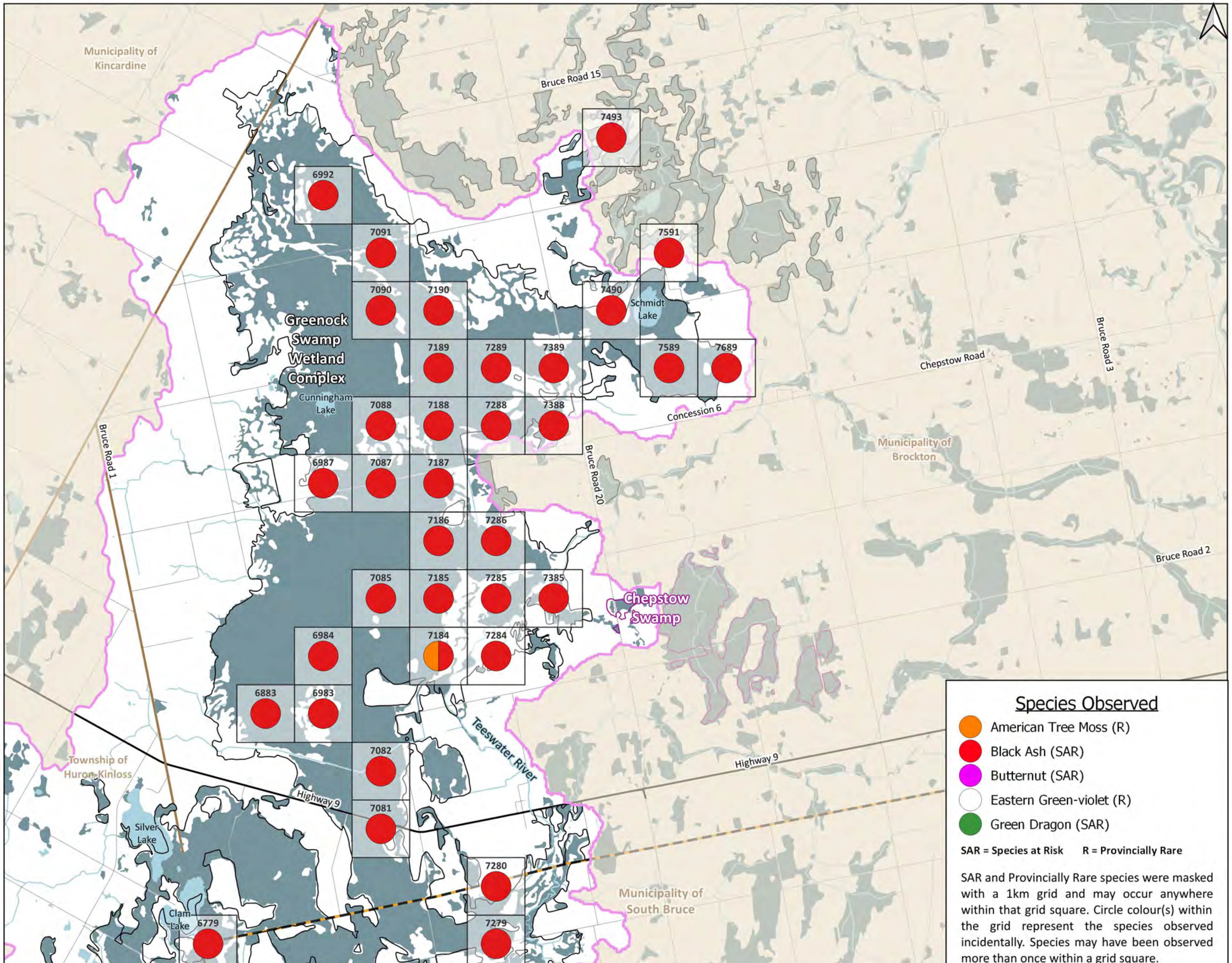
0 2 4 km

ZOETICA

Data received from:
Ontario GeoHub — OHN Waterbody (MNRF); OHN Watercourse (MNRF); MNRF Road Segments (MNRF); Municipal Boundary - Lower and Single Tier (MMAH); Wetlands (MNRF)
NWMO — AOI; NHIC Species Occurrences (MNRF)
GBIF.org — GBIF Occurrence Download - Accessed Oct., 2021
EDDMapS Ontario — Invasive Species Observations - Accessed Jan.12, 2022
Wetlands and water features are mapped using ecosite data within the LSA_{ECO} and data available from Ontario GeoHub outside the LSA_{ECO}

Project CRS: NAD83 / UTM zone 17N

Author: AH	Reviewed by: RC	Approved by: HB
December 11, 2023	Map ID: NWMO_BIS_A079	



NWMO Biodiversity Impact Studies

Species of Interest Field Observations (SAR and Provincially Rare): Vegetation North LSA $_{AQU}$

Figure B-3a

- Area of Interest (AOI)
- Local Study Area (LSA$_{TER}$)
- Local Study Area (LSA$_{AQU}$)
- Lake
- Wetland
- Watercourse
- Highway
- Local Road
- South Bruce Boundary
- Municipal Boundary

Of all wetlands shown, only Provincially Significant Wetlands (PSWs) are labelled. The colour of the outline surrounding PSWs matches the colour of the respective PSW label.

PSW boundaries may not match wetland boundaries due to changes in aquatic habitat coverage since their creation compared to 2022.

1:65,000

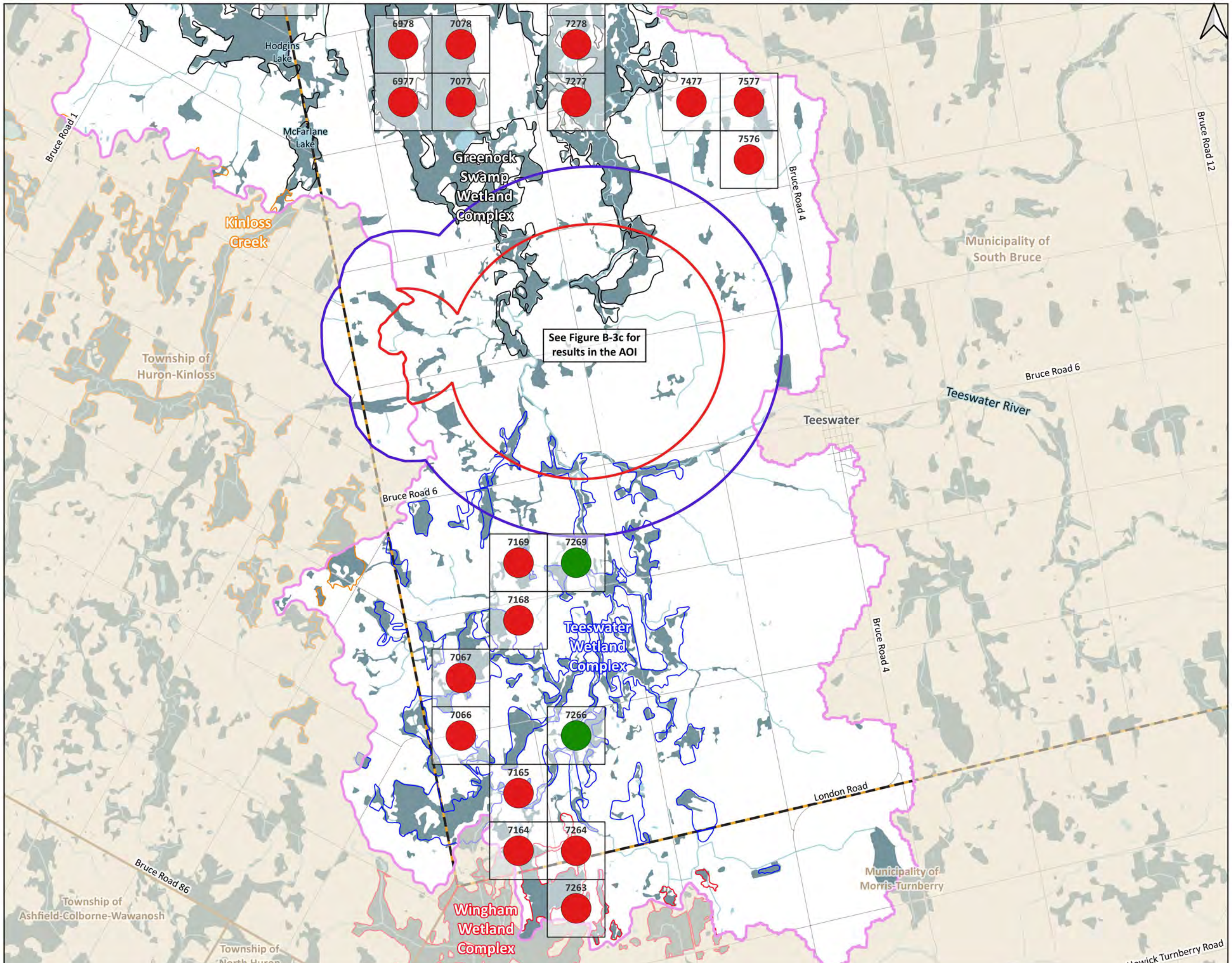
0 1 2 km

ZOETICA

Data received from:
Ontario GeoHub — OHN Waterbody (MNRF); OHN Watercourse (MNRF); MNRF Road Segments (MNRF); Municipal Boundary - Lower and Single Tier (MMAH); Wetlands (MNRF)
NWMO — AOI; NWMO Purchased or Optioned Land; 2022 SB TEM Ecosite Data Export V4 (Tulloch)
Wetlands and water features are mapped using ecosite data within the LSA$_{ECO}$ and data available from Ontario GeoHub outside the LSA$_{ECO}$.

Project CRS: NAD83 / UTM zone 17N

Author: AH	Reviewed by: RC	Approved by: HB
January 19, 2024	Map ID: NWMO_BIS_A119a	



NWMO Biodiversity Impact Studies

Species of Interest Field Observations (SAR and Provincially Rare): Vegetation South LSA $_{AQU}$

Figure B-3b

- Area of Interest (AOI)
- Local Study Area (LSA$_{TER}$)
- Local Study Area (LSA$_{AQU}$)
- Lake
- Wetland
- Watercourse
- Highway
- Local Road
- South Bruce Boundary
- Municipal Boundary

See Figure B-3a for Full Legend

Of all wetlands shown, only Provincially Significant Wetlands (PSWs) are labelled. The colour of the outline surrounding PSWs matches the colour of the respective PSW label.

PSW boundaries may not match wetland boundaries due to changes in aquatic habitat coverage since their creation compared to 2022.

1:65,000

0 1 2 km

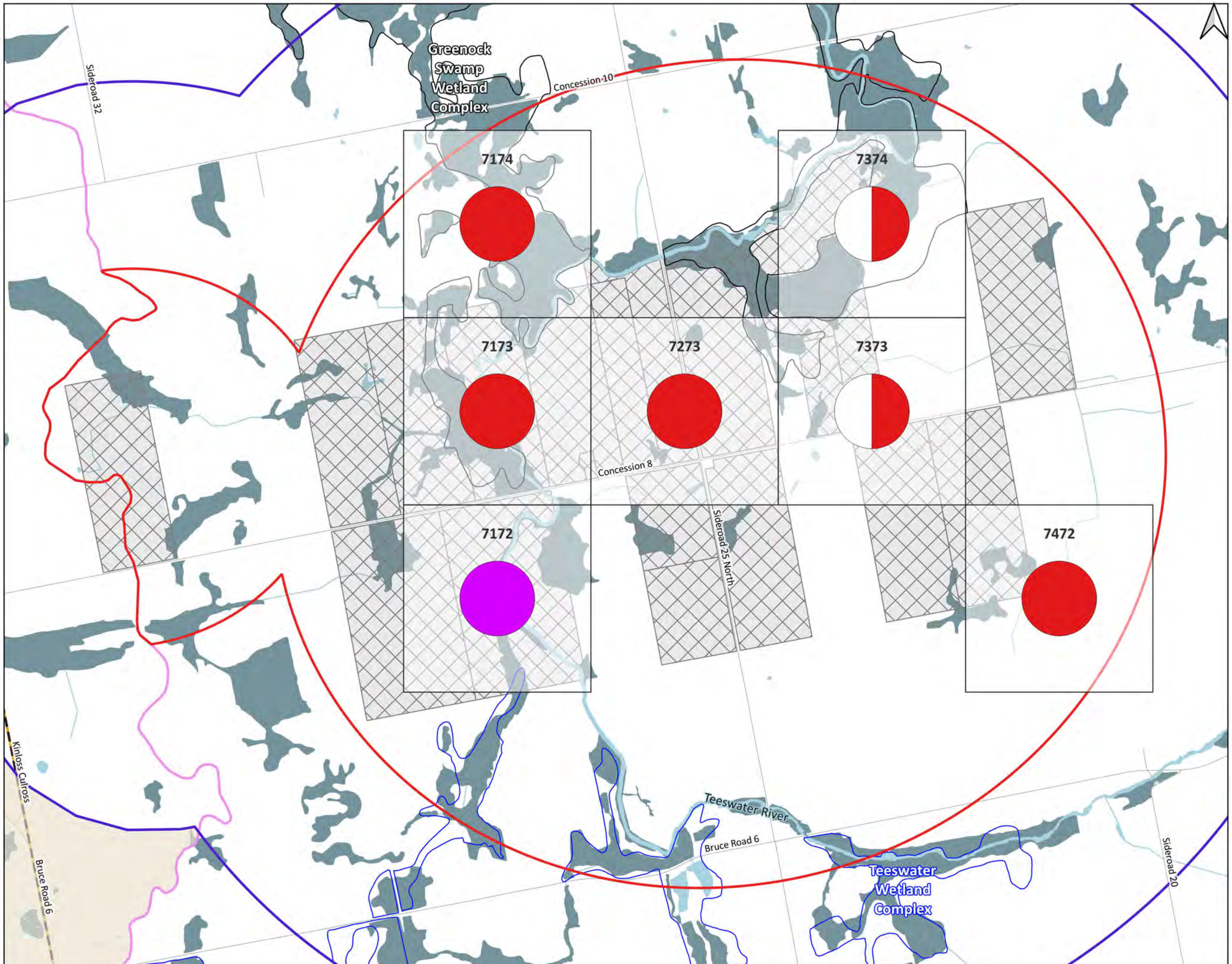
ZOETICA

Inset Basemap © OpenStreetMap contributors

Data received from:
Ontario GeoHub — OHN Waterbody (MNRF); OHN Watercourse (MNRF); MNRF Road Segments (MNRF); Municipal Boundary Lower and Single Tier (MMAH); Wetlands (MNRF)
NWMO — AOI; NWMO Purchased or Optioned Land; 2022 SB TEM Ecosite Data Export V4 (Tulloch)
Wetlands and water features are mapped using ecosite data within the LSA$_{ECO}$ and data available from Ontario GeoHub outside the LSA$_{ECO}$.

Project CRS: NAD83 / UTM zone 17N

Author: AH	Reviewed by: RC	Approved by: HB
January 19, 2024	Map ID: NWMO_BIS_A119b	



NWMO Biodiversity Impact Studies

Species of Interest Field Observations (SAR and Provincially Rare): Vegetation AOI

Figure B-3c

- Area of Interest (AOI)
- Local Study Area (LSA_{TER})
- Local Study Area (LSA_{AQU})
- Lake
- Wetland
- Watercourse
- Highway
- Local Road
- South Bruce Boundary
- Municipal Boundary
- NWMO Purchased or Optioned Land

See Figure B-3a for Full Legend

Of all wetlands shown, only Provincially Significant Wetlands (PSWs) are labelled. The colour of the outline surrounding PSWs matches the colour of the respective PSW label.

PSW boundaries may not match wetland boundaries due to changes in aquatic habitat coverage since their creation compared to 2022.

1:20,000

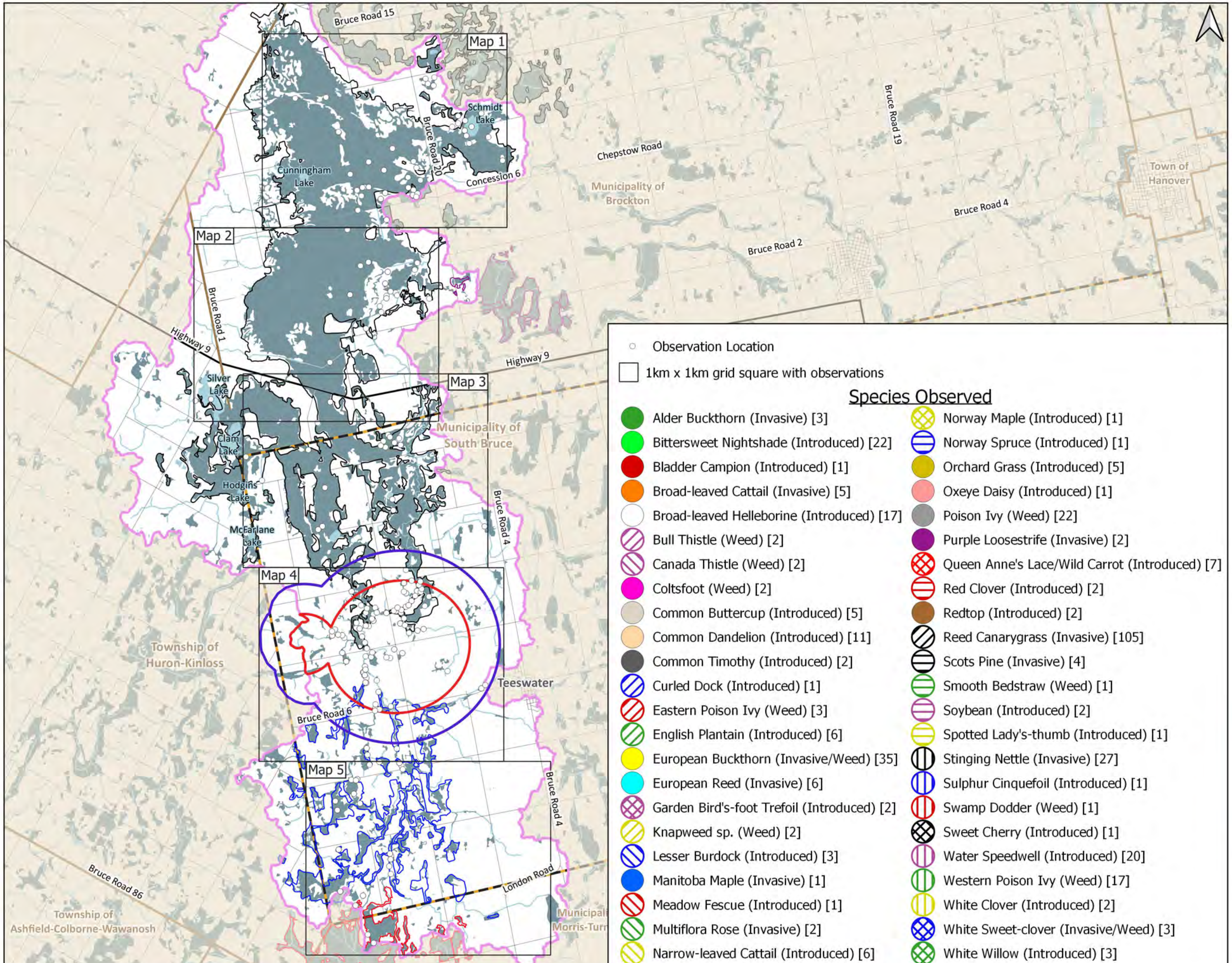
0 0.5 1 km

ZOETICA

Inset Basemap © OpenStreetMap contributors

Data received from:
Ontario GeoHub — OHN Waterbody (MNRF); OHN Watercourse (MNRF); MNRF Road Segments (MNRF); Municipal Boundary - Lower and Single Tier (MMAH); Wetlands (MNRF)
NWMO — AOI; NWMO Purchased or Optioned Land; 2022 SB TEM Ecosite Data Export V4 (Tulloch)
Wetlands and water features are mapped using ecosite data within the LSA_{ECO} and data available from Ontario GeoHub outside the LSA_{ECO}.

Project CRS: NAD83 / UTM zone 17N		
Author: AH	Reviewed by: RC	Approved by: HB
January 19, 2024	Map ID: NWMO_BIS_A119c	



NWMO Biodiversity Impact Studies

Species of Interest Field Observations (Invasive): Vegetation - Overview Map

Figure B-4a

- Area of Interest (AOI)
- Local Study Area (LSA_{TER})
- Local Study Area (LSA_{AQU})
- Lake
- Wetland
- Watercourse
- Highway
- Local Road
- South Bruce Boundary
- Municipal Boundary

Of all wetlands shown, only Provincially Significant Wetlands (PSWs) are labelled. The colour of the outline surrounding PSWs matches the colour of the respective PSW label.

PSW boundaries may not match wetland boundaries due to changes in aquatic habitat coverage since their creation compared to 2022.

1:125,000

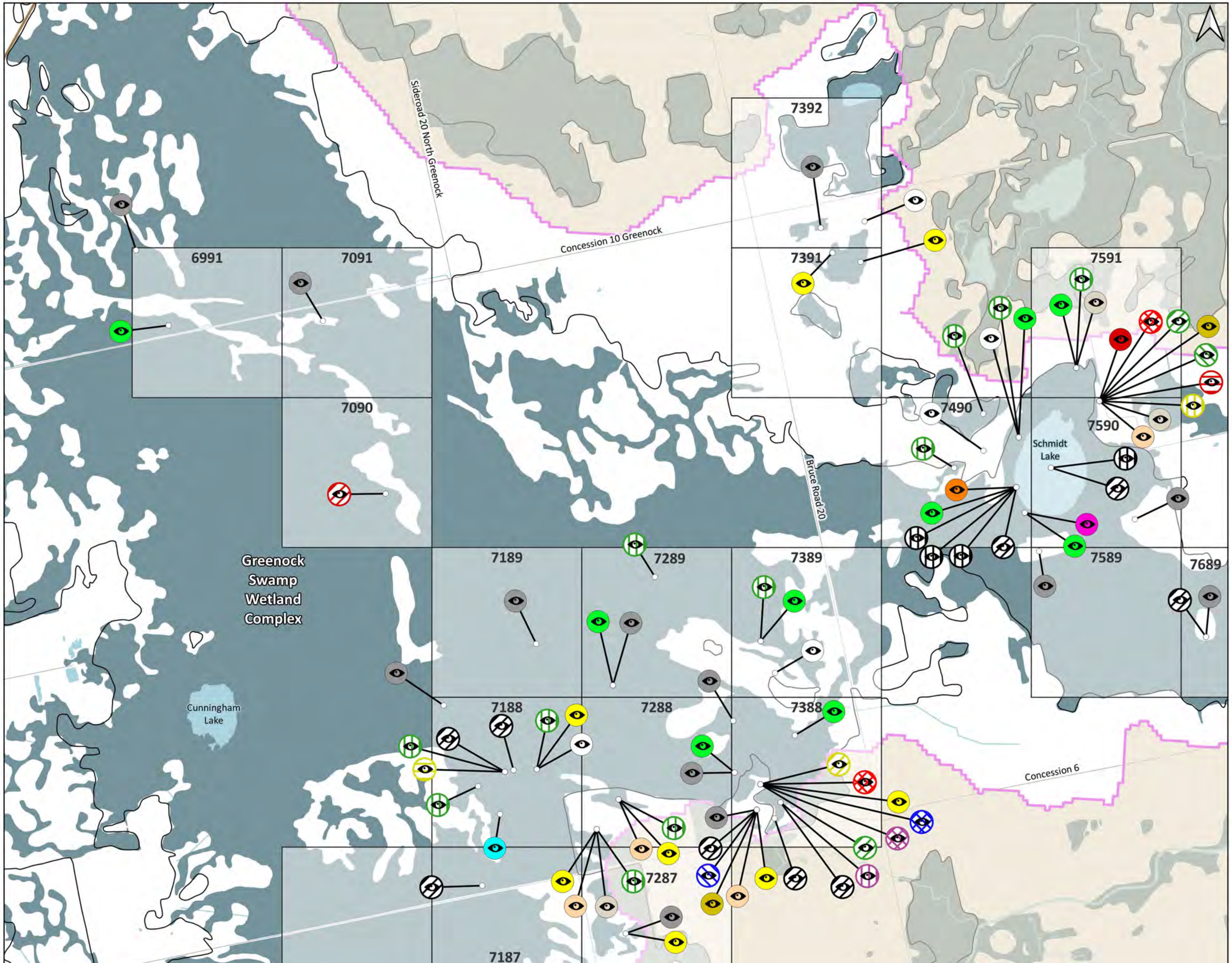
0 2 4 km

ZOETICA

Data received from:
Ontario GeoHub — OHN Waterbody (MNRF); OHN Watercourse (MNRF); MNRF Road Segments (MNRF); Municipal Boundary - Lower and Single Tier (MMAH); Wetlands (MNRF)
NWMO — AOI; 2022 SB TEM Ecosite Data Export V4 (Tulloch)
Noun Project — CC BY 3.0: "Eye" by Nicholas Menghini
Wetlands and water features are mapped using ecosite data within the LSA_{ECO} and data available from Ontario GeoHub outside the LSA_{ECO}.

Project CRS: NAD83 / UTM zone 17N

Author: AH	Reviewed by: RC	Approved by: HB
January 19, 2024	Map ID: NWMO_BIS_A124a	



NWMO Biodiversity Impact Studies

Species of Interest Field Observations (Invasive): Vegetation - Map 1

Figure B-4b

- Area of Interest (AOI)
- Local Study Area (LSA_{TER})
- Local Study Area (LSA_{AQU})
- Lake
- Wetland
- Watercourse
- Highway
- Local Road
- South Bruce Boundary
- Municipal Boundary

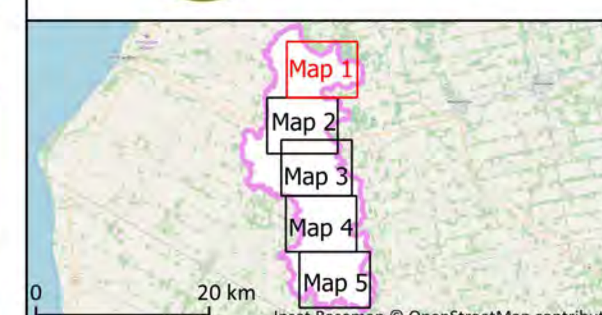
See Figure B-4a for Full Legend

Of all wetlands shown, only Provincially Significant Wetlands (PSWs) are labelled. The colour of the outline surrounding PSWs matches the colour of the respective PSW label.

PSW boundaries may not match wetland boundaries due to changes in aquatic habitat coverage since their creation compared to 2022.

1:25,000

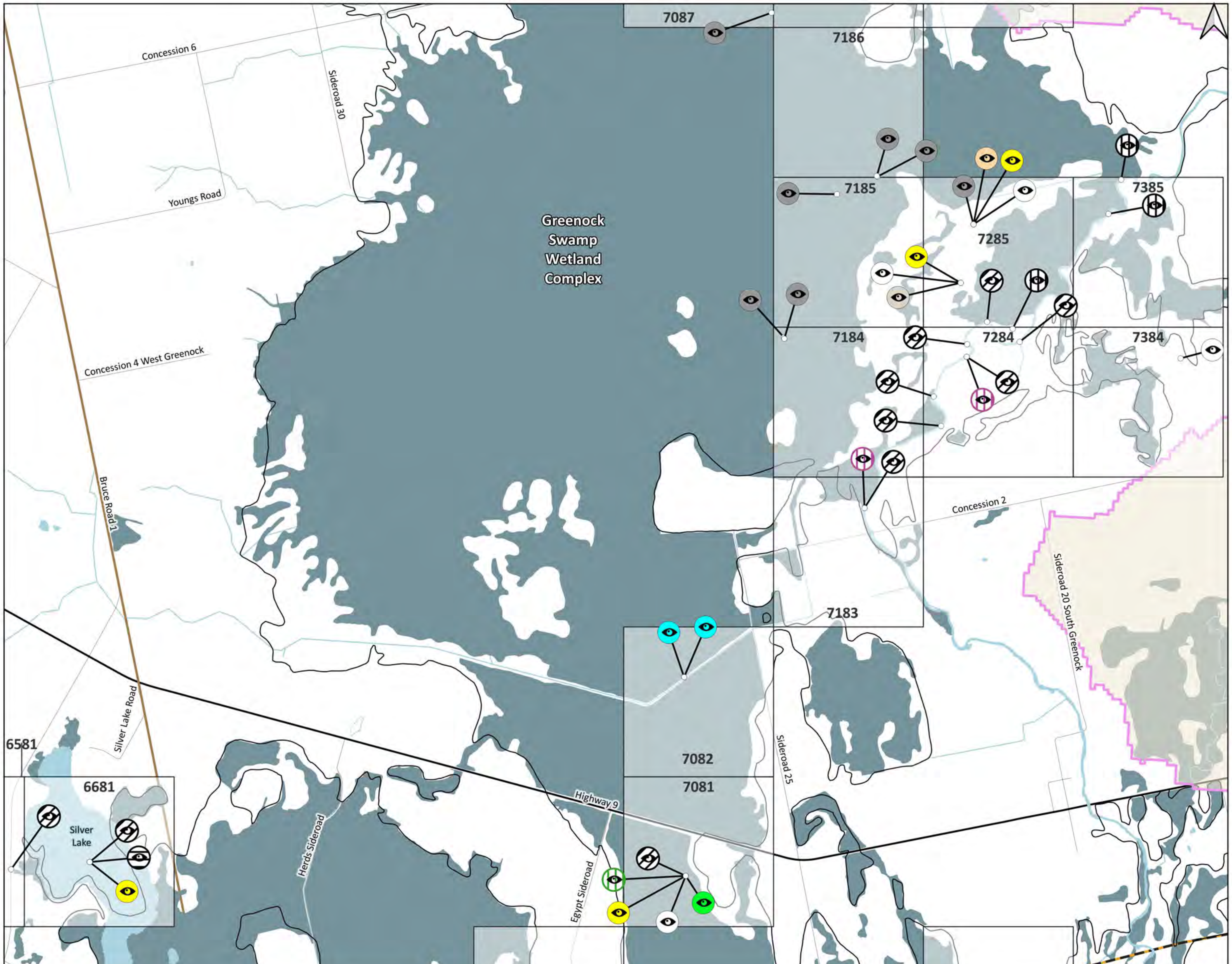
0 500 1,000 m



Data received from:
Ontario GeoHub — OHN Waterbody (MNRF); OHN Watercourse (MNRF); MNRF Road Segments (MNRF); Municipal Boundary - Lower and Single Tier (MMAH); Wetlands (MNRF)
NWMO — AOI; 2022 SB TEM Ecosite Data Export V4 (Tulloch)
Noun Project — CC BY 3.0: "Eye" by Nicholas Menghini
Wetlands and water features are mapped using ecosite data within the LSA_{ECO} and data available from Ontario GeoHub outside the LSA_{ECO}.

Project CRS: NAD83 / UTM zone 17N

Author: AH	Reviewed by: RC	Approved by: HB
January 19, 2024	Map ID: NWMO_BIS_A124b	



NWMO Biodiversity Impact Studies

Species of Interest Field Observations (Invasive): Vegetation - Map 2

Figure B-4c

- Area of Interest (AOI)
- Local Study Area (LSA_{TER})
- Local Study Area (LSA_{AQU})
- Lake
- Wetland
- Watercourse
- Highway
- Local Road
- South Bruce Boundary
- Municipal Boundary

See Figure B-4a for Full Legend

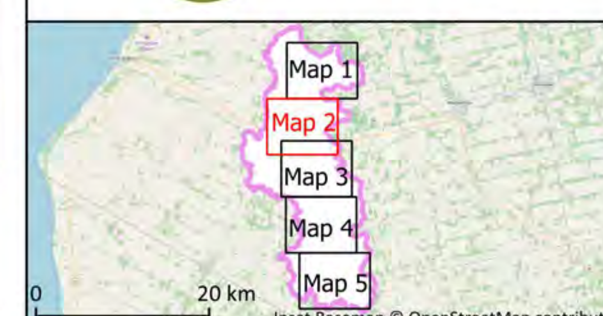
Of all wetlands shown, only Provincially Significant Wetlands (PSWs) are labelled. The colour of the outline surrounding PSWs matches the colour of the respective PSW label.

PSW boundaries may not match wetland boundaries due to changes in aquatic habitat coverage since their creation compared to 2022.

1:25,000

0 500 1,000 m

ZOETICA



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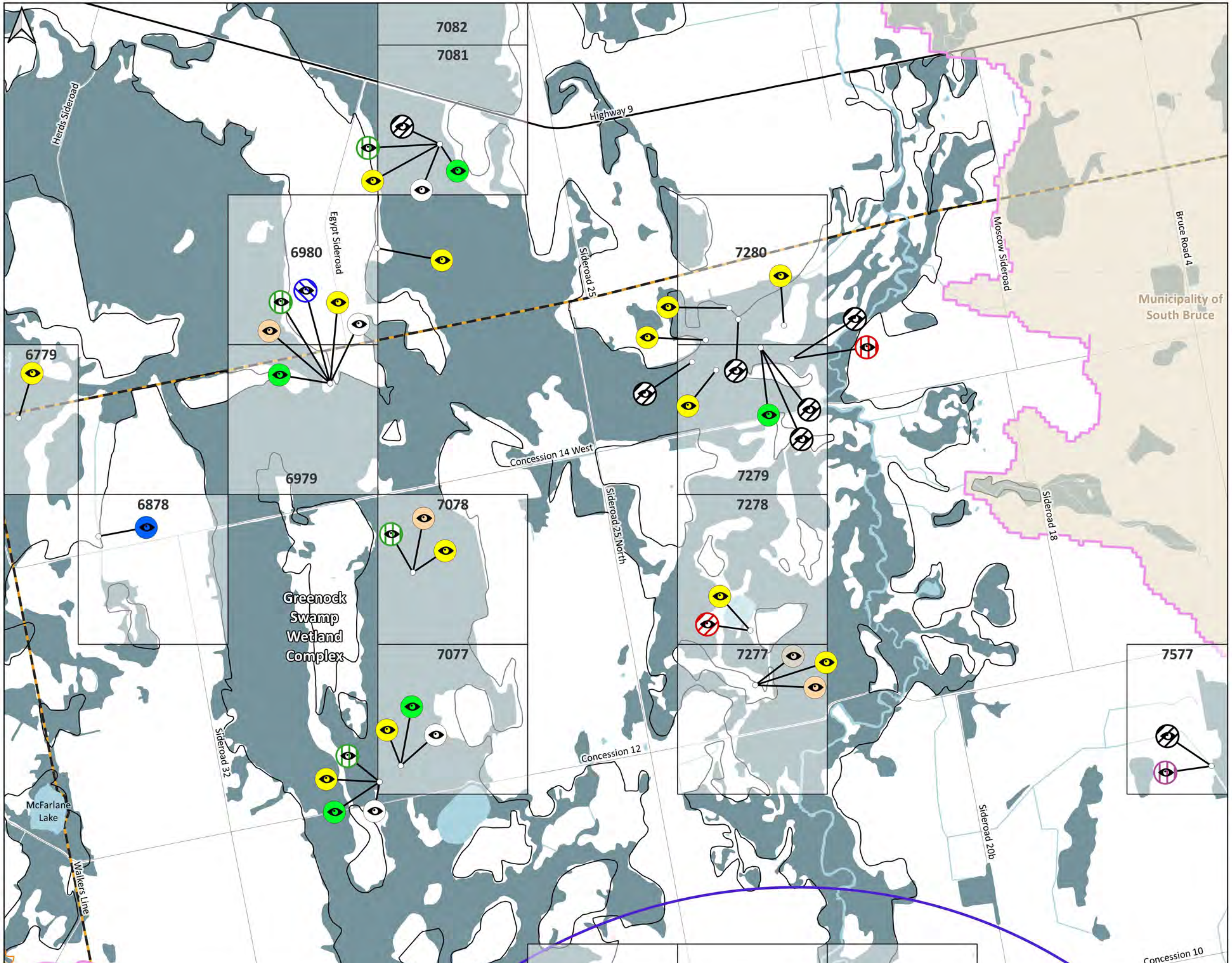
NWMO — AOI; 2022 SB TEM Ecosite Data Export V4 (Tulloch)
Noun Project — CC BY 3.0: "Eye" by Nicholas Menghini
Wetlands and water features are mapped using ecosite data within the LSA_{ECO} and data available from Ontario GeoHub outside the LSA_{ECO}.

Project CRS: NAD83 / UTM zone 17N		
Author: AH	Reviewed by: RC	Approved by: HB
January 19, 2024	Map ID: NWMO_BIS_A124c	

NWMO Biodiversity Impact Studies

Species of Interest Field Observations (Invasive): Vegetation - Map 3

Figure B-4d



- Area of Interest (AOI)
- Local Study Area (LSA_{TER})
- Local Study Area (LSA_{AQU})
- Lake
- Wetland
- Watercourse
- Highway
- Local Road
- South Bruce Boundary
- Municipal Boundary

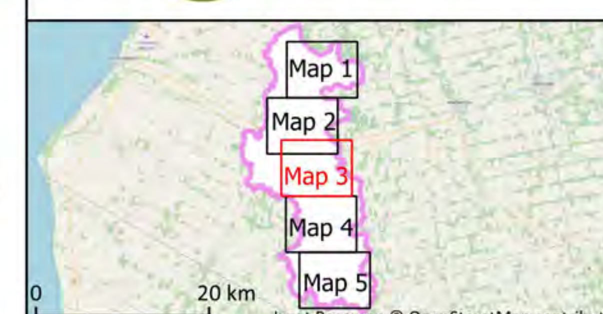
See Figure B-4a for Full Legend

Of all wetlands shown, only Provincially Significant Wetlands (PSWs) are labelled. The colour of the outline surrounding PSWs matches the colour of the respective PSW label.

PSW boundaries may not match wetland boundaries due to changes in aquatic habitat coverage since their creation compared to 2022.

1:25,000

0 500 1,000 m



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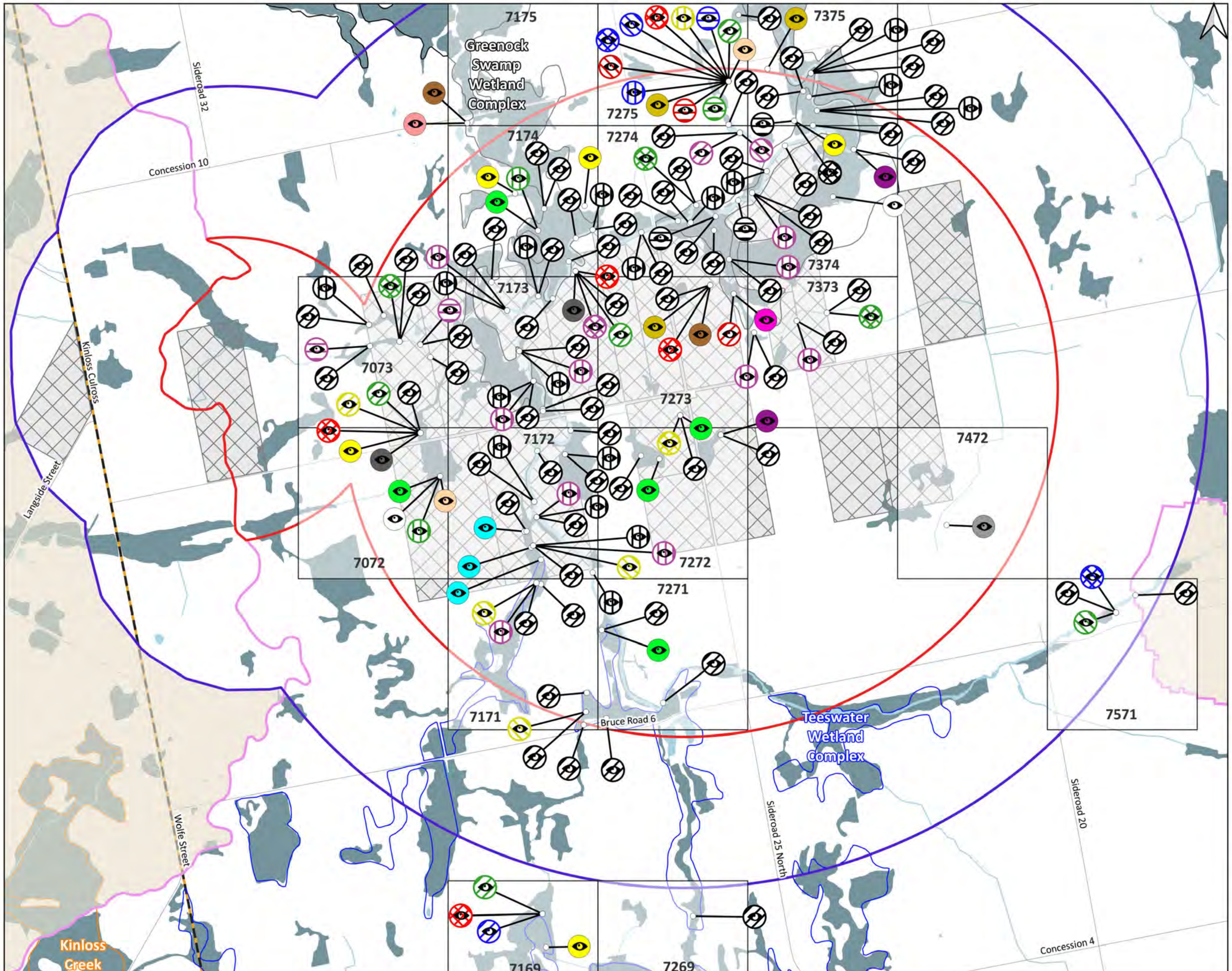
Ontario GeoHub — OHN Waterbody (MNRF); OHN Watercourse (MNRF); MNRF Road Segments (MNRF); Municipal Boundary Lower and Single Tier (MMAH); Wetlands (MNRF)
NWMO — AOI; 2022 SB TEM Ecosite Data Export V4 (Tulloch)
Noun Project — CC BY 3.0: "Eye" by Nicholas Menghini
Wetlands and water features are mapped using ecosite data within the LSA_{ECO} and data available from Ontario GeoHub outside the LSA_{ECO}.

Project CRS: NAD83 / UTM zone 17N		
Author: AH	Reviewed by: RC	Approved by: HB
January 19, 2024	Map ID: NWMO_BIS_A124d	



NWMO Biodiversity Impact Studies

Species of Interest Field Observations (Invasive): Vegetation - Map 4

Figure B-4e

- Area of Interest (AOI)
- Local Study Area (LSA_{TER})
- Local Study Area (LSA_{AQU})
- Lake
- Wetland
- Watercourse
- Highway
- Local Road
- South Bruce Boundary
- Municipal Boundary
- NWMO Purchased or Optioned Land

See Figure B-4a for Full Legend

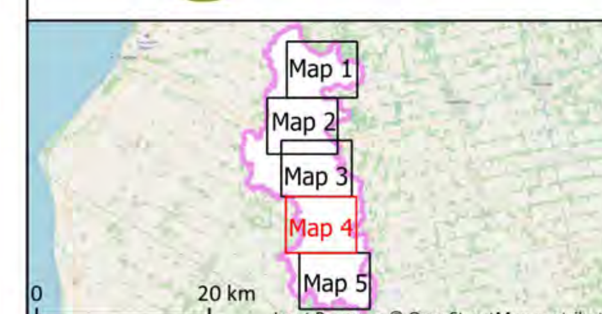
Of all wetlands shown, only Provincially Significant Wetlands (PSWs) are labelled. The colour of the outline surrounding PSWs matches the colour of the respective PSW label.

PSW boundaries may not match wetland boundaries due to changes in aquatic habitat coverage since their creation compared to 2022.

1:25,000

0 500 1,000 m

ZOETICA



Data received from:
Ontario GeoHub — OHN Waterbody (MNRF); OHN Watercourse (MNRF); MNRF Road Segments (MNRF); Municipal Boundary Lower and Single Tier (MMAH); Wetlands (MNRF)
NWMO — AOI; NWMO Purchased or Optioned Land; 2022 SB TEM Ecosite Data Export V4 (Tulloch)
Noun Project — CC BY 3.0: "Eye" by Nicholas Menghini
Wetlands and water features are mapped using ecosite data within the LSA_{ECO} and data available from Ontario GeoHub outside the LSA_{ECO}.

Project CRS: NAD83 / UTM zone 17N

Author: AH	Reviewed by: RC	Approved by: HB
January 19, 2024	Map ID: NWMO_BIS_A124e	

Report (R001)

BIODIVERSITY IMPACT STUDIES – SOUTHWESTERN ONTARIO REGION: 2023 BASELINE REPORT (CHAPTER 3: WETLANDS AND RIPARIAN ENVIRONMENTS)

December 13, 2023

PREPARED BY Zoetica Environmental Consulting Services

SUBMITTED TO Michelle Nearing
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GLOSSARY AND ABBREVIATIONS

AHM	Aquatic Habitat Mapping
AOI	Area of Interest
BIS	Biodiversity Impact Studies
BPD	Biodiversity Impact Studies – Southwestern Ontario Region: Baseline Program Design
BPPA	Biodiversity Impact Studies – Southwestern Ontario Region: Best Practices and Preferred Approaches
BV	Biodiversity Value; The biotic environmental components that will be considered for study within the Project's Biodiversity Impact Studies. A subset of biodiversity values will ultimately be scoped into the Biodiversity Impact Assessment as Valued Components.
Candidate SWH	Areas that meet the ELC ecosite code(s) and/or candidate habitat criteria outlined in the SWH ecoregional criteria schedules. For the purposes of the BIS, Zoetica has defined the following: *'Broad' candidate SWH* – ecosite codes that match criteria but are highly prevalent in the BIS study area(s) and have limited utility for informing subsequent baseline study design or the IA. Example: woodland raptor nesting habitat "may be found in all forested ELC Ecosites" (OMNRF 2017) but the defining criteria for the SWH are the nests themselves. '*Refined' candidate SWH* – areas that meet or partially meet additional habitat criteria and/or have records of selected wildlife species presence during the appropriate season (part of the defining criteria for the SWH). Certain rare vegetation communities are also automatically considered 'refined' candidate SWH when the ecosite criteria are met (e.g., cliff and cliff rim, talus slope, rock barren). 'Refined' candidate SWH will be prioritized for subsequent field studies to determine if the candidate SWH should be identified as confirmed SWH.
CNSC	Canadian Nuclear Safety Commission
DGR	Deep Geological Repository
ECCC	Environment and Climate Change Canada
Ecoregion	Second highest level of the ELC hierarchy (Crins et al. 2009). Large geographic areas primarily identified by sub-continental climatic regimes and bedrock geology.
Ecosite	The second lowest level of the ELC hierarchy. The land within an ecosite will generally contain similar substrate and vegetation.
Ecosite Classification Dataset	The dataset of ecosite classification created for the BIS using SWOOP 2020 Imagery
Ecosystem function	In the context of biodiversity, ecosystem functions include the physiochemical and biological processes that occur within the ecosystem to maintain biodiversity.
Ecosystem services	Ecosystem services are the direct and indirect benefits to human well-being that the natural environment provides through healthy ecosystems. Ecosystem services include provisioning services, such as the production of food and water; regulating services, such as the control of climate and disease; supporting services, such as nutrient cycles and oxygen production; and cultural services, such as spiritual and recreational benefits.

eDNA	Environmental DNA
ELC	Ecological Land Classification
EMBP	Environmental Media Baseline Program
GSWC	Greenock Swamp Wetland Complex
Habitat suitability / suitable habitat	The ability of the habitat, in its current condition, to provide the life requisites of a species.
IA	Impact Assessment
IAAC	Impact Assessment Agency of Canada
LSA	Local Study Area LSA_{ECO} = Local Study Area for ecosystem function and services LSA_{AQU} = Aquatic Local Study Area (fully encompassed by the LSA_{ECO})
Meta-analysis	Examination of data from several different studies to determine overall trends.
MNRF	Ontario Ministry of Natural Resources and Forestry
NWMO	Nuclear Waste Management Organization
OHN	Ontario Hydro Network
OWES	Ontario Wetland Evaluation System
PSW	Provincially Significant Wetland
Rights-holders	First Nation and Métis communities who have asserted and or hold recognized treaty and/or Indigenous rights and whose traditional territories include the project location.
RSA	Regional Study Area RSA_{ECO} = Regional Study Area for ecosystem function and services
SARA	Federal *Species at Risk Act*
SARO	Species at Risk in Ontario
SON	Saugeen Ojibway Nation
SON-South Bruce siting area	Used to describe the broader area surrounding the defined area within which the Project may be located. The SON-South Bruce siting area is the general area surrounding the Municipality of South Bruce and includes the traditional territory of Saugeen Ojibway Nation (SON) in southwestern Ontario.
SWH	Significant Wildlife Habitat; Defined in the Ontario Provincial Policy Statement, 2020 as: *Wildlife habitat* – areas where plants, animals, and other organisms live and find adequate food, water, shelter and space needed to sustain their populations. Specific wildlife habitats of concern may include areas where species concentrate at a vulnerable point in their annual life cycle; and areas important to migratory and non-migratory species. *Significant* – regarding wildlife habitat, ecologically important in terms of features, functions, representation or amount, and contributing to the quality and diversity of an identifiable geographic area or natural heritage system

TEM	Terrestrial Ecosystem Mapping
The Project	The Adaptive Phased Management Project is the Deep Geological Repository and other required infrastructure for the safe, long-term management of Canada's used nuclear fuel.
TISG	Tailored Impact Statement Guidelines. 'TISG Template' refers to the Tailored Impact Statement Guidelines Template (generic version) (IAAC 2022).
TWC	Teeswater Wetland Complex
VC	Valued Component. For impact assessments of designated projects under the *Impact Assessment Act*, the Agency's Glossary of Terms defines VCs as "environmental, health, social, economic or additional elements or conditions of the natural and human environment that may be impacted by a proposed project and are of concern or value to the public, Indigenous peoples, federal authorities and interested parties. Valued components may be identified as having scientific, biological, social, health, cultural, traditional, economic, historical, archaeological and/or aesthetic importance."

1.0 WETLANDS AND RIPARIAN ENVIRONMENTS

1.1 Introduction

Wetlands and riparian environments fulfill a wide range of ecological, hydrological, and biochemical functions, while supporting biodiversity. Wetlands are habitats at the interface between aquatic and terrestrial environments, and are considered natural heritage features in Ontario, which require protection and sustainable management (OMNR 2010). Wetlands include swamps, fens, marshes, bogs, sloughs, and peatlands and occur where the water table is at or near the surface (such as in areas surrounding watercourses and waterbodies). Riparian areas include wetlands and other vegetated areas next to waterbodies and watercourses. The Ontario Wetlands Evaluation System (OWES) assesses the value of wetlands based on their ecosystem and human utility values, and identifies particular valued wetlands at a provincial scale to be prioritized for protection. The OWES Manuals are divided into Southern and Northern Ontario, with the Adaptive Phased Management Project's (hereafter, 'the Project') Saugeen Ojibway Nation (SON)-South Bruce siting area falling within the southern Ontario region (MNRF 2013).

Wetlands and riparian habitat play important roles in supporting ecosystem function and services (see Chapter 9). Many wildlife species depend upon wetlands for various life-history phases and movement and migrations through connected, undisturbed habitat networks. Some species that rely on wetlands and riparian habitat are listed as at-risk under the federal *Species at Risk Act* (*SARA*) and the provincial Species at Risk in Ontario (SARO) schedule (e.g., birds, amphibians, insectivorous bats). In addition, wetlands and riparian habitats provide social benefits to humans, as they moderate storm flows and reduce flood risks, store water to counteract drought conditions in the dry season, improve water quality through natural filtration, provide erosion control, support species of social and cultural importance (e.g., fish), and contribute to outdoor recreational opportunities. Wetlands act as "carbon sinks" in Ontario, contribute to a stable long-term water supply as they serve as areas of groundwater recharge and discharge, and contribute to improved water quality by trapping sediments, removing excess nutrients, and degrading contaminants (OMNR 2010). Thus, the preservation of wetlands helps preserve many functions central to maintaining biodiversity and ecosystem function and services. Some of these benefits, such as water quality, are examined through the Environmental Media Baseline Program (EMBP) pillar of the Project (CanNorth 2021a). A further discussion on ecosystem function and services is provided in Chapter 9.

The Canadian Nuclear Safety Commission's (CNSC) *Guidance on Deep Geological Repository Site Characterization* requires that the aquatic and terrestrial environment be characterized as ecosystem components in the Area of Interest (AOI) (CNSC 2018). While this guidance document does not specifically identify the characterization of wetlands and riparian environments, these components fall within other ecosystem components (e.g., fish habitat, terrestrial habitat). In addition, the Tailored Impact Statement Guidelines (TISG) Template (generic version) ('TISG Template'[1]) includes guidance to characterize the project's effects on riparian and wetland environments (IAAC 2022). A full list of acts, regulations and other biodiversity considerations is available in Appendix E of the *Biodiversity Impact Studies – Southwestern Ontario Region: Best Practices and Preferred Approaches* (BPPA) Report (Zoetica 2021).

[1] Please see Chapter 1 for limitations of and planned updates to the TISG Template. (IAAC 2022)

This Chapter 3 (Wetlands and Riparian Environments) provides an overview of wetland and riparian environments within the relevant Biodiversity Impact Studies (BIS) study areas (see Section 1.2.1). The function and value of ecosystems, including wetland and riparian ecosystems, are considered in Chapter 9 of the BIS Baseline Report. Information presented in the current Chapter 3 will be used to describe baseline ecosystem function and services in Chapter 9.

1.1.1 Objectives

The general objectives of wetland and riparian environment studies for the BIS are to:

1. Determine the presence, distribution, and abundance of wetland and riparian habitat within the relevant BIS study areas (see Section 3.0, Chapter 1) to meet the requirements of the TISG Template, including:
    a. Identifying any potentially rare or unique wetland types within the BIS study areas (see Section 1.2.1); and,
    b. Determining whether these wetlands are within a geographic area of Canada where wetland loss or degradation has reached critical levels;
2. Describe the wetland and riparian environments in the context of the biodiversity they support; and
3. Provide additional baseline data to inform the Project's biodiversity Impact Assessment (IA) and mitigation measures and to assist in the potential development of monitoring program(s) to address environmental, regulatory, and stakeholder/rights-holder concerns.

Zoetica recognizes that additional TISG requirements exist for Wetlands and Riparian Environments (see Appendix C of Zoetica's BPPA Report (Zoetica 2021)). Several of these requirements (e.g., related to hydrological function) are addressed through studies planned as part of the Environmental Media Baseline Program (EMBP) (CanNorth 2021b). Additional wetland function and value studies, including an OWES assessment, may also be conducted after site selection to address TISG Template requirements. The current Chapter 3 begins to fulfill the requirements of the TISG Template required for wetland and riparian environments.

1.2 Methods

1.2.1 Study Areas

The BIS study areas for wetland and riparian environments include the AOI, a local study area (LSA_{ECO}), and a regional study area for ecosystem function and services (RSA_{ECO}). See Section 3.0 in Chapter 1 for further detail on study areas. Potential effects of the Project on wetlands and riparian habitat are not anticipated to extend beyond the LSA_{ECO}. The RSA_{ECO} is included for studying wetland and riparian environments in order to capture habitat information relevant to biodiversity values (e.g., fish, birds, herpetofauna, and semi-aquatic mammals) that depend on these habitats and which may interact with the Project beyond the LSA_{ECO}. Further rationale for developing these study areas can be found in Zoetica's BPPA Report (Zoetica 2021).

Thus far, desk- and field-based work completed for Tier 1 baseline studies has been primarily focused within the LSA_{ECO}. Ecosites were classified and mapped for Tier 1 TEM work (see Section 1.2.3.1), but this dataset did not extend to the boundaries of the RSA_{ECO} (see Appendix B, Chapter 1). Therefore, analyses involving ecosite data (e.g., to identify wetland types) are currently limited to the LSA_{ECO}.

1.2.2 Collation of Existing Data

Zoetica began desk-based investigations of wetland and riparian environments by delineating and identifying wetlands and aquatic habitat through the Ontario Hydro Network (OHN) database. In 2021, wetlands were delineated into specific wetland types (swamp, marsh, bog, fen) during desk-based terrestrial ecosite mapping exercises (see Section 1.2.3.1). Zoetica continued with desk-based research and mapping by collating existing data from government, citizen science, and other biodiversity databases.

Table 1-1. Spatial datasets and reports analyzed for wetland and riparian environments for the 2023 BIS Baseline Report.

Data Source / Owner	Dataset	Data Format	Date Accessed / Received	Contains relevant[1] data?
Ontario Ministry of Natural Resources and Forestry (MNRF)	OHN Watercourses	Shapefile	12/2019	Y
	OHN Waterbodies	Shapefile	12/2019	Y
	Wetlands	Shapefile	09/2020	Y

Notes:

1. Zoetica determined dataset relevance based on geographic and temporal relevance as well as relevance to wetland and riparian environments or species. For example, data that were not within the relevant BIS study areas, data that were too old to be considered relevant, or data that did not include records of wetland or aquatic species would have been labelled "N" for not containing relevant data.

1.2.3 Tier 1 Studies

Detailed methods for the Tier 1 studies outlined below are available in the *Biodiversity Impact Studies – Southwestern Ontario Region: Baseline Program Design* (BPD) Report and associated Standard Operating Procedures (SOPs) (Zoetica 2022).

1.2.3.1 Terrestrial Ecosystem Mapping

Terrestrial Ecosystem Mapping (TEM) work completed to date is described in Appendix B, Chapter 1. The ecosite classification dataset resulting from TEM work was used for desk-based delineation of various wetland types and in planning AHM surveys for collecting habitat information in wetlands. Ecosite mapping included only natural and naturalized areas, excluding anthropogenic areas like agriculture, roads, and dense development. The ecosite classification dataset was also used to identify candidate Significant Wildlife Habitat (SWH). Field contractors surveyed plots in 2022 to ground-truth ecosite identifications and investigate candidate SWH. Several SWHs are related to wetlands and/or riparian environments, and these are addressed with regards to wetland and riparian function (Sections 1.2.6.1 and 1.3.3.1) in this Chapter 3 of the BIS Baseline Report.

1.2.3.2 Aquatic Habitat Mapping

Aquatic Habitat Mapping (AHM) completed to date is described in Appendix D, Chapter 1. Relevant information was collected in watercourses, waterbodies, and wetlands to characterize habitat for fish and other aquatic and semi-aquatic biodiversity values (BVs), and to characterize riparian and aquatic vegetation. During the summer of 2022, field contractors conducted AHM surveys in various aquatic habitats within the AOI and the aquatic local study area (LSA_{AQU}), which comprises a large portion of and is fully contained within the LSA_{ECO}. AHM surveys evaluated riparian habitat, including documenting riparian type (wetland, forest, shrubland, meadow), predominant riparian species observed, and riparian stage within three buffer distances from the aquatic habitat sites. Field contractors conducted AHM surveys of wetlands from July 13 to September 29, 2022, and found that most (88.75%) were too dry to sample. Thus, AHM data presented in this Chapter are limited and will be updated in future iterations of the BIS Baseline Report after additional Tier 1 AHM studies are conducted in 2024.

1.2.3.3 Environmental DNA Metabarcoding

Environmental DNA (eDNA) metabarcoding studies[2] completed to date are described in Appendix E, Chapter 1. Thus far, field contractors have conducted two rounds of eDNA studies: once in the summer and once in the fall of 2022. These studies were conducted in various aquatic habitats, including wetlands. These data can serve as a starting point for determining biodiversity within wetland and riparian habitats. The two vertebrate primers and the invertebrate primer used for eDNA studies were primarily intended to capture aquatic and semi-aquatic species such as fish, amphibians, turtles, and invertebrates, but also captured other vertebrate BVs that may use these aquatic environments (see Section 2.6 of the BPD Report (Zoetica 2022)).

1.2.4 Presence, Distribution, and Abundance of Wetlands in the BIS Study Areas

1.2.4.1 Wetland Classification and Extent

Wetlands in relevant BIS study areas were first characterized following desk-based methods described in Section 1.2.3.1. Wetland ecosites were mapped to identify predominant ecosites within relevant study areas and to determine if rare wetland ecosites were present within the AOI or LSA_{ECO}. In the summer of 2022, field campaigns commenced within the AOI and LSA_{ECO} to confirm ecosite classifications determined through desk-based mapping (see Appendix B, Chapter 1). Zoetica has received the 2022 field data and included it in this 2023 BIS Baseline Report. In addition to TEM studies, AHM studies (see Section 1.2.3.2 and Appendix D, Chapter 1) were conducted in a selection of wetland ecosite polygons to characterize aquatic features (e.g., vegetation) within these habitat types.

1.2.4.2 Provincially Significant Wetland Mapping

In addition to ecosite mapping, desk-based studies for wetlands included collating information on any Provincially Significant Wetlands (PSWs) that may occur in the AOI, LSA_{ECO}, and RSA_{ECO}. The MNRF Wetlands shapefile contains all wetlands that have been evaluated by the province, including the ones deemed provincially significant (MNRF 2020). PSWs are provincially protected wetlands that may require specialized mitigation. For example, they are typically given a 120 m riparian buffer (MNRF 2013).

1.2.5 Biodiversity in Wetland Environments

Tier 1 field studies in the summer of 2022 were aimed at characterizing wildlife habitat information within various terrestrial (through TEM studies; see Section 1.2.3.1) and aquatic habitats (through AHM studies; see Section 1.2.3.2). Aquatic and terrestrial vegetation species were recorded as part of TEM and AHM field surveys. In addition to habitat studies, eDNA studies in 2022 (see Section 1.2.3.3) included detections of vertebrate and invertebrate species in wetland habitats. Field contractors also recorded any incidental

[2] In all sections of this 2023 BIS Baseline Report, where eDNA studies and results are noted, they refer to the use of eDNA in combination with metabarcoding for multi-species identification.

observations of flora and fauna while in the field, which included aquatic and riparian vegetation (see **Table B-4**).

1.2.6 Presence, Distribution, and Abundance of Important Habitat

1.2.6.1 SWH Relevant to Wetland and Riparian Function

Wetlands are important for sustaining a high number of species, and a variety of SWHs are related to wetland and riparian habitats. AHM surveys of wetlands will provide information on wetland and riparian habitat quality and functioning. Zoetica used the SWH criteria outlined in the Significant Wildlife Habitat Criteria Schedule for Ecoregion 6E (OMNRF 2015) to summarize SWH related to wetland and riparian environments that support various BVs (see Appendix C, Chapter 1 for more information on SWH).

1.2.7 Additional Baseline Data Collection to Inform the IA

1.2.7.1 Riparian Buffers

Watercourses, waterbodies, and wetlands are aquatic features typically afforded protective buffers based on standard mitigation practices (Environment Canada 2013). Wetlands of provincial significance often receive a buffer 120 m wide (MNRF 2013). The minimum riparian buffer width recommended by Environment and Climate Change Canada (ECCC) for watercourses and waterbodies is 30 m (Environment Canada 2013).

In a meta-analysis of buffer sizes to protect water quality, habitat, and organisms, Sweeney and Newbold (2014) found that a minimum of 30 m of riparian vegetation, ideally treed, was needed. This buffer width would protect small watercourses from harmful temperature fluctuations that could affect the ability of aquatic habitat to host fish and other aquatic organisms with specific thermal tolerances. Numerous other reports included in the meta-analysis recommended riparian buffers of 30 m or larger (Erman et al. 1977, Newbold et al. 1980, Wenger 1999, Mayer et al. 2007, Rykken et al. 2007, Richardson et al. 2012). In a review of the effects of climate change on the ability of watercourses and waterbodies to support fish, vegetation buffers of 15 m provided partial but vital functionality and were ranked as very highly important (Zoetica and LFFA 2020). Riparian buffer widths between 15 and 30 m provided temperature stability and supported fish communities in streams and were ranked as highly important (Zoetica and LFFA 2020). Riparian buffer widths of up to 100 m provided moderate to complete functionality for habitat and ecosystem services and were ranked as moderately important (Zoetica and LFFA 2020). Areas greater than 100 m benefitted watercourses and waterbodies by enhancing protection against increased sediment runoff and nitrate removal, but were deemed to have less of a role in watercourse resilience against climate change (Zoetica and LFFA 2020). For the BIS, Zoetica buffered PSWs using the legally required 120 m riparian buffer. Riparian buffers surrounding non-PSW aquatic habitats were mapped at three levels: 15, 30, and 100 m corresponding to the buffer zones deemed to have moderate to very high importance in providing resilience to climate change (see **Figure D-3**). Comparing the habitats within these buffers can help inform which areas should be considered most important to avoid disturbing.

For the purposes of mapping, all wet areas (wetlands, waterbodies, and watercourses) were grouped together (represented as light blue) and buffers were applied around the outer extent of the wet areas. Waterbodies were outlined in dark blue and labelled when feasible. PSW outlines were drawn around evaluated wetlands that were deemed provincially significant in the Wetlands database (MNRF 2020), but desk-based ecosite delineations done for the BIS revealed additional wetlands around the edges of these polygons in several places. Therefore, the PSW buffer is interrupted by wetlands in several places (**Figure D-3**).

1.3 Results

1.3.1 Presence, Distribution, and Abundance of Wetlands in the BIS Study Areas

1.3.1.1 Wetland Classification and Extent

Zoetica classified ecosites within natural and naturalized areas of the BIS study areas to determine the presence of any rare or unique wetland ecosites. A detailed breakdown of wetland ecosite classification and distribution within the BIS aquatic study areas is presented in Appendix B, Chapter 1. This section summarizes the major wetland types (marsh, swamp, fen) within the mapped areas of the relevant study areas. The total areas and proportions of each wetland type found in each study area are reported in **Table 1-2**. These data are based on desk-based ecosite classification followed by field surveys in 2022 to ground-truth the classifications. Wetland habitat types within the AOI are presented in **Figure D-1**a, and those in the LSA_{ECO} are presented in **Figure D-1**b and c. Most ecosite code updates from field data did not alter the broader category of ecosite (e.g., “hardwood swamp”; see Appendix B, Chapter 1 for further explanation) and so updated figures presented in this report do not differ strongly from the 2022 iteration of the BIS Baseline Report.

Swamp habitat was the most dominant wetland type in all study areas, with most swamps in both the AOI and LSA_{ECO} classified as hardwood swamp followed by mixedwood swamp. In the AOI, conifer swamp was next most abundant, followed by shrub swamp. In the LSA_{ECO}, shrub swamp was marginally more abundant than conifer swamp, but each covered < 1% of the LSA_{ECO} (**Table 1-2**). Swamp habitat was distributed evenly within the AOI except within the southeastern portion, where only a small amount of wetland habitat exists (**Figure D-1**a). The northwestern quadrat of the AOI included conifer, mixedwood, hardwood, and shrub swamp habitat. The northeastern quadrat included mixedwood and hardwood swamp, with a small area of conifer swamp. The southern half of the AOI included conifer and hardwood swamp, with one small area of mixedwood swamp. In the northern portion of the LSA_{ECO}, swamp habitat was consolidated primarily within the Greenock Swamp Wetland Complex (GSWC). Swamp in this area was mainly hardwood swamp, with larger consolidated polygons of mixedwood swamp on the central and eastern side of the GSWC (**Figure D-1**b). In the southern portion of the $LSA_{ECO,}$ swamp habitat occurred in smaller patches than in the northern LSA_{ECO}, and was distributed fairly evenly on the western side where wetlands were more prevalent, likely due to the presence of the Teeswater Wetland Complex (TWC; **Figure D-1**c).

Marsh habitat represented < 3.2% of the area in both the AOI and the LSA_{ECO} (**Table 1-2**). Within the AOI, marsh habitat primarily occurred along sections of the Teeswater River with smaller polygons mapped on tributaries in the western and northern AOI (**Figure D-1**a). In the northern LSA_{ECO}, most marsh habitat was around or near lakes, except for one relatively large marsh surrounded by hardwood swamp in the GSWC just north of Highway 9. Marsh occurred around Schmidt and Cunningham Lakes and in a few polygons east of Schmidt Lake and southwest and southeast of Cunningham Lake. Additional marsh habitat was mapped around Silver and Clam Lakes, and small polygons occurred northwest and northeast of McGlinn

Lake and along the Teeswater River closer to the AOI (**Figure D-1**b). In the southern LSA_{ECO}, marsh habitat occurred primarily on Alps Creek, the Teeswater River, and other small unnamed tributaries (**Figure D-1**c).

No fen habitat was mapped within the AOI, and <0.1% of the LSA_{ECO} contained fen wetland (**Table 1-2**) in a small area north of the AOI and south of McGlinn Lake (**Figure D-1**b). No fen sites were field surveyed in 2022. No bog habitat occurred in the AOI or LSA_{ECO}.

Table 1-2. Area and proportion of each wetland type within the AOI and LSA_{ECO}.

Study Areas		Conifer Swamp		Hardwood Swamp		Mixedwood Swamp		Shrub Swamp		Marsh		Fen	
	(ha)	(ha)	(%)[1]	(ha)	(%)[1]	(ha)	(%)[1]	(ha)	(%)[1]	(ha)	(%)[1]	(ha)	(%)[1]
AOI	1,827.41	26.27	1.44	72.11	3.95	55.65	3.05	20.23	1.11	56.91	3.11	-	-
LSA_{ECO}	27,879.5	239.25	0.86	5022.63	18.02	1927.29	6.91	245.49	0.88	388.16	1.39	17.90	< 0.1

Notes:
Area and proportion of wetland ecosite type are calculated using the ecosite classification dataset updated with field ecosite verification for 26.4% of wetland sites in 2022. See Appendix B, Chapter 1 for further details on the ecosite classification dataset.
Wetlands within the RSA_{ECO} were not calculated as ecosystem classification was not conducted within this area. If the SON-South Bruce site is selected, the RSA_{ECO} may be mapped in future years.
[1] Percentages are the percent of the total area of the study area that is covered by the ecosite. Notably, the entirety of the study areas are not mapped in the ecosite classification dataset.

Zoetica briefly reviewed available desk-based data to determine whether wetlands in the BIS study areas are in an area where wetland loss or degradation has reached critical levels. Wetland decline in Ontario has been most severe in the southwestern region (Ducks Unlimited Canada 2010). Thus, it is likely that southwestern Ontario, and thus the SON-South Bruce siting area, is considered a region within Canada where wetland loss or degradation has reached critical levels.

1.3.1.2 Provincially Significant Wetlands

The MNRF's Wetlands dataset (accessed via Ontario GeoHub) revealed several PSWs within the AOI, LSA_{ECO}, and RSA_{ECO} (MNRF 2020). Portions of the GSWC (140.9 ha) and the TWC (33.7 ha) occur in the northern and southern sections of the AOI, respectively (**Figure D-2**a). Together, these features represent approximately 9.6% of the area of the AOI. In the LSA_{ECO}, the major contiguous areas of the GSWC, representing 8,055 ha of the Complex, are contained in the northern part of the LSA_{ECO}. The TWC is contained in the southern portion of the LSA_{ECO} (**Figure D-2**). In addition, portions of the Wingham Wetland Complex (135.4 ha) occur in the southern LSA_{ECO}, the Kinloss Creek Wetland Complex (47.0 ha total) occurs along the western side of the LSA_{ECO}, and Chepstow Swamp Wetland Complex (13.6 ha total) occurs in the northeastern portion of the LSA_{ECO} (**Figure D-2**). All PSW areas represent approximately 33.0% of the LSA_{ECO} (see **Table 1-3**). Seventeen PSWs are fully or partially contained within RSA_{ECO} (see **Table 1-3**; **Figure D-2**b) and represent approximately 8.7% of the RSA_{ECO}. **Table 1-3** presents a breakdown of the area of each PSW contained within the RSA_{ECO}.

Table 1-3. Provincially Significant Wetlands partially or fully contained within the AOI, LSA_{ECO} and RSA_{ECO}, and the percentages of each study area covered by each PSW.

PSW	Area	AOI		LSA_{ECO}		RSA_{ECO}	
		1,827.4 ha		27,879.5 ha		186,892.6 ha	
	(ha)	(ha)	(%)	(ha)	(%)	(ha)	(%)
Greenock Swamp Wetland Complex	8,916.6	140.9	7.7	8,055.0	28.9	8,916.6	4.8
Teeswater Wetland Complex	977.1	33.7	1.8	961.3	3.4	977.1	0.5
Wingham Wetland Complex	724.4	-	-	135.4	0.5	724.4	0.4
Kinloss Creek	786.0	-	-	47.0	0.2	786.0	0.4
Chepstow Swamp	314.3	-	-	13.6	0.0	314.3	0.2
Saratoga Wetland Complex	2,031.7	-	-	-	-	837.5	0.4
Dickies Creek Wetland Complex	808.1	-	-	-	-	808.1	0.4
Howick Bog	606.2	-	-	-	-	606.2	0.3
Bluevale Wetland Complex	443.0	-	-	-	-	443.0	0.2
Wroxeter Wetland Complex	1,168.6	-	-	-	-	369.6	0.2
St Augustine Wetland Complex	470.6	-	-	-	-	393.2	0.2
Anderson Creek Wetland Complex	326.8	-	-	-	-	326.8	0.2
St Helens Wetland Complex	198.2	-	-	-	-	198.2	0.1
Sangs Creek	187.6	-	-	-	-	184.5	0.1
Otter Creek	155.3	-	-	-	-	155.3	0.1
Lakelet Lake Wetland Complex	750.0	-	-	-	-	120.4	0.1
Edengrove Wetland Complex	110.0	-	-	-	-	10.0	0.0
Total	**18,974.5**	**174.6**	**9.6**	**9,212.2**	**33.0**	**16,171.2**	**8.7**
Notes: Totals are calculated from numbers with additional decimal points; whereas numbers reported in table are rounded to one decimal place. This accounts for any minor differences between the sums of values in table and the 'Total' sums reported.							

1.3.2 Biodiversity in Wetland Environments

Tier 1 field studies in the summer of 2022 included the collection of aquatic and riparian vegetation observations during AHM (see Appendix D, Chapter 1) and TEM (see Appendix B, Chapter 1) field surveys, and the detection of vertebrate and invertebrate species via eDNA surveys (see Appendix E, Chapter 1). During AHM surveys, field contractors recorded a total of 17 aquatic vegetation taxa (species or genus), including five taxa of submergent, three taxa of floating, and nine taxa of emergent aquatic vegetation, in wetlands in the BIS aquatic study areas (see Table B-1).

eDNA surveys were unevenly distributed across the study areas and seasons, and so numbers of species detections cannot reliably be compared across study areas or seasons. In the AOI, eDNA studies detected 14 vertebrate species in wetlands in the summer, including five mammal, two amphibian, four bird, and three fish species. In the fall, eDNA surveys detected nine vertebrate species in the AOI, including three mammal, one amphibian, two bird, and three fish species. Summer eDNA studies in the LSA_{ECO} (outside the AOI) detected 13 vertebrate species in wetlands,, including two mammal, no amphibian, one bird, and ten fish species. Fall eDNA studies conducted in the LSA_{ECO} detected 13 vertebrate species in wetlands, including six mammal, no amphibian, seven bird, and no fish species (see **Table B-2**).

In the AOI, eDNA studies detected 51 invertebrate species in wetlands in the summer, and 43 in the fall. In the LSA_{ECO}, eDNA studies detected 34 invertebrate species in wetlands in the summer and 152 in the fall (**Table B-3**). See **Table B-2** and **Table B-3** for vertebrate and invertebrate species detected in wetlands, respectively. See Appendix E, Chapter 1 for a full breakdown of species detected via eDNA metabarcoding in various wetlands.

Table 1-4. eDNA species detections in wetlands in summer and fall 2022.

Study Area	Wetland type	Taxon	Number of species
AOI	Swamp	Mammal	4
AOI	Marsh	Mammal	4
AOI total unique species		Mammal	6
LSA_{ECO}	Swamp	Mammal	6
LSA_{ECO}	Marsh	Mammal	4
LSA_{ECO} total unique species		Mammal	6
AOI	Swamp	Amphibian	1
AOI	Marsh	Amphibian	2
AOI total unique species		Amphibian	2
LSA_{ECO}	Swamp	Amphibian	0
LSA_{ECO}	Marsh	Amphibian	0
LSA_{ECO} total unique species		Amphibian	0
AOI	Swamp	Bird	4
AOI	Marsh	Bird	3
AOI total unique species		Bird	5
LSA_{ECO}	Swamp	Bird	7
LSA_{ECO}	Marsh	Bird	1
LSA_{ECO} total unique species		Bird	7
AOI	Swamp	Fish	4
AOI	Marsh	Fish	4
AOI total unique species		Fish	4
LSA_{ECO}	Swamp	Fish	3
LSA_{ECO}	Marsh	Fish	9
LSA_{ECO} total unique species		Fish	10
AOI	Swamp	Invertebrate	36
AOI	Marsh	Invertebrate	49
AOI total unique species		Invertebrate	80
LSA_{ECO}	Swamp	Invertebrate	105
LSA_{ECO}	Marsh	Invertebrate	85
LSA_{ECO} total unique species		Invertebrate	168
Note: Sample sizes among study areas and wetland types were uneven, so numbers of species detections should not be directly compared.			

During AHM, TEM, and eDNA field surveys, contractors recorded any incidental observations of vegetation and animal species, which included several species that live in or near wetlands and riparian environments, or rely on them for a stage of their life history. In 2022, there were incidental observations of 27 taxa of aquatic vegetation (see **Table B-4**), four species of semi-aquatic mammals (see Chapter 4), ten species of amphibians (see Chapter 5), seven species of waterbirds (see Chapter 7), 12 taxa of fish, two taxa of semi-aquatic invertebrates, and two taxa of aquatic invertebrates (see Chapter 8).

1.3.2.1 Species of Conservation Concern

Riparian tree black ash (Endangered) was detected in desk-based data, TEM surveys in the field, and incidentally by field contractors within the AOI and LSA_{ECO}. Black ash is discussed in more detail in Chapter 2, but dieback of black ash due to emerald ash borer may have significant impacts on wetlands, as it could cause higher water tables, increased potential for flooding, and altered soil nitrogen and carbon cycling (Kolka et al. 2018). Facultative wetland species green dragon (Special Concern, S3) was incidentally observed by field contractors in 2022 at two sites in the LSA_{ECO} south of the AOI (see Chapter 2). Growing in moist deciduous forests and floodplains, often along rivers or creeks, green dragon is threatened by habitat loss and degradation (Donley et al. 2013). Aquatic plant Hill's pondweed (Special Concern[3], S2S3) was detected in desk-based data at one site in the GSWC in the northern LSA_{ECO} (see Chapter 2). In southwestern Ontario, this species' habitat may be impacted by decreased water quality from cottages or abundant introduced curly-leaved pondweed (Parks Canada Agency 2014). Curly-leaved pondweed was detected in AHM surveys at a waterbody in the RSA_{AQU} (Cargill Mill Pond), but not within the AOI or LSA_{ECO} thus far (see Chapter 2).

1.3.3 Presence, Distribution, and Abundance of Important Habitat

1.3.3.1 SWH Relevant to Wetland and Riparian Function

Wetland and riparian environments can provide SWH for a variety of biodiversity values (see Appendix C, Chapter 1). Ecoregion 6E, where the SON-South Bruce siting area is located, contains 25 SWHs that are related to wetland and riparian environments. Candidate SWH in the BIS study areas, including those related to wetland and riparian environments, are examined in each respective BV chapter. Zoetica used ecosite information and field surveys to identify candidate and confirmed SWH in the BIS study areas; these findings are presented in Appendix C, Chapter 1. Of the 25 SWH supported by wetland and riparian habitats, 20 have candidate SWH and three (Seeps and Springs, Terrestrial Crayfish, and Deer Winter Congregation Areas) have areas that meet the criteria for confirmed SWH for BVs presented in the 2023 BIS Baseline Report (**Table 1-5**).

During AHM surveys in 2022, 81 wetlands were visited but only ten contained water and thus were sampleable. Sampled wetlands were three marshes and two swamps in the AOI, and five swamps in the LSA_{ECO}. Therefore, information on wetland quality and function is currently limited, but will be expanded in future iterations of the BIS Baseline Report as more field data is collected.

[3] For the purposes of this BIS Baseline Report chapter, conservation statuses described in text for at-risk species refer to their Species at Risk in Ontario (SARO) listings unless otherwise indicated. Conservation statuses are from the NHIC's Ontario species list, current to March 1, 2023, and updated for any discrepancies with provincial and federal SAR listings up to August 15, 2023. As such, species and status listings may differ from those presented in Zoetica's 2021 BPPA Report (Zoetica 2021)

Table 1-5. SWH related to wetland and riparian environments and associated biodiversity value(s) they support.

Significant Wildlife Habitat (Ecoregion 6E)	**Biodiversity Value and Chapter**	**Candidate SWH detected in BV Study Areas?**
Special Concern and Rare Wildlife Species	All wildlife chapters	Y
Bald Eagle and Osprey Nesting, Foraging and Perching Habitat	Birds; Chapter 7	Y
Colonially-Nesting Bird Breeding Habitat (Ground)	Birds; Chapter 7	Y
Colonially-Nesting Bird Breeding Habitat (Tree/Shrubs)	Birds; Chapter 7	Y
Marsh Breeding Bird Habitat	Birds; Chapter 7	Y
Raptor Wintering Area	Birds; Chapter 7	Y
Shorebird Migratory Stopover Area	Birds; Chapter 7	Y
Waterfowl Nesting Area	Birds; Chapter 7	Y
Waterfowl Stopover and Staging Areas (Aquatic)	Birds; Chapter 7	Y
Amphibian Breeding Habitat (Wetlands)	Herpetofauna; Chapter 5	Y
Amphibian Breeding Habitat (Woodland)	Herpetofauna; Chapter 5	Y
Amphibian Movement Corridors	Herpetofauna; Chapter 5	Y
Reptile Hibernaculum	Herpetofauna; Chapter 5	Y
Turtle Nesting Areas	Herpetofauna; Chapter 5	Y
Turtle Wintering Areas	Herpetofauna; Chapter 5	Y
Seeps and Springs	Mammals; Chapter 4	Y
	Herpetofauna; Chapter 5	Y
	Birds; Chapter 7	Y
Terrestrial Crayfish	Fish and Fish Habitat: Chapter 8	Y
Other Rare Vegetation Communities	Vegetation; Chapter 2	-
Woodland Area-Sensitive Bird Breeding Habitat	Birds; Chapter 7	Y
Woodland Raptor Nesting Habitat	Birds; Chapter 7	Y
Bat Maternity Colonies	Mammals; Chapter 4	Y
Deer Movement Corridors	Mammals; Chapter 4	TBD
Deer Winter Congregation Areas	Mammals; Chapter 4	Y
Deer Yarding Areas	Mammals; Chapter 4	Y
Old Growth Forest	Vegetation; Chapter 2	Y

1.3.4 Additional Baseline Data Collection to Inform the IA

1.3.4.1 Riparian Buffers

The required 120 m buffers around PSWs covered approximately 15% of the AOI and 16% of the LSA_{ECO} (see **Table 1-6**). Buffering non-PSW watercourses, waterbodies, and wetlands using the provincially recommended 30 m riparian buffers resulted in classifying approximately 13% of the AOI and 12% of the LSA_{ECO} as area that directly contributes to the health of existing aquatic habitats. Using other buffer distances described in Section 1.2.7.1 resulted in areas ranging from approximately 6–38% of the study areas that may contribute to the health of the existing aquatic habitats (see **Table 1-6**). Wetlands that lack provincial designation but are adjacent to PSWs are likely still ecologically important and may be awarded a 100 m buffer.

Table 1-6. Area and proportion of each buffer width surrounding aquatic habitat within the AOI and LSA_{ECO}.

Study Area		Non-PSW Buffers						PSW Buffers[1]			
		0 - 15 m		0 - 30 m		0 - 100 m		0 - 120 m		> 100 m	
Name	ha	ha	%	ha	%	ha	%	ha	%	ha	%
AOI	1,827	126.4	6.9%	243.7	13.3%	691.0	37.8%	268.5	14.7%	35.5	1.9%
LSA_{ECO}	27,879	1691.5	6.1%	3218.4	11.5%	8509.1	30.5%	4381.7	15.7%	1088.0	3.9%

Notes:
Data reported for each buffer width and study area are inclusive of all areas within those buffers or study areas, including smaller nested buffers or study areas. For example, the 30 m buffer of the LSA_{ECO} includes the 15 m buffer of the LSA_{ECO}, and all riparian buffers within the AOI.
[1] Column "> 100 m" indicates the area of the PSW buffer that is beyond the largest non-PSW buffer (100 m). This represents the additional area afforded protection by the PSW buffer regulations.

Figure D-3 depicts the riparian buffer width distances applied to wetlands, watercourses, and waterbodies within the AOI and LSA_{ECO}. Within the AOI, buffered riparian areas often connect wetlands, watercourses, and waterbodies (see **Figure D-3**a). Particularly for the 100 m non-PSW or 120 m PSW buffers, the edges of the buffers frequently overlap one another so that the land between two wetlands would be protected. These areas are more important in maintaining the health of the aquatic habitats they surround relative to other areas in the AOI. There are also several areas that lack any wetland, watercourse, waterbody, or buffer, primarily in the AOI's central, eastern, and southeastern portions. Within the LSA_{ECO}, PSWs and their buffers represent a vast proportion of the study area. They are oriented in a north-to-south alignment throughout the study area, and are mainly absent in the northwest and southeast areas of the LSA_{ECO} (see **Figure D-3**b and c). The provincially significant GSWC in the northern LSA_{ECO} and TWC in the southern LSA_{ECO} represent a large overall proportion of the LSA_{ECO}. Additional buffer areas within the LSA_{ECO} primarily represent riparian areas surrounding watercourses and waterbodies that drain into the GSWC and the TWC (**Figure D-3**).

During AHM surveys conducted within the BIS aquatic study areas in the summer of 2022 (see Appendix D, Chapter 1), riparian habitat was recorded within three riparian zones at each watercourse and waterbody visited. The two swamps that field teams surveyed south of the AOI were surrounded by mature forest and abundant riparian vegetation. The three swamps north of the AOI were surrounded by young or mature forest and abundant riparian vegetation. Streams and tributaries in the AOI occurred mainly in wetland and deciduous forest areas in the northern portion, and in agricultural landscapes in the central and southern portions (see Table B-4 in Appendix D, Chapter 1). Field teams surveyed two waterbodies in the AOI, which both had primarily vegetated shorelines adjacent to wetlands. Habitat around waterbodies surveyed in the LSA_{ECO} outside the AOI varied among wetlands and forests, with some grass/lawn and croplands (see Table C-3a in Appendix D, Chapter 1).

In addition to these data from AHM surveys, the ecosite classification dataset can provide information on habitats within the riparian zones (see **Table C-1**; **Figure D-4**; **Figure D-5**). However, the ecosite classification dataset only covers natural and naturalized areas within the BIS study areas, excluding anthropogenic lands. Zoetica mapped ecosites in the PSW (**Figure D-5**) and non-PSW (**Figure D-4**) buffers separately, due to overlap of buffers. Within the mapped area of the AOI, hardwood forest was the most common ecosite within the non-PSW and PSW riparian buffers, followed by mixedwood forest (**Table C-1**). Both of these forest types were distributed fairly evenly throughout the mapped areas of non-PSW buffers within the AOI, and were present within all four quadrats. In the PSW buffers, hardwood forest was present around the southern end of the GSWC that protrudes into the AOI and the northern end of the TWC that enters the southern AOI. Mixedwood forest was well-represented in PSW buffers around the GSWC, but only in two small areas around the TWC in the AOI. Conifer forest was the next most abundant in non-PSW buffers, with a large patch in the far west of the AOI, and some smaller patches in the north, east, and southwest. Conifer forests were not as abundant in the PSW buffers (less abundant than meadows and plantations), and were only present in a few small patches around the GSWC and TWC. Meadows were the fourth most abundant in non-PSW buffers, largely concentrated in the north-central AOI with two smaller patches in the southwest and far west. In PSW buffers, meadows were present in larger patches around both the GSWC and TWC in the AOI. There were plantation ecosites in non-PSW buffers in the northwest and east-central AOI, and shrub ecosites in the west-central AOI along the Teeswater River. In PSW buffers, plantations occurred in the northwest around the GSWC and in the far south around the TWC, and shrub occurred in the same small patch as in non-PSW buffers on the Teeswater River around the GSWC. PSW buffers also included some wetlands; there were patches of hardwood swamp and mixedwood swamp around the GSWC, patches of marsh and conifer swamp around both the GSWC and TWC, and a couple patches of shrub swamp around the GSWC. Across the three non-PSW buffer widths, the ecosite type most often stayed the same for a given piece of shoreline. However, there were some regions, particularly in the western AOI, where the ecosite changed from one forest type to another between the 15-30 m buffers and the broader 100 m buffer. There were also some finer-scale ecosite changes in the northeastern quadrat of the AOI and in one area in the southwest, where riparian areas changed between meadow and different types of forest across the different buffer widths.

Within the broader LSA_{ECO}, hardwood forest was the most common ecosite in non-PSW and PSW riparian buffers (**Table C-1**). Based on visual inspection of the non-PSW buffer map, hardwood forest was dominant in the LSA_{ECO} north of the AOI, and common in the LSA_{ECO} south of the AOI but not as dominant (**Figure D-4**). The Teeswater River north of the AOI was mostly buffered by hardwood forest. Within PSW buffers, hardwood forest was more continuously distributed throughout the north and south LSA_{ECO} (**Figure D-5**). Mixedwood forest was the second most abundant ecosite within the non-PSW and PSW riparian buffers of the LSA_{ECO}, and occurred fairly evenly throughout the study area in both buffer types. Conifer forest, the third most abundant ecosite, was most common in the LSA_{ECO} south of the AOI, largely within the TWC, for both buffer types. Meadows were fourth most common in non-PSW buffers and occurred scattered throughout the LSA_{ECO}. Across both buffer types, there were meadow ecosites in the southeastern corner of the LSA_{ECO}, in small patches in the TWC, in the GSWC north and west of Cunningham Lake, and in a larger patch northwest of the AOI near Clam Lake. Plantations were also scattered throughout the LSA_{ECO}, particularly around the GSWC north of the AOI and within the TWC south of the AOI. Shrubland occurred in non-PSW and PSW buffers south of Cunningham Lake in the GSWC and in one small area in the central TWC along Alps Creek. In non-PSW buffers, there was a small area of field in the northeastern LSA_{ECO}. In PSW buffers, hardwood swamp was most common north of the AOI around the GSWC and Chepstow Swamp, while mixedwood swamp was more common south of the AOI in the TWC and in the southern GSWC. Marsh was fairly evenly distributed throughout the LSA_{ECO} in PSW buffers. Shrub swamp was present in buffers around the southern and central GSWC and in some patches around the TWC. Conifer swamp was present in small patches around the TWC, and around the GSWC in small patches north of McFarlane Lake and east of Silver Lake. There was a fen ecosite just north of the AOI around the GSWC, which was a rarer ecosite on the landscape (see Appendix B, Chapter 1).

Overall in the LSA_{ECO} (inclusive of the AOI), hardwood forest was the most dominant ecosite in the non-PSW and PSW riparian buffer areas (**Table C-1**). Mixedwood forest was second most abundant in the non-PSW buffers but conifer forest was second most abundant in the PSW buffers, and vice versa for the third most abundant ecosites. Meadows were the next most abundant, followed by plantations, then shrubland and fields. Watercourse, waterbody, and wetland ecosites were not represented within the non-PSW riparian buffers because they were included within the riparian areas that the buffers are drawn around. There were some wetland ecosites within the PSW buffers due to differences between the Wetlands dataset and the ecosite classification dataset, but these represented only 0.1-0.2% of PSW buffer space. Thus, natural forest ecosites covered most of the mapped riparian buffers within the BIS study areas. Anthropogenic meadows, plantations, and fields constituted a total of only 2.5% of the non-PSW and 2.1% of the PSW riparian buffer areas. Overall, the recommended 30 m non-PSW buffers, coupled with the area of the wetlands they are buffering, constitute 27.4% of the AOI and 40.7% of the LSA_{ECO}. The PSWs and their 120 m buffers covered 24.2% and 48.8% of the AOI and LSA_{ECO}, respectively, which includes areas also covered by the non-PSW buffers. Additional years of data will improve descriptions of the quality of riparian habitat at surveyed sites within the LSA_{ECO} and will be presented in future iterations of the BIS Baseline Report.

1.4 Discussion

The current Chapter 3 of the 2023 BIS Baseline Report focussed on desk and field-based analyses of wetland and riparian habitat data within the BIS aquatic study areas. Additional years of relevant information collected during fieldwork conducted as part of TEM, AHM, and eDNA metabarcoding studies will be incorporated into future iterations of the BIS Baseline Report once Zoetica receives these data.

1.4.1 Presence, Distribution, and Abundance of Wetlands in the BIS Study Areas

Currently, information about the presence, distribution, and abundance of wetlands and riparian environments is based on a desk-based analysis of ecosites in the AOI and LSA_{ECO} followed by field-based ground-truthing for some sites during TEM surveys. Locations of PSWs within the AOI, LSA_{ECO} and RSA_{ECO} are determined by the Ontario MNRF (MNRF 2020). Zoetica may conduct additional desk-based TEM mapping in the RSA_{ECO} in future years if the SON-South Bruce siting area is selected.

No fens were field surveyed in 2022 to verify ecosite classification, but desk-based TEM mapping revealed that wetland fens were rare on the landscape, occurring only in a small area within the LSA_{ECO} north of the AOI and not present within the AOI. In addition, no bog wetlands were mapped within the AOI or LSA_{ECO}. Thus, peatland wetlands (fen and bogs) are rare within the SON-South Bruce siting area. A higher relative percent (by area) of marshes were present in the AOI relative to the LSA_{ECO} (**Table 1-2**) and were predominantly located around watercourses in both study areas (**Figure D-1**). Marshes naturally contain more open water than other wetland types; thus, they may also naturally contain more aquatic species. In the AOI and southern portion of the LSA_{ECO}, swamp habitat was relatively evenly distributed on the landscape, except for regions on the eastern side of these study areas (**Figure D-1**). However, in the northern portion of the LSA_{ECO}, swamp habitat occurred in more consolidated polygons within the GSWC.

This is likely because the GSWC, as a PSW, is protected from further fragmentation moreso than other areas within the AOI and the southern $LSA_{ECO,}$ where more agricultural areas are located. Field verification of ecosite classifications altered the amount of area covered by different wetland types in the AOI and LSA_{ECO}. Most notably, the amount of shrub swamp in the AOI increased from 7.4 ha in desk-based mapping (see Table C-1 in Appendix B, Chapter 1) to 20.2 ha after field surveys (**Table 1-2**). Field surveys also increased the amount of conifer swamp in the AOI and the amount of hardwood swamp and shrub swamp in the LSA_{ECO}. After field truthing, coverage by conifer swamp declined in the LSA_{ECO}, hardwood swamp declined in the AOI, and mixedwood swamp and marsh declined in both the AOI and LSA_{ECO}.

Desk-based searches of existing literature revealed 17 PSWs either fully or partially contained within the RSA_{ECO}, of which five were fully or partially contained within the LSA_{ECO}, and two (GSWC and TWC) were partially contained within the AOI (**Table 1-3**). According to the OHN Watercourses dataset, water from the TWC flows north and into the Teeswater River within the AOI, where it exits the northern AOI and flows through the southeastern side of the GSWC. Thus, the TWC is unlikely to be affected by water flow within the AOI. While waters from the AOI flow into the Teeswater River and exit the AOI in the north, waters from the GSWC generally flow towards the Teeswater River during most months. Waters from the Teeswater River may interact with waters contained within the GSWC during high-flow periods. However, more information from field studies is required to verify this assumption.

1.4.2 Biodiversity in Wetland Environments

To date, no desk-based information on biodiversity in wetland environments exists within searched datasets. In the summer of 2022, Tier 1 field surveys were conducted for TEM, AHM and eDNA in various aquatic habitats, including wetlands. Aquatic and riparian vegetation detected in AHM surveys included 17 taxa from 12 families (Table B-1). eDNA surveys detected several species that depend upon wetland and riparian environments, including herpetofauna, waterbirds, vegetation, and invertebrates (see **Table 1-4**). Incidental observations by field crews also included biodiversity that relies on wetlands and riparian environments. Additional years of Tier 1 data collection will allow for a more fulsome characterization of biodiversity in wetland environments, which will be discussed in this section in future iterations of the BIS Baseline Report.

1.4.3 Wetland and Riparian Function

This Chapter addressed wetland and riparian function as it pertains to the maintenance of biodiversity. To date, desk-based Tier 1 studies conducted for the BIS have revealed that wetland and riparian environments can contribute to at least 25 different SWHs within the SON-South Bruce siting area, of which 23 have been determined to be Candidate or Confirmed SWH in study areas relevant to the BVs they support. This finding demonstrates the diversity of habitats that wetlands and riparian environments provide for wildlife BVs. Thus, it is likely that wetlands (especially marshes and swamps) support a high richness of species in the SON-South Bruce siting area.

In addition to supporting SWH for biodiversity values, wetlands and riparian habitats provide numerous benefits to biodiversity. Riparian areas provide habitat and migratory travel corridors for various species that depend on the interface between land and water. These habitats often represent the longest and least impacted connected green corridors (e.g., used as travel corridors for wildlife), as riparian vegetation is often afforded more protection relative to upland vegetation and thus has undergone less disturbance and fragmentation. In addition, vegetation in the riparian zone can provide canopy cover (i.e., from tall trees) and shade, reducing temperatures of waterbodies, which is of growing importance in light of climate change. The temperature moderation by riparian vegetation can be crucial for maintaining water temperatures within acceptable thermal tolerance ranges of fish and aquatic species.

The SON-South Bruce siting area contains numerous aquatic habitats within the AOI and LSA_{ECO}. Non-PSW wetland ecosites and their buffers of 30 m (needed to maintain the health of aquatic environments) covered approximately 27.4% and 40.7% of the AOI and LSA_{ECO}, respectively. The PSWs and their 120 m buffers covered 24.2% and 48.8% of the AOI and LSA_{ECO}, respectively. Most of the mapped riparian buffers contained natural forest ecosites, and there was limited representation by anthropogenic ecosites (**Figure D-4**; **Figure D-5**). However, it is important to note that 52.4 and 50.2% of 30 m non-PSW and 120 m PSW buffers within the AOI were unmapped areas, which are anthropogenic lands. As well, 44.7 and 65.5% of 30 m non-PSW ans PSW buffers within the LSA_{ECO} was unmapped. These data therefore indicate that the riparian buffers in some areas may be healthy and of good quality to support the wetlands and riparian areas. This may be due in part to the large coverage by PSWs within the study areas, particularly the GSWC and TWC, which have afforded protections to the 120 m buffers around many wetlands and riparian areas. However, roughly half of the riparian buffers are unmapped anthropogenic land, which is likely not of good quality to support the wetlands. Even areas within 30 m of non-PSW aquatic habitats that have habitat loss or low-quality habitat issues should optimally be left undeveloped or be revegetated to protect the aquatic habitats they surround from degradation, particularly as the effects of climate change increase. Additional years of AHM survey data on riparian habitat, species observations, and riparian stage may help to further describe the condition of riparian habitat in the BIS study areas.

1.4.4 Next Steps

Since field contractors found that most wetlands were too dry to sample, Zoetica recommends future AHM wetland surveys be done during the spring when wetlands are more likely to contain water. Additional relevant information collected during AHM surveys of wetlands will be integrated into future iterations of this Chapter.

Zoetica has proposed many Tier 2 studies aimed at characterizing biodiversity communities, anticipated to commence after site selection (see Section 5.2 of Zoetica's BPPA Report (Zoetica 2021) for proposed Tier 2 studies). If the SON-South Bruce siting area is selected for further study, relevant data will be integrated in this Chapter once received by Zoetica. Tier 2 studies may include characterizing biodiversity in wetland and riparian environments, and OWES assessments of wetland function in select non-PSW wetlands that may be affected by the Project. These studies are designed so that wetlands can be compared and rated relative to one another (within the southern Ontario region) and will provide a preliminary inventory of wetlands to support the development and protection of PSWs. Tier 2 OWES studies may focus on unevaluated wetlands, as opposed to comparatively well-studied PSWs, along with 120 m adjacent land buffers (around both evaluated and unevaluated wetlands).

In addition to studies designed to characterize biodiversity in wetlands, additional studies are planned as part of the EMBP (CanNorth 2021b) to characterize the environmental media components (water, sediment, soil) and hydrology. These studies are important for understanding the functioning of aquatic habitats in the SON-South Bruce siting area. Combined with BIS studies, they can provide useful information to address the TISG requirements related to wetlands and riparian habitats. Where possible, relevant information collected as part of EMBP studies will be integrated with biodiversity information presented in this chapter to help characterize the wetland and riparian environments within the AOI and other relevant study areas.

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APPENDIX A – SPECIES LIST

Table A-1. Common and scientific names for species mentioned in this Chapter. Species names follow the NHIC's Ontario species lists (current to March 1, 2023).

Common Name	**Scientific Name**
Vegetation	
American elm / white elm	*Ulmus americana*
Arrowhead	*Sagittaria* spp.
Ash	*Fraxinus* spp.
Basswood	*Tilia americana*
Bittersweet nightshade	*Solanum dulcamara*
Black ash	*Fraxinus nigra*
Black spruce	*Picea mariana*
Bladderwort	*Utricularia* spp.
Broad-leaf cattail	*Typha latifolia*
Buckthorn	*Rhamnus* spp.
Bur-reed	*Sparganium* spp.
Canada wood nettle	*Laportea canadensis*
Canary grass	*Phalaris* spp.
Cattail	*Typha* spp.
Cherry	*Prunus* spp.
Chokecherry	*Prunus virginiana*
Club-spur orchid	*Platanthera clavellata*
Common boneset	*Eupatorium perfoliatum*
Common water-parsnip	*Sium suave*
Common woolly bulrush /Wool grass	*Scirpus cyperinus*
Creeping spikerush	*Eleocharis palustris*
Curly-leaved pondweed	*Potamogeton crispus*
Dark-green bulrush	*Scirpus atrovirens*
Dogwood	*Cornus* spp.
Duckweed	Lemnaceae spp.
Eastern hemlock	*Tsuga canadensis*
Eastern rough sedge	*Carex scabrata*
Eastern white cedar	*Thuja occidentalis*
Eastern white pine	*Pinus strobus*
Elderberry	*Sambucus* spp.
European buckthorn	*Rhamnus cathartica*
European reed	*Phragmites australis* ssp. *australis*
Fowl mannagrass	*Glyceria striata*
Fringed sedge	*Carex crinita*
Goldenrod	*Solidago* spp.
Green ash / red ash	*Fraxinus pennsylvanica*
Hill's pondweed	*Potamogeton hillii*

Common Name	**Scientific Name**
Horsetail	*Equisetum* spp.
Joe-pye weed	*Eutrochium* spp.
Lake sedge	*Carex lacustris*
Loesel's twayblade	*Liparis loeselii*
Manitoba maple	*Acer negundo*
Maple	*Acer* spp.
Meadowsweet	*Spiraea* spp.
Milkweed	*Asclepias* spp.
New England aster	*Symphyotrichum novae-angliae*
Ninebark	*Physocarpus* spp.
Ostrich fern	*Matteuccia struthiopteris*
Peach-leaved willow	*Salix amygdaloides*
Pickerelweed	*Pontederia cordata*
Pond-lily	Nymphaeaceae spp.
Poplar	*Populus* spp.
Purple loosestrife	*Lythrum salicaria*
Raspberry	*Rubus* spp.
Red maple	*Acer rubrum*
Red oak	*Quercus rubra*
Red osier dogwood	*Cornus sericea*
Reed canarygrass	*Phalaris arundinacea*
Riverbank grape	*Vitis riparia*
Royal fern	*Osmunda regalis*
Sago pondweed	*Stuckenia pectinata*
Scots pine	*Pinus sylvestris*
Sedge	*Carex* spp.
Sensitive fern	*Onoclea sensibilis*
Showy lady's-slipper	*Cypripedium reginae*
Silky dogwood	*Cornus obliqua*
Silver maple	*Acer saccharinum*
Smartweed	*Polygonum* spp.
Softstem bulrush	*Scirpus torreyi*
Sphagnum	*Sphagnum* spp.
Spotted jewelweed	*Impatiens capensis*
Spotted joe-pye weed	*Eutrochium maculatum*
Stinging nettle	*Urtica dioica*
Swamp loosestrife	*Decodon verticillatus*
Sweet gale	*Myrica gale*
Tamarack	*Larix laricina*
Tape grass / American eelgrass	*Vallisneria americana*
Tussock sedge	*Carex stricta*
Water arum / wild calla	*Calla palustris*

Common Name	**Scientific Name**
Water-lily	*Nymphaea* spp.
Water-milfoil	*Myriophyllum* spp.
Water smartweed	*Persicaria amphibia*
Watercress	*Nasturtium* or *Rorippa* spp.
White birch / paper birch	*Betula papyrifera*
White spruce	*Picea glauca*
Willow	*Salix* spp.
Woodreed	*Cinna* spp.
Woolly-fruit sedge	*Carex lasiocarpa*
Yellow birch	*Betula alleghaniensis*
Yellow pond-lily	*Nuphar* spp.
Invertebrates	
Emerald ash borer	*Agrilus planipennis*
Mammals	
Beaver	*Castor canadensis*
Star-nosed mole	*Condylura cristata*
Human	*Homo sapiens*
Meadow vole	*Microtus pennsylvanicus*
Muskrat	*Ondatra zibethicus*
Raccoon	*Procyon lotor*
Pig	*Sus scrofa*
Amphibians	
Eastern newt	*Notophthalmus viridescens*
Wood frog	*Lithobates sylvaticus*
Birds	
Wood duck	*Aix sponsa*
Hermit thrush	*Catharus guttatus*
Swainson’s thrush	*Catharus ustulatus*
Brown creeper	*Certhia americana*
Blue jay	*Cyanocitta cristata*
Ruby-crowned kinglet	*Corthylio calendula*
Golden-crowned kinglet	*Regulus satrapa*
Eastern phoebe	*Sayornis phoebe*
American robin	*Turdus migratorius*
Fish	
Northern redbelly dace	*Chrosomus eos*
Finescale dace	*Chrosomus neogaeus*
Brook stickleback	*Culaea inconstans*
Iowa darter	*Etheostoma exile*
Pumpkinseed	*Lepomis gibbosus*
Golden shiner	*Notemigonus crysoleucas*
Blacknose shiner	*Notropis heterolepis*

Common Name	Scientific Name
Fathead minnow	*Pimephales promelas*
Creek chub	*Semotilus atromaculatus*
Central mudminnow	*Umbra limi*

APPENDIX B – SPECIES DETECTED IN WETLANDS WITHIN THE AOI AND LSA$_{ECO}$

Table B-1. Predominant aquatic vegetation species detected during AHM surveys in wetlands in the AOI and in the LSA$_{ECO}$ north and south of the AOI. Scientific names follow the NHIC's Ontario species lists (current to March 1, 2023).

		Swamp			Marsh			Pond[1]	
Common Name	**Scientific Name**	**AOI**	**North**	**South**	**AOI**	**North**	**South**	**AOI**	**South**
Submergent									
American eelgrass	*Vallisneria americana*	0	0	0	0	0	0	1	0
Water-milfoil	*Myriophyllum* spp.	0	0	0	1	0	0	0	0
Sago pondweed	*Stuckenia pectinata*	0	0	0	1	0	0	0	0
Bladderwort	*Utricularia* all	0	0	0	0	1	0	1	0
Water smartweed	*Persicaria amphibia*	0	0	0	0	0	0	1	0
Floating									
Duckweed	*Lemna* spp.	0	1	1	0	1	0	1	0
Smartweed	*Persicaria* spp.	0	0	0	0	0	0	1	0
Water-lily	*Nymphaea* spp.	0	0	0	1	0	0	0	0
Emergent									
Reed canarygrass	*Phalaris arundinacea*	0	0	0	1	0	0	1	0
Sedge	*Carex* spp.	0	0	0	1	0	1	0	0
Common woolly bulrush	*Scirpus cyperinus*	0	0	0	0	0	1	0	0
Softstem bulrush	*Scirpus torreyi*	0	0	0	1	0	0	0	0
Cattail	*Typha* spp.	0	0	0	0	1	1	1	0
Wild calla	*Calla palustris*	0	1	0	0	0	0	0	0
Creeping spikerush	*Eleocharis palustris*	0	0	0	0	1	0	0	0
Bittersweet nightshade	*Solanum dulcamara*	0	0	0	0	0	0	1	0
Common water-parsnip	*Sium suave*	0	0	0	0	0	0	1	0
	Total	0	2	1	6	4	3	9	0

[1]These sites were classified as ponds in desk-based data but re-classified as wetlands by field contractors.

Table B-2. Vertebrate species detected via eDNA metabarcoding studies in wetlands in the AOI and LSA_{ECO}. Scientific names follow the NHIC's Ontario species lists (current to March 1, 2023).

Common Name	Scientific Name	AOI		LSA_{ECO}	
		Marsh	Swamp	Marsh	Swamp
Mammals					
Beaver	*Castor canadensis*	-	-	-	✓
Star-nosed mole	*Condylura cristata*	-	✓	✓	✓
Human[1]	*Homo sapiens*	✓	✓	✓	✓
Meadow vole	*Microtus pennsylvanicus*	✓	-	-	-
Muskrat	*Ondatra zibethicus*	✓	-	✓	✓
Raccoon	*Procyon lotor*	✓	✓	✓	✓
Pig[1]	*Sus scrofa*	-	✓	-	✓
Amphibians					
Eastern newt	*Notophthalmus viridescens*	✓	✓	-	-
Wood frog	*Lithobates sylvaticus*	✓	-	-	-
Birds					
Wood duck	*Aix sponsa*	✓	✓	✓	✓
Hermit thrush	*Catharus guttatus*	-	✓	-	✓
Swainson's thrush	*Catharus ustulatus*	-	-	-	✓
Brown creeper	*Certhia americana*	-	-	-	✓
Blue jay	*Cyanocitta cristata*	-	✓	-	-
Ruby-crowned kinglet	*Corthylio calendula*	-	-	-	✓
Golden-crowned kinglet	*Regulus satrapa*	-	-	-	✓
Eastern phoebe	*Sayornis phoebe*	✓	-	-	-
American robin	*Turdus migratorius*	✓	✓	-	✓
Fish					
Northern redbelly dace	*Chrosomus eos*	✓	✓	✓	-
Finescale dace	*Chrosomus neogaeus*	-	-	✓	-
Brook stickleback	*Culaea inconstans*	✓	✓	-	✓
Iowa darter	*Etheostoma exile*	-	-	✓	✓
Pumpkinseed	*Lepomis gibbosus*	-	-	✓	-

Common Name	Scientific Name	AOI		LSA$_{ECO}$	
		Marsh	Swamp	Marsh	Swamp
Golden shiner	*Notemigonus crysoleucas*	-	-	✓	-
Blacknose shiner	*Notropis heterolepis*	-	-	✓	-
Fathead minnow	*Pimephales promelas*	-	-	✓	-
Creek chub	*Semotilus atromaculatus*	✓	✓	✓	-
Central mudminnow	*Umbra limi*	✓	✓	✓	✓
	Total	13	13	14	16

Notes:

1. eDNA detections of human and pig are likely a results of contamination from nearby farming. Refer to Appendix E, Chapter 1 for further discussion on the caveats and limitations of eDNA metabarcoding results.

Table B-3. Invertebrate species detected via eDNA metabarcoding studies in wetlands in the AOI and LSA_{ECO}. Data are reported as '1' if the species was detected in that habitat, and '0' if the species was not detected in that habitat. A record of '0' does not mean the species is definitely absent from the habitat, only that it was not detected during 2022 eDNA metabarcoding studies.

			AOI		LSA_{ECO}	
Order	**Family**	**Scientific Name**	**Swamp**	**Marsh**	**Swamp**	**Marsh**
Phylum: Annelida						
Class: Clitellata						
Crassiclitellata	Lumbricidae	*Dendrobaena octaedra*	0	0	1	0
Crassiclitellata	Lumbricidae	*Lumbricus terrestris*	0	0	1	0
Crassiclitellata	Lumbricidae	*Octolasion tyrtaeum*	0	0	0	1
Enchytraeida	Enchytraeidae	*Cernosvitoviella minor*	0	0	1	0
Enchytraeida	Enchytraeidae	*Globulidrilus riparius*	0	0	1	1
Enchytraeida	Enchytraeidae	*Henlea perpusilla*	0	0	1	0
Haplotaxida	Naididae	*Aulodrilus pluriseta*	0	0	0	1
Haplotaxida	Naididae	*Branchiura sowerbyi*	0	0	0	1
Haplotaxida	Naididae	*Ilyodrilus templetoni*	0	1	0	0
Haplotaxida	Naididae	*Nais communis*	0	0	1	1
Haplotaxida	Naididae	*Nais stolci*	0	0	0	1
Haplotaxida	Naididae	*Slavina appendiculata*	0	1	0	1
Phylum: Arthropoda						
Class: Branchiopoda						
Diplostraca	Bosminidae	*Bosmina longirostris*	0	1	0	0
Diplostraca	Chydoridae	*Alona circumfimbriata*	0	1	0	0
Diplostraca	Daphniidae	*Simocephalus serrulatus*	0	0	0	1
Class: Insecta						
Coleoptera	Carabidae	*Agonum placidum*	1	0	0	0
Coleoptera	Carabidae	*Clivina fossor*	0	0	0	1
Coleoptera	Carabidae	*Elaphrus clairvillei*	0	0	1	0
Coleoptera	Carabidae	*Pterostichus melanarius*	1	0	0	0
Coleoptera	Chrysomelidae	*Longitarsus suspectus*	0	0	0	1
Coleoptera	Corylophidae	*Orthoperus scutellaris*	0	0	1	0

Order	Family	Scientific Name	AOI		LSA_{ECO}	
			Swamp	Marsh	Swamp	Marsh
Coleoptera	Curculionidae	*Barypeithes pellucidus*	1	0	0	0
Coleoptera	Curculionidae	*Sciaphilus asperatus*	1	0	0	1
Coleoptera	Dytiscidae	*Acilius confusus*	0	1	0	0
Coleoptera	Dytiscidae	*Clemnius laccophilinus*	0	0	1	0
Coleoptera	Dytiscidae	*Hydrocolus persimilis*	0	0	1	0
Coleoptera	Dytiscidae	*Hydrovatus pustulatus*	0	1	0	0
Coleoptera	Dytiscidae	*Ilybiosoma seriatum*	1	0	1	0
Coleoptera	Dytiscidae	*Ilybius biguttulus*	0	1	1	1
Coleoptera	Dytiscidae	*Neoporus clypealis*	0	1	1	0
Coleoptera	Dytiscidae	*Neoporus undulatus*	1	0	1	0
Coleoptera	Elateridae	*Athous rufifrons*	0	0	1	0
Coleoptera	Elmidae	*Optioservus fastiditus*	0	0	0	1
Coleoptera	Elmidae	*Stenelmis crenata*	0	0	0	1
Coleoptera	Haliplidae	*Haliplus immaculicollis*	0	1	0	0
Coleoptera	Hydrophilidae	*Berosus sayi*	1	0	0	0
Coleoptera	Hydrophilidae	*Coelostoma orbiculare*	0	1	0	0
Coleoptera	Hydrophilidae	*Hydrobius fuscipes*	0	0	1	0
Coleoptera	Hydrophilidae	*Hydrochara obtusata*	0	1	0	0
Coleoptera	Noteridae	*Hydrocanthus iricolor*	0	0	0	1
Coleoptera	Phalacridae	*Olibrus semistriatus*	0	0	0	1
Coleoptera	Psephenidae	*Psephenus herricki*	0	0	0	1
Coleoptera	Scarabaeidae	*Amphimallon majale*	1	1	0	0
Coleoptera	Scarabaeidae	*Melinopterus prodromus*	0	0	1	0
Coleoptera	Scirtidae	*Contacyphon obscurus*	0	1	1	0
Coleoptera	Scirtidae	*Prionocyphon limbatus*	0	0	1	0
Coleoptera	Scirtidae	*Scirtes tibialis*	0	1	0	1
Coleoptera	Staphylinidae	*Erichsonius nanus*	0	0	1	0
Coleoptera	Staphylinidae	*Hemiquedius ferox*	0	0	1	0
Coleoptera	Staphylinidae	*Lathrobium simplex*	0	0	1	0

Order	Family	Scientific Name	AOI		LSA_{ECO}	
			Swamp	Marsh	Swamp	Marsh
Coleoptera	Staphylinidae	*Myllaena arcana*	0	0	1	0
Coleoptera	Staphylinidae	*Olophrum obtectum*	0	0	0	1
Coleoptera	Staphylinidae	*Philonthus lomatus*	0	0	1	0
Coleoptera	Staphylinidae	*Philonthus monaeses*	0	0	1	0
Coleoptera	Staphylinidae	*Tachinus limbatus*	0	0	0	1
Coleoptera	Tenebrionidae	*Isomira quadristriata*	0	0	1	0
Diptera	Agromyzidae	*Nemorimyza posticata*	0	0	0	1
Diptera	Anthomyzidae	*Anthomyza dichroa*	1	0	1	0
Diptera	Bibionidae	*Bibio xanthopus*	1	0	0	0
Diptera	Ceratopogonidae	*Culicoides haematopotus*	0	0	0	1
Diptera	Ceratopogonidae	*Culicoides mulrennani*	0	1	1	0
Diptera	Ceratopogonidae	*Culicoides venustus*	0	1	0	0
Diptera	Ceratopogonidae	*Dasyhelea turficola*	0	0	0	1
Diptera	Chaoboridae	*Chaoborus albipes*	1	1	0	0
Diptera	Chaoboridae	*Chaoborus punctipennis*	1	0	0	1
Diptera	Chironomidae	*Bryophaenocladius ictericus*	0	0	1	0
Diptera	Chironomidae	*Chironomus acidophilus*	1	1	1	0
Diptera	Chironomidae	*Chironomus bifurcatus*	1	1	0	0
Diptera	Chironomidae	*Chironomus lugubris*	0	0	1	0
Diptera	Chironomidae	*Chironomus maturus*	1	1	1	1
Diptera	Chironomidae	*Chironomus melanescens*	0	0	1	0
Diptera	Chironomidae	*Cladopelma edwardsi*	0	0	0	1
Diptera	Chironomidae	*Cladopelma galeator*	0	0	0	1
Diptera	Chironomidae	*Conchapelopia telema*	1	0	0	1
Diptera	Chironomidae	*Corynoneura scutellata*	1	1	1	1
Diptera	Chironomidae	*Cricotopus annulator*	0	0	0	1
Diptera	Chironomidae	*Cricotopus bicinctus*	0	0	1	1
Diptera	Chironomidae	*Cricotopus triannulatus*	0	0	0	1
Diptera	Chironomidae	*Cricotopus tristis*	0	0	0	1

Order	Family	Scientific Name	AOI		LSA_{ECO}	
			Swamp	Marsh	Swamp	Marsh
Diptera	Chironomidae	*Dicrotendipes modestus*	0	0	0	1
Diptera	Chironomidae	*Dicrotendipes tritomus*	0	0	1	1
Diptera	Chironomidae	*Glyptotendipes glaucus*	0	1	0	0
Diptera	Chironomidae	*Gymnometriocnemus brumalis*	1	0	0	0
Diptera	Chironomidae	*Lauterborniella agrayloides*	0	0	1	0
Diptera	Chironomidae	*Limnophyes asquamatus*	0	0	1	0
Diptera	Chironomidae	*Limnophyes minimus*	0	0	1	0
Diptera	Chironomidae	*Limnophyes natalensis*	0	0	1	0
Diptera	Chironomidae	*Metriocnemus albolineatus*	1	0	0	0
Diptera	Chironomidae	*Micropsectra nigripila*	1	1	1	1
Diptera	Chironomidae	*Micropsectra polita*	0	0	0	1
Diptera	Chironomidae	*Micropsectra recurvata*	0	0	1	0
Diptera	Chironomidae	*Micropsectra subletteorum*	1	0	1	0
Diptera	Chironomidae	*Micropsectra xantha*	1	0	1	1
Diptera	Chironomidae	*Microtendipes pedellus*	0	1	0	1
Diptera	Chironomidae	*Nilotanypus fimbriatus*	0	0	0	1
Diptera	Chironomidae	*Orthocladius smolandicus*	0	0	1	0
Diptera	Chironomidae	*Pagastia orthogonia*	0	0	0	1
Diptera	Chironomidae	*Parachironomus tenuicaudatus*	1	1	0	1
Diptera	Chironomidae	*Paraphaenocladius impensus*	0	0	1	1
Diptera	Chironomidae	*Parochlus kiefferi*	0	0	1	1
Diptera	Chironomidae	*Polypedilum aviceps*	0	0	0	1
Diptera	Chironomidae	*Polypedilum convictum*	1	0	0	1
Diptera	Chironomidae	*Procladius denticulatus*	1	0	0	0
Diptera	Chironomidae	*Prodiamesa olivacea*	1	0	1	0
Diptera	Chironomidae	*Rheocricotopus robacki*	0	0	0	1
Diptera	Chironomidae	*Stempellinella fimbriata*	0	0	1	1
Diptera	Chironomidae	*Tanytarsus glabrescens*	0	1	0	1
Diptera	Chironomidae	*Tanytarsus mendax*	0	1	0	1

Order	Family	Scientific Name	AOI		LSA_{ECO}	
			Swamp	Marsh	Swamp	Marsh
Diptera	Chironomidae	*Thienemanniella xena*	0	0	1	1
Diptera	Chironomidae	*Tvetenia paucunca*	1	0	0	1
Diptera	Chironomidae	*Xenochironomus xenolabis*	0	0	0	1
Diptera	Culicidae	*Anopheles punctipennis*	0	0	1	0
Diptera	Culicidae	*Culex territans*	1	0	1	0
Diptera	Culicidae	*Ochlerotatus thibaulti*	0	0	1	0
Diptera	Dolichopodidae	*Dolichopus albiciliatus*	0	0	1	0
Diptera	Dolichopodidae	*Gymnopternus lividifrons*	0	0	1	0
Diptera	Drosophilidae	*Scaptomyza flava*	1	0	0	0
Diptera	Dryomyzidae	*Dryomyza anilis*	0	0	0	1
Diptera	Ephydridae	*Hydrellia albilabris*	0	1	1	0
Diptera	Ephydridae	*Hydrellia notata*	1	0	0	1
Diptera	Fanniidae	*Fannia falcata*	0	0	1	0
Diptera	Fanniidae	*Fannia latifrons*	0	0	1	0
Diptera	Fanniidae	*Fannia sociella*	0	0	1	1
Diptera	Heleomyzidae	*Suillia laevis*	0	0	1	0
Diptera	Lauxaniidae	*Poecilominettia puncticeps*	0	0	1	0
Diptera	Limoniidae	*Antocha saxicola*	0	0	0	1
Diptera	Limoniidae	*Discobola annulata*	0	0	1	0
Diptera	Limoniidae	*Epiphragma fasciapenne*	0	0	1	0
Diptera	Limoniidae	*Erioptera ebenina*	0	0	1	0
Diptera	Limoniidae	*Erioptera septemtrionis*	0	1	0	0
Diptera	Limoniidae	*Euphylidorea luteola*	0	0	1	0
Diptera	Limoniidae	*Helius flavipes*	0	1	1	0
Diptera	Limoniidae	*Hexatoma spinosa*	0	0	0	1
Diptera	Limoniidae	*Molophilus hirtipennis*	0	0	1	0
Diptera	Limoniidae	*Ormosia affinis*	0	0	1	0
Diptera	Limoniidae	*Pseudolimnophila inornata*	0	1	0	0
Diptera	Limoniidae	*Pseudolimnophila luteipennis*	0	1	1	0

Order	Family	Scientific Name	AOI		LSA_{ECO}	
			Swamp	Marsh	Swamp	Marsh
Diptera	Muscidae	*Lispe albitarsis*	0	0	1	0
Diptera	Muscidae	*Neodexiopsis rufitibia*	0	0	1	0
Diptera	Muscidae	*Pentacricia aldrichii*	0	0	1	0
Diptera	Mycetophilidae	*Exechia nigroscutellata*	0	0	1	0
Diptera	Mycetophilidae	*Mycomya pulchella*	0	0	1	0
Diptera	Pediciidae	*Dicranota guerini*	0	0	0	1
Diptera	Pediciidae	*Pedicia goldsworthyi*	1	0	0	0
Diptera	Periscelididae	*Cyamops nebulosus*	0	0	1	0
Diptera	Platystomatidae	*Rivellia steyskali*	1	1	0	0
Diptera	Psychodidae	*Psychoda alternata*	0	1	0	0
Diptera	Psychodidae	*Psychoda phalaenoides*	0	0	1	0
Diptera	Ptychopteridae	*Bittacomorpha clavipes*	0	0	1	1
Diptera	Ptychopteridae	*Ptychoptera quadrifasciata*	0	0	1	1
Diptera	Rhagionidae	*Chrysopilus quadratus*	0	0	1	0
Diptera	Sciomyzidae	*Atrichomelina pubera*	0	0	1	0
Diptera	Sciomyzidae	*Elgiva solicita*	0	1	0	0
Diptera	Sciomyzidae	*Sepedon armipes*	0	1	0	1
Diptera	Sciomyzidae	*Sepedon fuscipennis*	1	0	0	0
Diptera	Sciomyzidae	*Tetanocera annae*	0	1	1	0
Diptera	Sphaeroceridae	*Copromyza neglecta*	0	1	0	1
Diptera	Sphaeroceridae	*Pullimosina pullula*	0	1	0	0
Diptera	Syrphidae	*Allograpta obliqua*	1	0	0	0
Diptera	Syrphidae	*Chalcosyrphus nemorum*	0	0	1	0
Diptera	Syrphidae	*Eristalis anthophorina*	0	0	0	1
Diptera	Syrphidae	*Helophilus fasciatus*	0	0	1	0
Diptera	Tabanidae	*Chrysops calvus*	0	0	0	1
Diptera	Tabanidae	*Tabanus atratus*	0	1	0	0
Diptera	Tabanidae	*Tabanus superjumentarius*	0	1	0	0
Diptera	Tephritidae	*Campiglossa albiceps*	0	0	0	1

Order	Family	Scientific Name	AOI		LSA_{ECO}	
			Swamp	Marsh	Swamp	Marsh
Diptera	Tipulidae	*Nephrotoma cornicina*	1	0	0	0
Diptera	Tipulidae	*Tipula abdominalis*	0	0	1	1
Diptera	Tipulidae	*Tipula mallochi*	0	1	0	0
Diptera	Tipulidae	*Tipula oropezoides*	1	0	0	0
Diptera	Tipulidae	*Tipula sayi*	0	0	1	0
Diptera	Tipulidae	*Tipula senega*	0	0	1	0
Diptera	Tipulidae	*Tipula tephrocephala*	1	0	1	0
Diptera	Tipulidae	*Tipula tricolor*	0	0	1	1
Ephemeroptera	Caenidae	*Caenis diminuta*	0	1	1	0
Ephemeroptera	Ephemeridae	*Hexagenia atrocaudata*	0	0	0	1
Ephemeroptera	Leptophlebiidae	*Paraleptophlebia adoptiva*	0	0	0	1
Hemiptera	Belostomatidae	*Belostoma flumineum*	0	0	0	1
Hemiptera	Cicadellidae	*Typhlocyba hockingensis*	0	0	1	0
Hemiptera	Notonectidae	*Notonecta irrorata*	0	1	0	0
Hemiptera	Pentatomidae	*Euschistus variolarius*	0	0	1	0
Hemiptera	Pleidae	*Neoplea striola*	0	1	0	0
Lepidoptera	Erebidae	*Palthis angulalis*	0	0	1	0
Lepidoptera	Erebidae	*Pyrrharctia isabella*	0	0	0	1
Lepidoptera	Tortricidae	*Argyrotaenia velutinana*	0	0	0	1
Lepidoptera	Tortricidae	*Choristoneura fumiferana*	1	0	0	0
Lepidoptera	Tortricidae	*Epinotia lindana*	0	0	1	0
Megaloptera	Corydalidae	*Chauliodes rastricornis*	1	0	1	0
Megaloptera	Corydalidae	*Nigronia serricornis*	0	0	0	1
Megaloptera	Sialidae	*Sialis vagans*	0	0	0	1
Neuroptera	Coniopterygidae	*Conwentzia pineticola*	0	0	1	0
Neuroptera	Hemerobiidae	*Micromus posticus*	0	0	1	1
Neuroptera	Hemerobiidae	*Sympherobius amiculus*	1	0	0	0
Orthoptera	Gryllidae	*Eunemobius carolinus*	0	1	0	0
Plecoptera	Capniidae	*Paracapnia angulata*	0	0	0	1

Order	Family	Scientific Name	AOI		LSA_{ECO}	
			Swamp	**Marsh**	**Swamp**	**Marsh**
Plecoptera	Nemouridae	*Soyedina vallicularia*	0	0	0	1
Plecoptera	Perlodidae	*Isoperla nana*	1	0	0	0
Psocoptera	Caeciliusidae	*Valenzuela flavidus*	0	0	1	1
Psocoptera	Ectopsocidae	*Ectopsocus meridionalis*	0	0	1	0
Psocoptera	Lepidopsocidae	*Echmepteryx hageni*	0	0	1	0
Psocoptera	Psocidae	*Trichadenotecnum majus*	0	0	1	0
Psocoptera	Stenopsocidae	*Graphopsocus cruciatus*	0	0	1	0
Trichoptera	Lepidostomatidae	*Lepidostoma vernale*	0	0	0	1
Trichoptera	Limnephilidae	*Limnephilus indivisus*	0	0	1	0
Trichoptera	Limnephilidae	*Limnephilus ornatus*	0	0	0	1
Trichoptera	Limnephilidae	*Platycentropus radiatus*	0	1	1	1
Class: Malacostraca						
Decapoda	Cambaridae	*Fallicambarus fodiens*	0	0	1	0
Decapoda	Cambaridae	*Orconectes immunis*	0	0	0	1
Class: Ostracoda						
Podocopida	Cyprididae	*Cypridopsis vidua*	0	1	1	1
Phylum: Rotifera						
Class: Eurotatoria						
Ploima	Synchaetidae	*Polyarthra vulgaris*	0	0	0	1

Table B-4. Incidental observations of aquatic and riparian vegetation during TEM, AHM, and eDNA field surveys within the AOI or LSA_{ECO} in 2022.

Common Name	Scientific Name	Aquatic or Riparian	SAR	Rare	Introd./ Invasive	Notes
Algae	NA	Aquatic	NA	NA	NA	
American elm / white elm	*Ulmus americana*	Riparian	N	N	N	
Aquatic macrophytes	NA	Aquatic	NA	NA	NA	
Aquatic plants	NA	Aquatic	NA	NA	NA	
Arrowhead	*Sagittaria* sp.	Aquatic	NA	NA	NA	
Ash	*Fraxinus* sp.	Riparian	NA	NA	NA	
Basswood	*Tilia americana*	Riparian	N	N	N	
Bittersweet nightshade	*Solanum dulcamara*	Riparian	N	N	Y	
Black ash	*Fraxinus nigra*	Riparian	Y	N	N	END in Ontario, THR in Canada
Black spruce	*Picea mariana*	Riparian	N	N	N	
Bladderwort	*Utricularia* sp.	Aquatic	NA	NA	NA	
Broad-leaf cattail	*Typha latifolia*	Aquatic	N	N	N	
Buckthorn	*Rhamnus* sp.	Riparian	NA	NA	NA	
Bur-reed	*Sparganium* sp.	Aquatic	NA	NA	NA	
Canada wood nettle	*Laportea canadensis*	Riparian	N	N	N	
Canary grass	*Phalaris* sp.	Riparian	NA	NA	NA	
Cattail	*Typha* sp.	Aquatic	NA	NA	NA	
Cherry	*Prunus* sp.	Riparian	NA	NA	NA	
Chokecherry	*Prunus virginiana*	Riparian	N	N	N	
Club-spur orchid	*Platanthera clavellata*	Aquatic	N	N	N	
Common boneset	*Eupatorium perfoliatum*	Riparian	N	N	N	
Common water-parsnip	*Sium suave*	Aquatic	N	N	N	
Common woolly bulrush	*Scirpus cyperinus*	Aquatic	NA	NA	NA	
Dark-green bulrush	*Scirpus atrovirens*	Aquatic	N	N	N	
Dogwood	*Cornus* sp.	Riparian	NA	NA	NA	
Duckweed	Lemnaceae sp.	Aquatic	NA	NA	NA	
Eastern hemlock	*Tsuga canadensis*	Riparian	N	N	N	
Eastern rough sedge	*Carex scabrata*	Aquatic	NA	NA	NA	

Common Name	Scientific Name	Aquatic or Riparian	SAR	Rare	Introd./ Invasive	Notes
Eastern white cedar	*Thuja occidentalis*	Riparian	N	N	N	
Eastern white pine	*Pinus strobus*	Riparian	N	N	N	
Elderberry	*Sambucus* sp.	Riparian	NA	NA	NA	
European buckthorn	*Rhamnus cathartica*	Riparian	N	N	Y	
European reed	*Phragmites australis* ssp. *australis*	Aquatic	N	N	Y	
Ferns	Polypodiopsida	Riparian	NA	NA	NA	
Filamentous algae	NA	Aquatic	NA	NA	NA	
Floating vegetation	NA	Aquatic	NA	NA	NA	
Fowl mannagrass	*Glyceria striata*	Aquatic	N	N	N	
Fringed sedge	*Carex crinita*	Aquatic	N	N	N	
Goldenrod	*Solidago* sp.	Riparian	NA	NA	NA	
Green ash / red ash	*Fraxinus pennsylvanica*	Riparian	N	N	N	
Horsetail	*Equisetum* sp.	Aquatic	NA	NA	NA	
Hydrophytic vegetation	NA	Aquatic	NA	NA	NA	
Joe-pye weed	*Eutrochium* sp.	Riparian	NA	NA	NA	
Lake sedge	*Carex lacustris*	Aquatic	N	N	N	
Loesel's twayblade	*Liparis loeselii*	Aquatic	N	N	N	
Loosestrife	Dicotyledoneae sp.	Aquatic	NA	NA	NA	
Macroalgae	NA	Aquatic	NA	NA	NA	
Macrophytes	NA	Aquatic	NA	NA	NA	
Manitoba maple	*Acer negundo*	Riparian	N	N	N	
Maple	*Acer* sp.	Riparian	NA	NA	NA	
Meadowsweet	*Spiraea* sp.	Riparian	NA	NA	NA	
Milkweed	*Asclepias* sp.	Riparian	NA	NA	NA	
Moss	Bryophyta	Riparian	NA	NA	NA	
New England aster	*Symphyotrichum novae-angliae*	Riparian	N	N	N	
Ninebark	*Physocarpus* sp.	Riparian	NA	NA	NA	

Common Name	Scientific Name	Aquatic or Riparian	SAR	Rare	Introd./ Invasive	Notes
Ostrich fern	*Matteuccia struthiopteris*	Riparian	N	N	N	
Peach-leaf willow	*Salix amygdaloides*	Riparian	N	N	N	
Pickerelweed	*Pontederia cordata*	Aquatic	N	N	N	
Pond-lily	Nymphaeaceae sp.	Aquatic	NA	NA	NA	
Poplar	*Populus* sp.	Riparian	NA	NA	NA	
Purple loosestrife	*Lythrum salicaria*	Aquatic	N	N	Y	
Raspberry	*Rubus* sp.	Riparian	NA	NA	NA	
Red maple	*Acer rubrum*	Riparian	N	N	N	
Red oak	*Quercus rubra*	Riparian	N	N	N	
Red osier dogwood	*Cornus sericea*	Riparian	N	N	N	
Reed canarygrass	*Phalaris arundinacea*	Aquatic	N	N	N	
Reeds	Poaceae sp.	Aquatic	NA	NA	NA	
Riparian grasses	Poaceae	Riparian	NA	NA	NA	
Riparian herbs	NA	Riparian	NA	NA	NA	
Riparian vegetation	NA	Riparian	NA	NA	NA	
Riverbank grape	*Vitis riparia*	Riparian	N	N	N	
Royal fern	*Osmunda regalis*	Riparian	N	N	N	
Rubus	*Rubus* sp.	Riparian	NA	NA	NA	
Scots pine	*Pinus sylvestris*	Riparian	N	N	Y	
Sedges	*Carex* spp.	Aquatic	NA	NA	NA	
Sensitive fern	*Onoclea sensibilis*	Riparian	N	N	N	
Showy lady's-slipper	*Cypripedium reginae*	Riparian	N	N	N	
Silky dogwood	*Cornus obliqua*	Riparian	N	N	N	
Silver maple	*Acer saccharinum*	Riparian	N	N	N	
Sphagnum	*Sphagnum* sp.	Aquatic	NA	NA	NA	
Spotted jewelweed	*Impatiens capensis*	Riparian	N	N	N	
Spotted joe-pye weed	*Eutrochium maculatum*	Riparian	N	N	N	
Stinging nettle	*Urtica dioica*	Riparian	N	N	Y	
Submergent grasses	Poaceae sp.	Aquatic	NA	NA	NA	

Common Name	Scientific Name	Aquatic or Riparian	SAR	Rare	Introd./ Invasive	Notes
Submergent vegetation	NA	Aquatic	NA	NA	NA	
Swamp loosestrife	*Decodon verticillatus*	Aquatic	N	N	N	
Sweet gale	*Myrica gale*	Riparian	N	N	N	
Tamarack	*Larix laricina*	Riparian	N	N	N	
Tussock sedge	*Carex stricta*	Aquatic	N	N	N	
Watercress	*Nasturtium* or *Rorippa* sp.	Aquatic	NA	NA	NA	
White birch / paper birch	*Betula papyrifera*	Riparian	N	N	N	
White spruce	*Picea glauca*	Riparian	N	N	N	
Willow	*Salix* sp.	Riparian	NA	NA	NA	
Woodreed	*Cinna* sp.	Riparian	NA	NA	NA	
Woolly-fruit sedge	*Carex lasiocarpa*	Aquatic	N	N	N	
Yellow birch	*Betula alleghaniensis*	Riparian	N	N	N	
Yellow pond-lily	*Nuphar* sp.	Aquatic	NA	NA	NA	Some species of yellow pond-lily are rare

Notes:
Introd. = Introduced species
END = endangered; THR = threatened

APPENDIX C – HABITATS WITHIN RIPARIAN BUFFERS

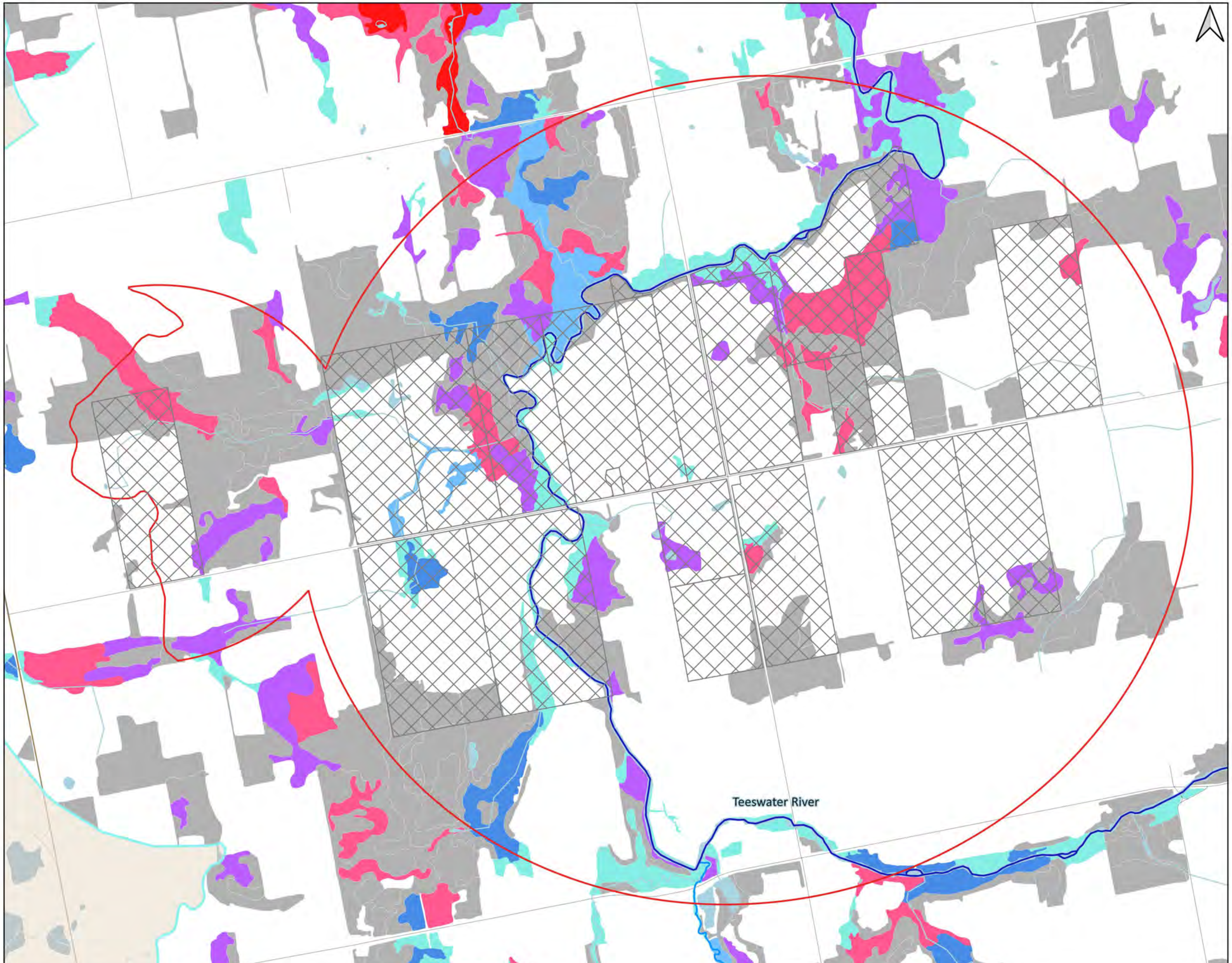
For additional data on riparian habitats, see Table C-3a (waterbodies) and Table B-4 (watercourses), in Appendix D, Chapter 1 (AHM).

Table C-1. Amount and percent of each ecosite within the 15 m, 30 m, and 100 m riparian buffers, as well as the 120 m PSW buffers, of wetlands, waterbodies, and watercourses within the AOI and LSA_{ECO}.

	AOI										LSA_{ECO}									
	Non-PSW Buffers						PSW Buffers				Non-PSW Buffers						PSW Buffers			
	0 - 15 m		0 - 30 m		0 - 100 m		0 - 120 m		> 100 m[1]		0 - 15 m		0 - 30 m		0 - 100 m		0 - 120 m		> 100 m[1]	
	ha	%	ha	%	ha	%	ha	%	ha	%	ha	%	ha	%	ha	%	ha	%	ha	%
Conifer	8.4	6.7	15.7	6.5	30.3	4.4	6.3	2.3	0.4	1.2	112.0	6.6	206.2	6.4	431.4	5.1	227.7	5.2	40.7	3.7
Mixedwood	20.0	15.8	35.5	14.6	64.5	9.3	25.0	9.3	13.3	37.4	240.5	14.2	433.4	13.5	789.8	9.3	200.3	4.6	73.8	6.8
Hardwood	27.2	21.5	50.1	20.6	122.2	17.7	42.5	15.8	3.5	10.0	559.3	33.1	1031.2	32.0	2065.5	24.3	478.3	10.9	206.3	19.0
Plantation	1.8	1.4	3.7	1.5	9.2	1.3	7.1	2.6	0.6	1.8	16.6	1.0	32.2	1.0	79.2	0.9	54.6	1.2	13.4	1.2
Shrub	1.2	1.0	1.8	0.7	2.0	0.3	0.7	0.3	-	-	4.3	0.3	6.5	0.2	7.8	0.1	2.0	0.0	-	-
Meadow	5.2	4.1	9.1	3.7	18.0	2.6	10.4	3.9	1.0	2.8	38.5	2.3	66.1	2.1	124.3	1.5	41.1	0.9	9.6	0.9
Field	-	-	-	-	-	-	-	-	-	-	1.7	0.1	3.5	0.1	7.2	0.1	-	-	-	-
Wetlands[2]	0.0	0.0	0.0	0.0	0.0	0.0	41.6	0.2	-	-	0.0	0.0	0.0	0.0	0.0	0.0	508.3	0.1	0.0	0.0
Total Ecosites	**63.8**	**50.5**	**115.9**	**47.6**	**246.1**	**35.6**	**133.6**	**49.8**	**18.9**	**53.2**	**972.9**	**57.5**	**1779.0**	**55.3**	**3505.1**	**41.2**	**1512.2**	**34.5**	**343.7**	**31.6**
Unmapped[3]	62.6	49.5	127.8	52.4	444.9	64.4	134.8	50.2	16.6	46.8	718.6	42.5	1439.4	44.7	5004.0	58.8	2869.5	65.5	744.3	68.4

Notes:
Data reported for each buffer width and study area are inclusive of all areas within those buffers or study areas, including smaller nested buffers or study areas. For example, the 30 m buffer of the LSA_{ECO} includes the 15 m buffer of the LSA_{ECO}, and all riparian buffers within the AOI.
[1]Columns labelled "> 100 m" represent the area of the PSW buffer that is beyond the largest non-PSW buffer (100 m). This represents the additional area afforded protection by the PSW buffer regulations.
[2]Wetlands include swamps, marshes, fens, rivers, lakes, and anthropogenic water. Non-PSW riparian buffers are drawn around all wetlands, so contain no wetlands within them. PSW buffers may contain wetlands due to differences between the provincial PSW data layer and the mapped ecosites. See Section 1.3.3.1 for more information.
[3]The unmapped area is the amount of riparian buffer that was not covered by the ecosite classification dataset, which constitutes anthropogenic land (see Section 1.3.3.1 for more information).

APPENDIX D – MAPS OF WETLANDS AND RIPARIAN AREAS IN THE BIS STUDY AREAS



NWMO Biodiversity Impact Studies

Wetlands in the AOI

Figure D-1a

- Area of Interest (AOI)
- Local Study Area (LSA_{ECO})
- NWMO Purchased or Optioned Land
- Teeswater River
- Alps Creek
- Other Watercourse
- Lake
- Wetland Outside LSA_{ECO}
- Municipal Boundary
- Local Road
- Conifer Swamp
- Mixedwood Swamp
- Hardwood Swamp
- Shrub Swamp
- Marsh
- Fen
- Upland Areas

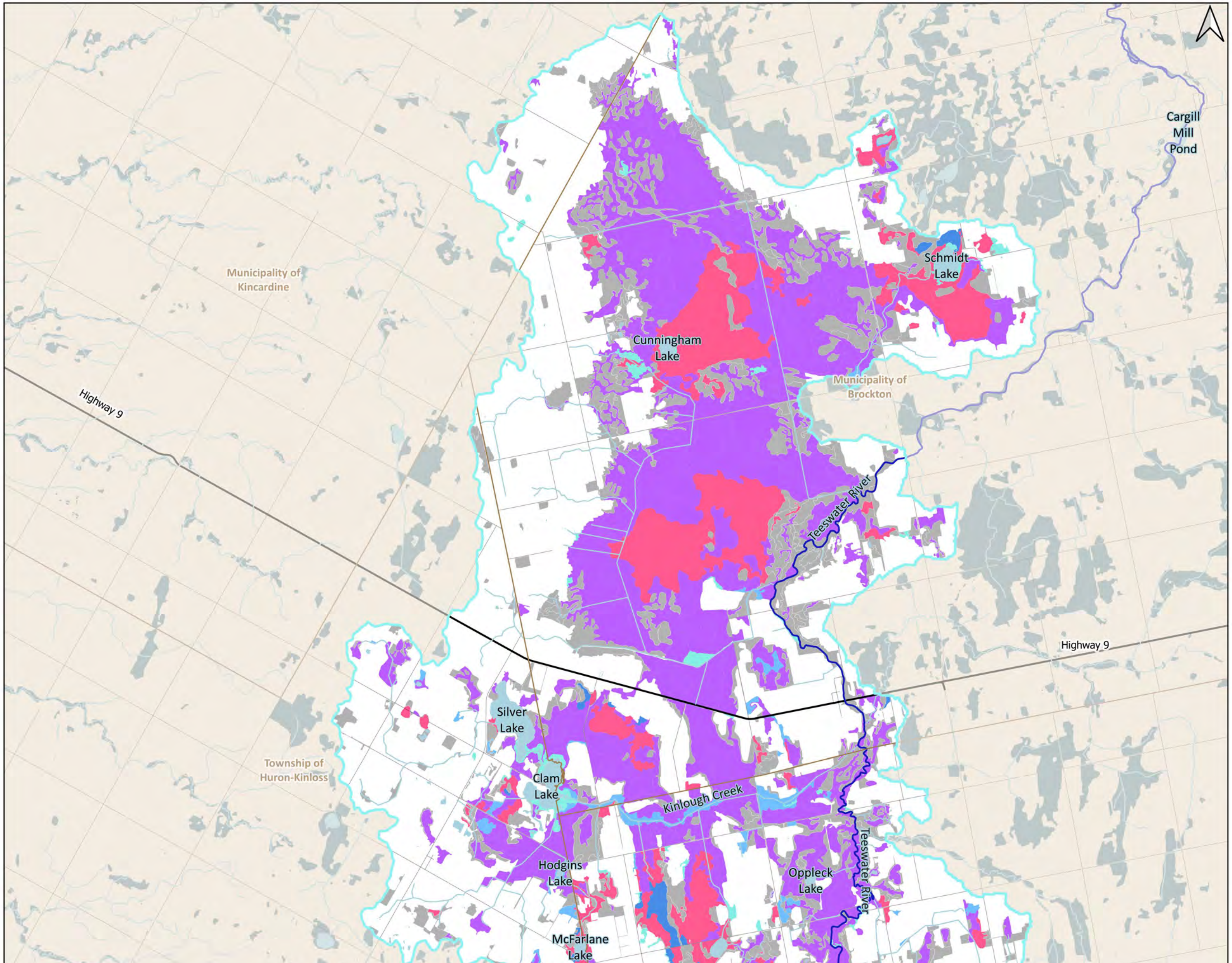
1:75,000

0 0.5 1 km

ZOETICA

Data received from:
Ontario GeoHub — OHN Waterbody (MNRF); OHN Watercourse (MNRF); ORN Road Segment (MNRF); Municipal Boundary - Lower and Upper Tier (MMAH); Wetlands (MNRF)
NWMO — AOI; NWMO Purchased or Optioned Land
Ecosite data were created for the BIS Project. Wetlands and water features are mapped using ecosite data within the LSA_{ECO} and data available from Ontario GeoHub outside the LSA_{ECO}.

Project CRS: NAD83 / UTM zone 17N		
Author: DM	Reviewed by: RC	Approved by: HB
December 12, 2023	Map ID: NWMO_BIS_D182a	



NWMO Biodiversity Impact Studies

Wetlands in the North LSA_{ECO}

Figure D-1b

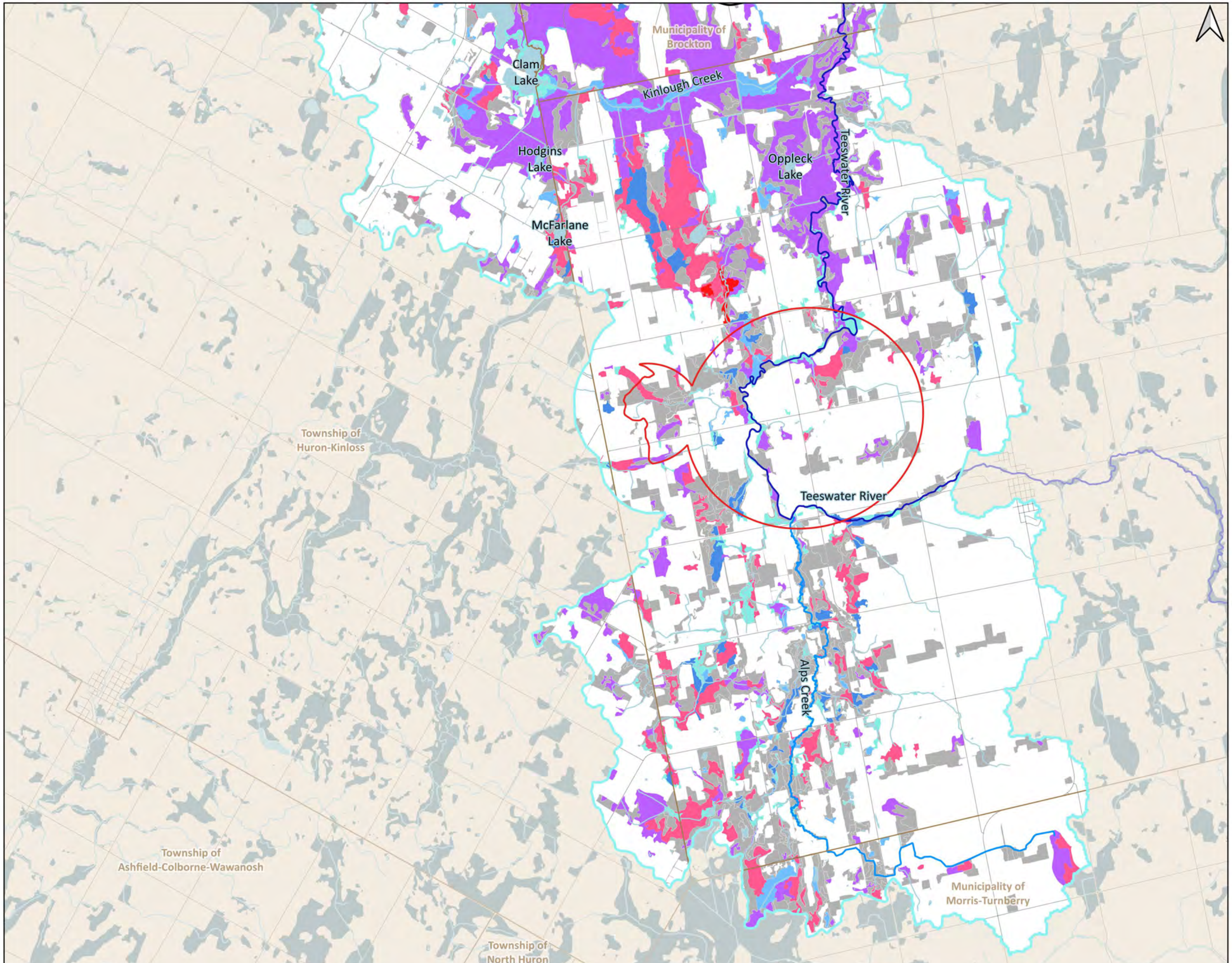
- Area of Interest (AOI)
- Local Study Area (LSA_{ECO})
- Teeswater River
- Alps Creek
- Other Watercourse
- Lake
- Wetlands Outside LSA_{ECO}
- Municipal Boundary
- Highway
- Local Road
- Conifer Swamp
- Mixedwood Swamp
- Hardwood Swamp
- Shrub Swamp
- Marsh
- Fen
- Upland Areas

1:75,000
0 1 2 km

ZOETICA

Data received from:
Ontario GeoHub — OHN Waterbody (MNRF); OHN Watercourse (MNRF); ORN Road Segment (MNRF); Municipal Boundary - Lower and Upper Tier (MMAH); Wetlands (MNRF)
NWMO — AOI; NWMO Purchased or Optioned Land
Ecosite data were created for the BIS Project. Wetlands and water features are mapped using ecosite data within the LSA_{ECO} and data available from Ontario GeoHub outside the LSA_{ECO}.

Project CRS: NAD83 / UTM zone 17N		
Author: DM	Reviewed by: RC	Approved by: HB
December 12, 2023	Map ID: NWMO_BIS_D182b	



NWMO Biodiversity Impact Studies

Wetlands in the South LSA$_{ECO}$

Figure D-1c

- Area of Interest (AOI)
- Local Study Area (LSA$_{ECO}$)
- Teeswater River
- Alps Creek
- Other Watercourse
- Lake
- Wetlands Outside LSA$_{ECO}$
- Municipal Boundary
- Local Road
- Conifer Swamp
- Mixedwood Swamp
- Hardwood Swamp
- Shrub Swamp
- Marsh
- Fen
- Upland Areas

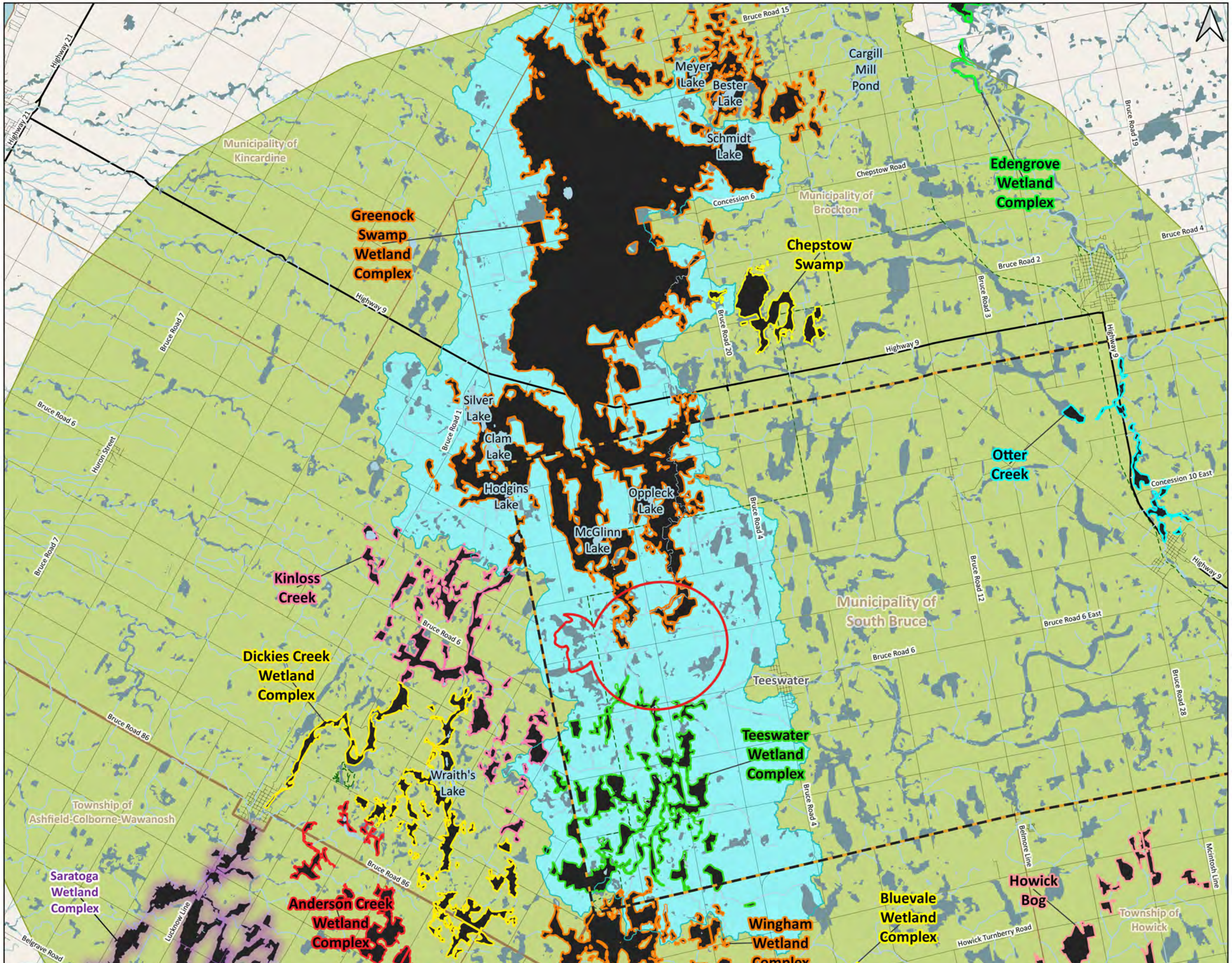
1:75,000

0 1 2 km

ZOETICA

Data received from:
Ontario GeoHub — OHN Waterbody (MNRF); OHN Watercourse (MNRF); ORN Road Segment (MNRF); Municipal Boundary - Lower and Upper Tier (MMAH); Wetlands (MNRF)
NWMO — AOI; NWMO Purchased or Optioned Land
Ecosite data were created for the BIS Project. Wetlands and water features are mapped using ecosite data within the LSA$_{ECO}$ and data available from Ontario GeoHub outside the LSA$_{ECO}$.

Project CRS: NAD83 / UTM zone 17N		
Author: DM	Reviewed by: RC	Approved by: HB
December 12, 2023	Map ID: NWMO_BIS_D182c	



NWMO Biodiversity Impact Studies

Provincially Significant Wetlands and Potential Reference Wetlands -AOI and LSA$_{ECO}$

Figure D-2a

- Area of Interest (AOI)
- Local Study Area (LSA$_{ECO}$)
- Regional Study Area (RSA$_{ECO}$)
- Provincially Significant Wetland (PSW)
- Potential Reference Wetland
- Other Wetland
- Lake
- Watercourse
- Highway
- Local Road
- Municipal Boundary
- South Bruce Boundary

Only PSWs located within the extent of the BIS study areas were labelled. The colour of the outline surrounding PSWs matches the colour of the respective PSW label.

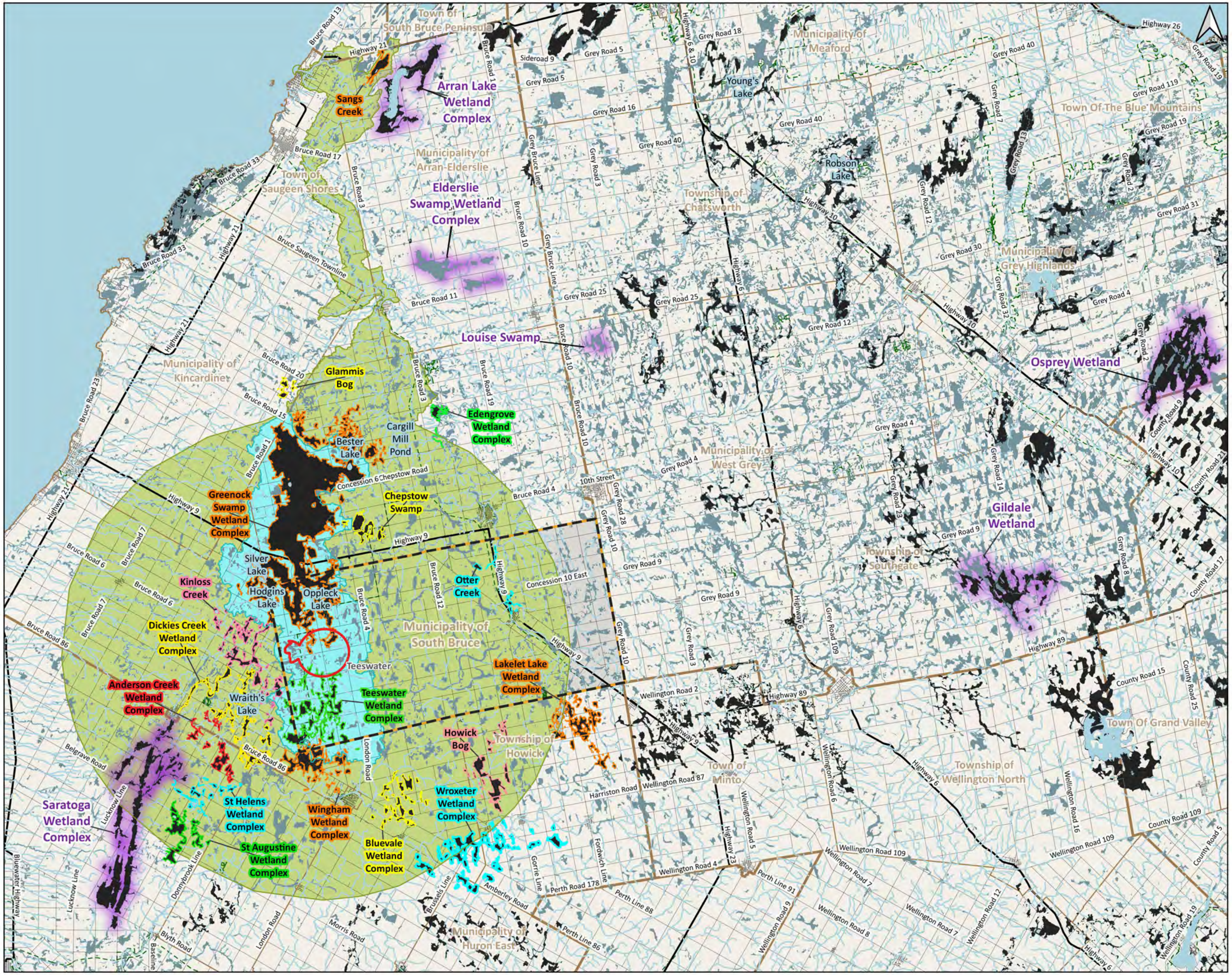
1:130,000

0 2 4 km

Data received from:
Ontario GeoHub — OHN Waterbody (MNRF); OHN Watercourse (MNRF); MNRF Road Segments (MNRF); Municipal Boundary - Lower and Single Tier (MMAH); Wetlands (MNRF)
NWMO — AOI; Trail Segments (MNRF)

Project CRS: NAD83 / UTM zone 17N

Author: AH	Reviewed by: RC	Approved by: HB
December 12, 2023	Map ID: NWMO_BIS_A033a	



NWMO Biodiversity Impact Studies

Provincially Significant Wetlands and Potential Reference Wetlands - RSA$_{ECO}$

Figure D-2b

- Area of Interest (AOI)
- Local Study Area (LSA$_{ECO}$)
- Regional Study Area (RSA$_{ECO}$)
- Provincially Significant Wetland (PSW)
- Potential Reference Wetland
- Other Wetland
- Lake
- Watercourse
- Highway
- Local Road
- Municipal Boundary
- South Bruce Boundary

Only PSWs located within the extent of the BIS study areas were labelled. The colour of the outline surrounding PSWs matches the colour of the respective PSW label.

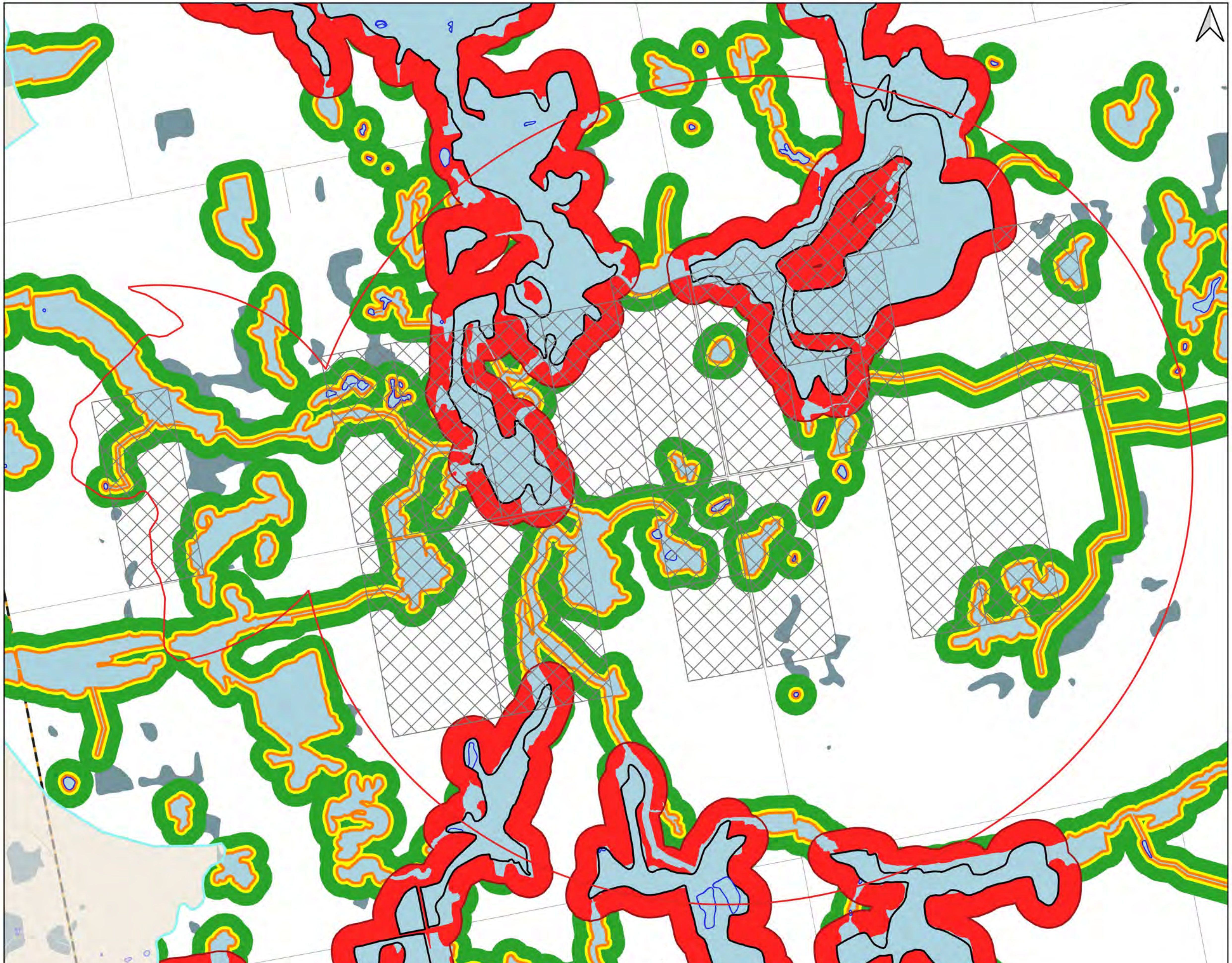
1:350,000

0 6 12 km

Data received from:
Ontario GeoHub — OHN Waterbody (MNRF); OHN Watercourse (MNRF); MNRF Road Segments (MNRF); Municipal Boundary - Lower and Single Tier (MMAH); Wetlands (MNRF)
NWMO — AOI; Trail Segments (MNRF)

Project CRS: NAD83 / UTM zone 17N

Author: AH	Reviewed by: RC	Approved by: HB
December 12, 2023	Map ID: NWMO_BIS_A033b	



NWMO Biodiversity Impact Studies

Riparian Buffers - AOI

Figure D-3a

- Area of Interest (AOI)
- Local Study Area (LSA_{ECO})
- NWMO Purchased or Optioned Land
- South Bruce Boundary
- Municipal Boundary
- Local Road
- Water Feature (Wetland, Lake, or Watercourse)
- Wetlands Outside LSA_{ECO}
- Lake Shoreline
- Provincially Significant Wetland (PSW) Boundary

Riparian Buffers

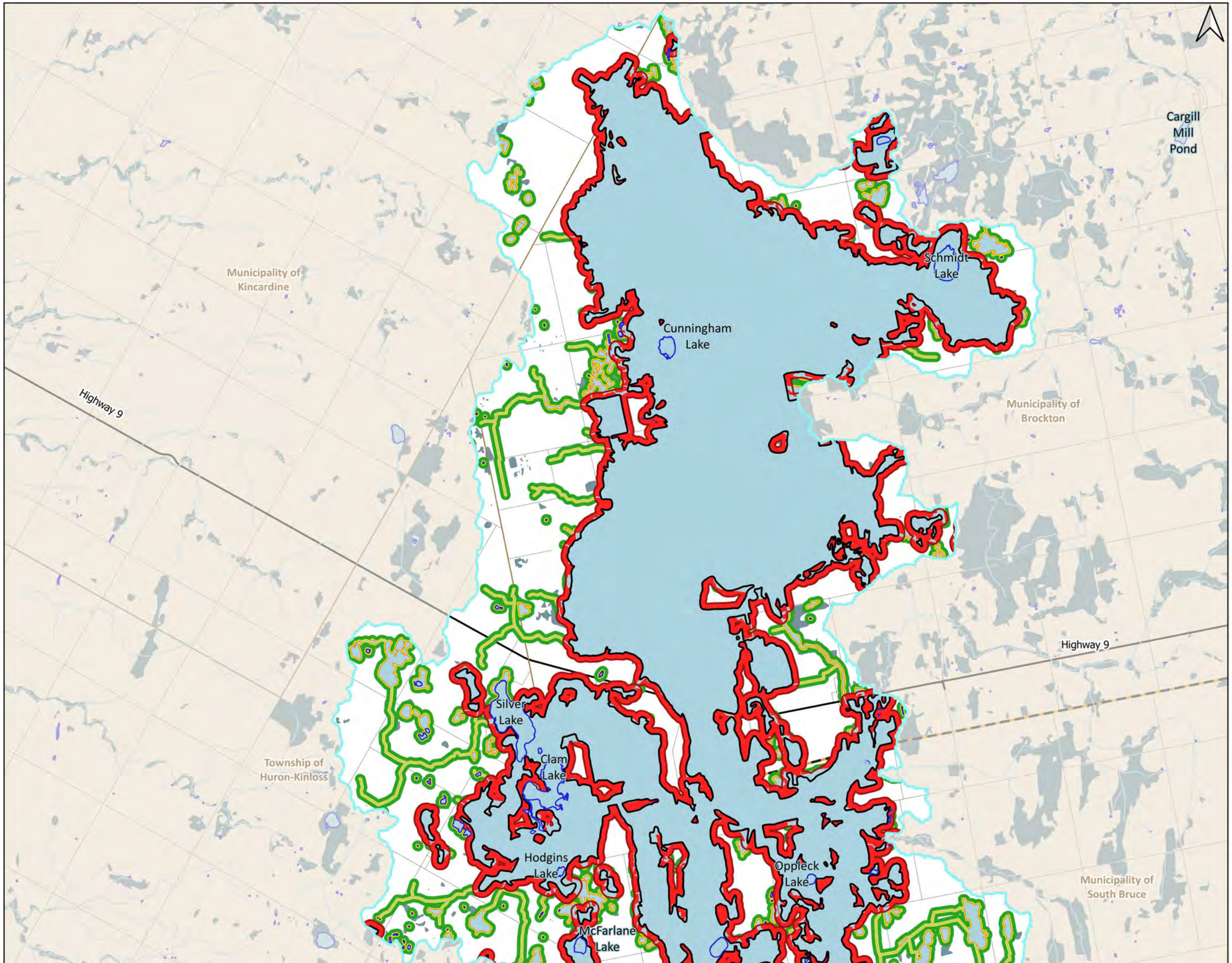
- 15m
- 30m
- 100m
- 120m (PSW Only)

1:75,000

0 0.5 1 km

Data received from:
Ontario GeoHub — OHN Waterbody (NDMNRF); OHN Watercourse (NDMNRF); ORN Road Segment (NDMNRF); Municipal Boundary - Lower and Upper Tier (MMAH); Wetlands (MNRF)
NWMO — AOI; NWMO Purchased or Optioned Land
Ecosite data were created for the BIS Project. Wetlands and water features are mapped using ecosite data within the LSA_{ECO} and data available from Ontario GeoHub outside the LSA_{ECO}.

Project CRS: NAD83 / UTM zone 17N		
Author: DM	Reviewed by: RC	Approved by: HB
December 12, 2023	Map ID: NWMO_BIS_D183a	



NWMO Biodiversity Impact Studies

Riparian Buffers - North LSA_{ECO}

Figure D-3b

- Local Study Area (LSA_{ECO})
- South Bruce Boundary
- Municipal Boundary
- Local Road
- Water Feature (Wetland, Lake, or Watercourse)
- Wetlands Outside LSA_{ECO}
- Lake Shoreline
- Provincially Significant Wetland (PSW) Boundary

Riparian Buffers

- 15m
- 30m
- 100m
- 120m (PSW Only)

1:75,000

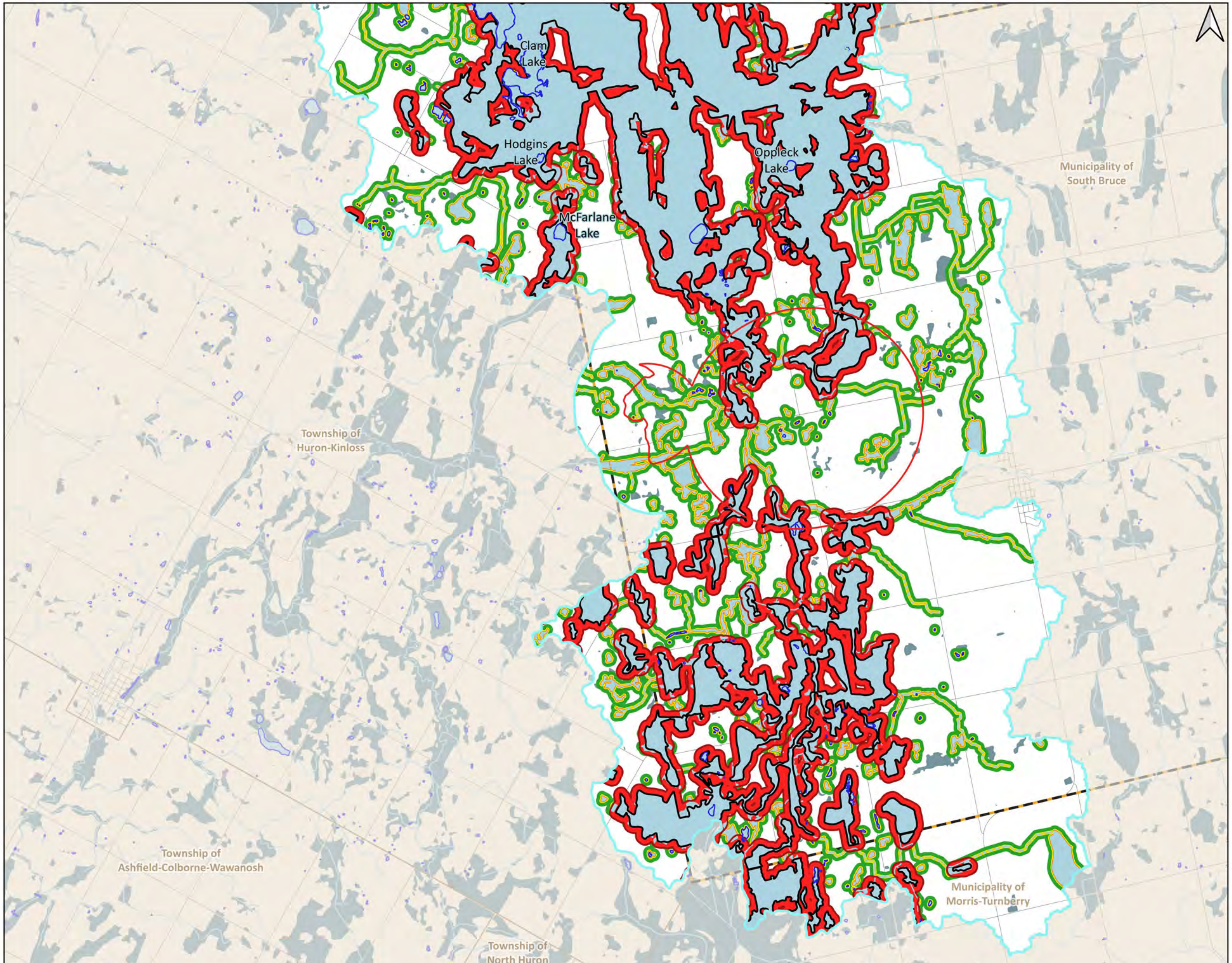
0 1 2 km

ZOETICA

Data received from:
Ontario GeoHub — OHN Waterbody (NDMNRF); OHN Watercourse (NDMNRF); ORN Road Segment (NDMNRF); Municipal Boundary - Lower and Upper Tier (MMAH); Wetlands (MNRF)
NWMO — AOI; NWMO Purchased or Optioned Land
Ecosite data were created for the BIS Project. Wetlands and water features are mapped using ecosite data within the LSA_{ECO} and data available from Ontario GeoHub outside the LSA_{ECO}.

Project CRS: NAD83 / UTM zone 17N

Author: DM	Reviewed by: RC	Approved by: HB
December 12, 2023	Map ID: NWMO_BIS_D183b	



NWMO Biodiversity Impact Studies

Riparian Buffers - South LSA_{ECO}

Figure D-3c

- Area of Interest (AOI)
- Local Study Area (LSA_{ECO})
- South Bruce Boundary
- Municipal Boundary
- Local Road
- Water Feature (Wetland, Lake, or Watercourse)
- Wetlands Outside LSA_{ECO}
- Lake Shoreline
- Provincially Significant Wetland (PSW) Boundary

Riparian Buffers

- 15m
- 30m
- 100m
- 120m (PSW Only)

1:75,000

0 1 2 km

ZOETICA

Data received from:
Ontario GeoHub — OHN Waterbody (NDMNRF); OHN Watercourse (NDMNRF); ORN Road Segment (NDMNRF); Municipal Boundary - Lower and Upper Tier (MMAH); Wetlands (MNRF)
NWMO — AOI; NWMO Purchased or Optioned Land
Ecosite data were created for the BIS Project. Wetlands and water features are mapped using ecosite data within the LSA_{ECO} and data available from Ontario GeoHub outside the LSA_{ECO}.

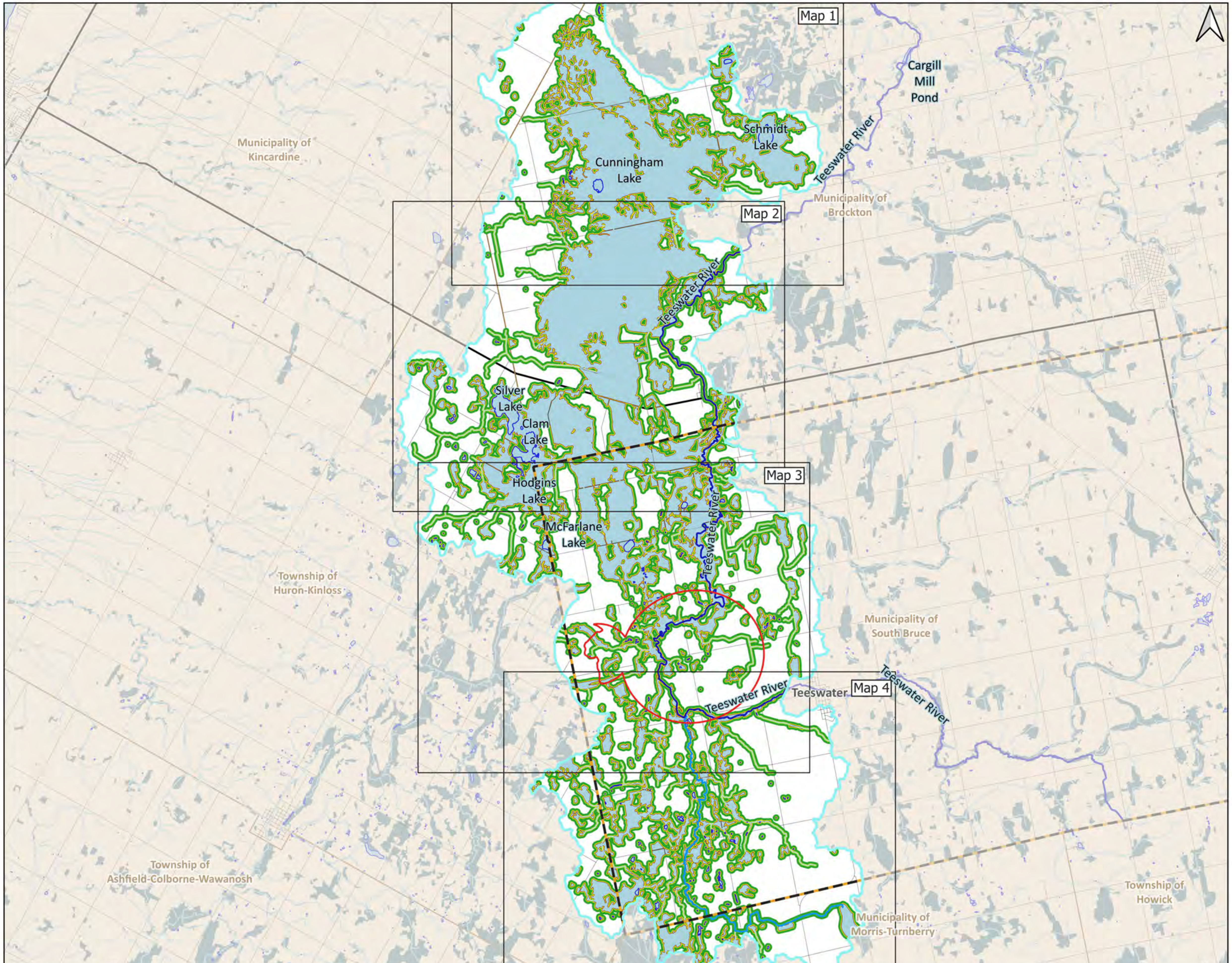
Project CRS: NAD83 / UTM zone 17N

Author: DM	Reviewed by: RC	Approved by: HB
December 12, 2023	Map ID: NWMO_BIS_D183c	

NWMO Biodiversity Impact Studies

Ecosites within Riparian Buffers - Overview Map

Figure D-4a



- Area of Interest (AOI)
- Local Study Area (LSA_{ECO})
- South Bruce Boundary
- Municipal Boundary
- Highway
- Local Road
- Teeswater River
- Alps Creek
- Other Watercourse
- Lake Shoreline
- Water Feature (Wetland, Lake, or Watercourse)
- 15m Riparian Buffer
- 30m Riparian Buffer
- 100m Riparian Buffer

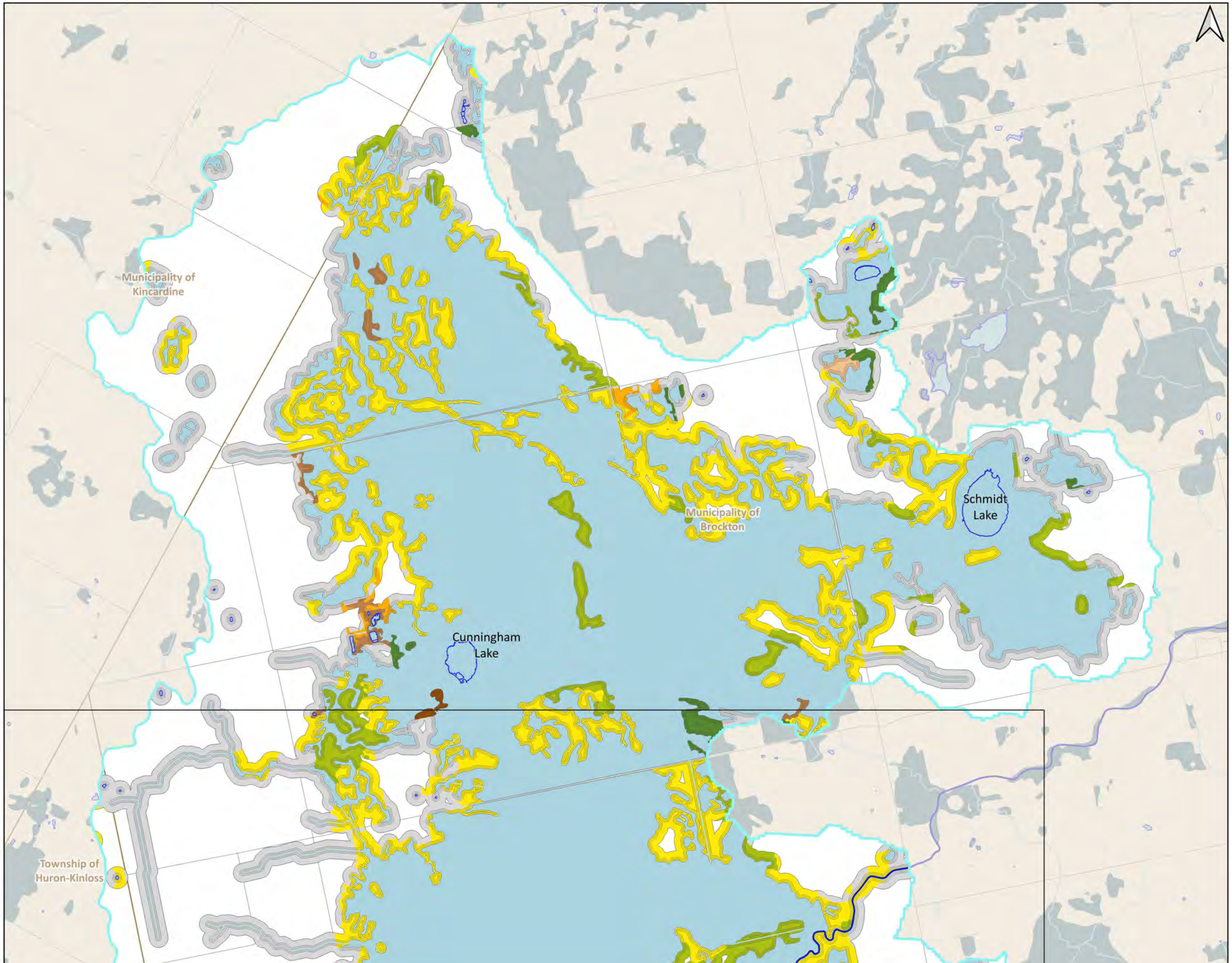
1:125,000

0 2 4 km

Data received from:
Ontario GeoHub — Municipal Boundary - Lower and Upper Tiers (MMAH); OHN Waterbody (MNRF); OHN Watercourse (MNRF); ORN Road Element (MNRF)
NWMO — AOI; NWMO Purchased or Optioned Land; TerraNet Parcels
Wetlands and water features are mapped using ecosite data within the LSA_{ECO} and data available from Ontario GeoHub outside the LSA_{ECO}.

Project CRS: NAD83 / UTM zone 17N

Author: DM	Reviewed by: RC	Approved by: HB
December 12, 2023	Map ID: NWMO_BIS_D190	



NWMO Biodiversity Impact Studies

Ecosites within Riparian Buffers - Map 1

Figure D-4b

- Local Study Area (LSA_{ECO})
- Municipal Boundary
- Local Road
- 15m, 30m, and 100m Buffers
- Teeswater River
- Other Watercourse
- Water Features
- Lake Shoreline
- Wetlands Outside LSA_{ECO}

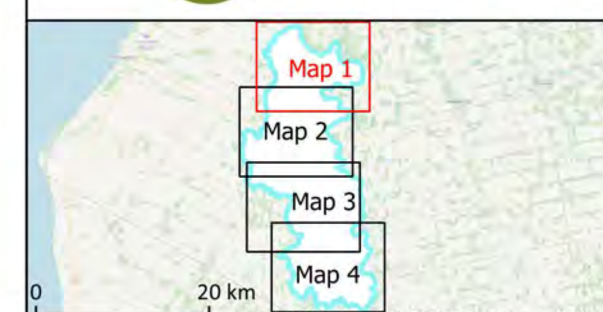
Ecosite Group

- Conifer
- Mixedwood
- Hardwood
- Plantation
- Shrub
- Meadow
- Field
- *Unmapped*

Grey areas within the buffers represent areas that do not have ecosite mapping completed.

1:40,000

0 500 1,000 m



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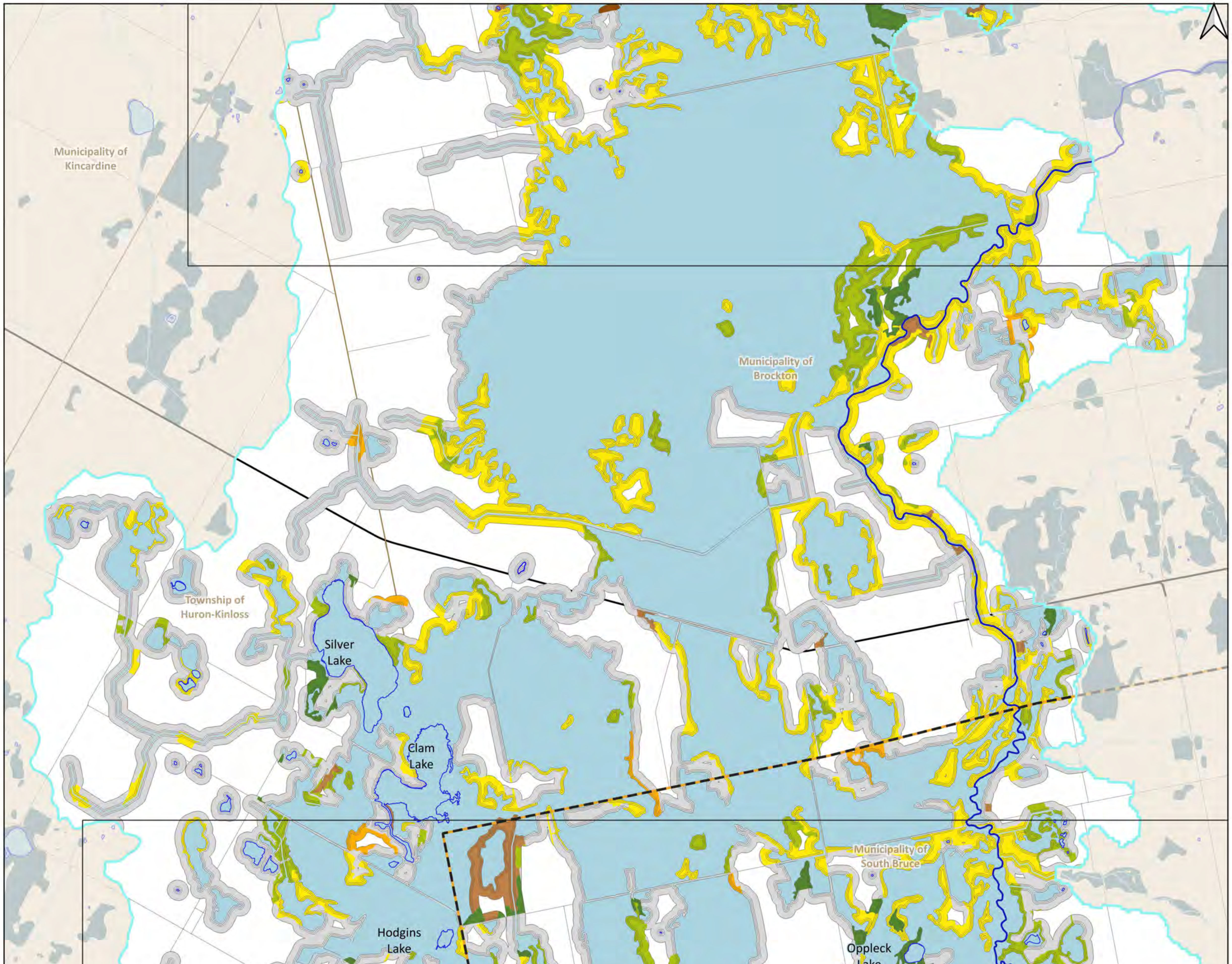
Data received from:
Ontario GeoHub — Municipal Boundary - Lower and Upper Tiers (MMAH); OHN Waterbody (MNRF); OHN Watercourse (MNRF); ORN Road Element (MNRF)
NWMO — AOI; NWMO Purchased or Optioned Land; TerraNet Parcels
Wetlands and water features are mapped using ecosite data within the LSA_{ECO} and data available from Ontario GeoHub outside the LSA_{ECO}.

Project CRS: NAD83 / UTM zone 17N		
Author: DM	Reviewed by: RC	Approved by: HB
December 12, 2023	Map ID: NWMO_BIS_D190	



NWMO Biodiversity Impact Studies

Ecosites within Riparian Buffers - Map 2

Figure D-4c

- Local Study Area (LSA_{ECO})
- Municipal Boundary
- South Bruce Boundary
- Highway
- Local Road
- 15m, 30m, and 100m Buffers
- Teeswater River
- Other Watercourse
- Water Features
- Lake Shoreline
- Wetlands Outside LSA_{ECO}

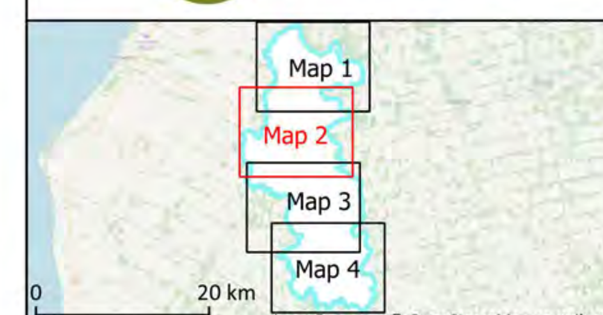
Ecosite Group

- Conifer
- Mixedwood
- Hardwood
- Plantation
- Shrub
- Meadow
- Field
- *Unmapped*

Grey areas within the buffers represent areas that do not have ecosite mapping completed.

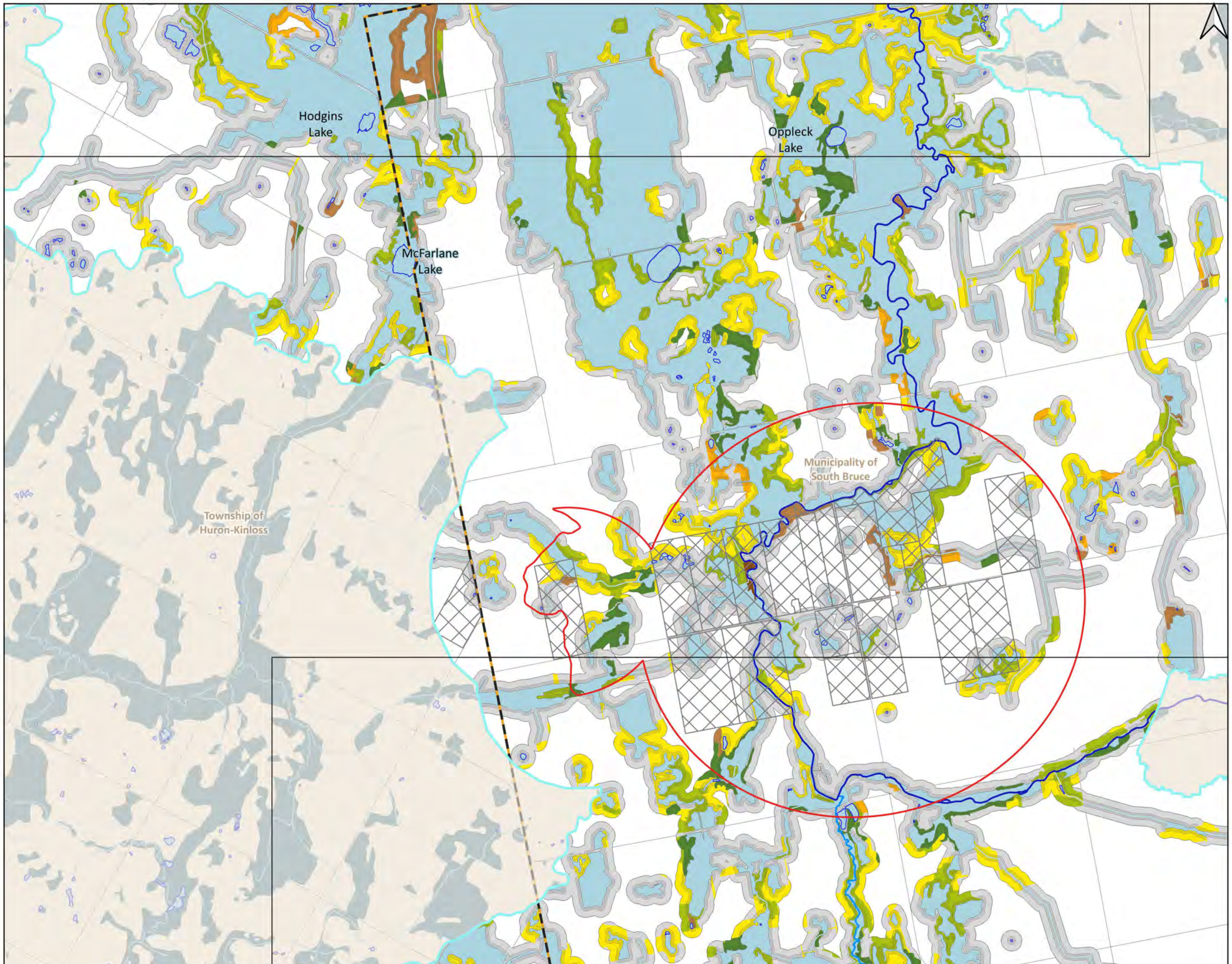
1:40,000
0 500 1,000 m

ZOETICA



Data received from:
Ontario GeoHub — Municipal Boundary - Lower and Upper Tiers (MMAH); OHN Waterbody (MNRF); OHN Watercourse (MNRF); ORN Road Element (MNRF)
NWMO — AOI; NWMO Purchased or Optioned Land; TerraNet Parcels
Wetlands and water features are mapped using ecosite data within the LSA_{ECO} and data available from Ontario GeoHub outside the LSA_{ECO}.

Project CRS: NAD83 / UTM zone 17N		
Author: DM	Reviewed by: RC	Approved by: HB
December 12, 2023	Map ID: NWMO_BIS_D190	



NWMO Biodiversity Impact Studies

Ecosites within Riparian Buffers - Map 3

Figure D-4d

- Area of Interest (AOI)
- Local Study Area (LSA_{ECO})
- NWMO Purchased or Optioned Land
- Municipal Boundary
- South Bruce Boundary
- Local Road
- 15m, 30m, and 100m Buffers
- Teeswater River
- Alps Creek
- Other Watercourse
- Water Features
- Lake Shoreline
- Wetlands Outside LSA_{ECO}

Ecosite Group

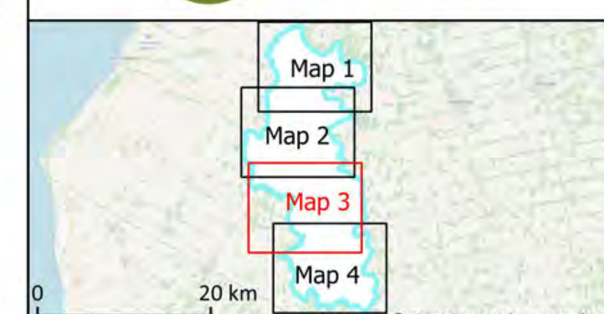
- Conifer
- Mixedwood
- Hardwood
- Plantation
- Shrub
- Meadow
- Field
- *Unmapped*

Grey areas within the buffers represent areas that do not have ecosite mapping completed.

1:40,000

0 500 1,000 m

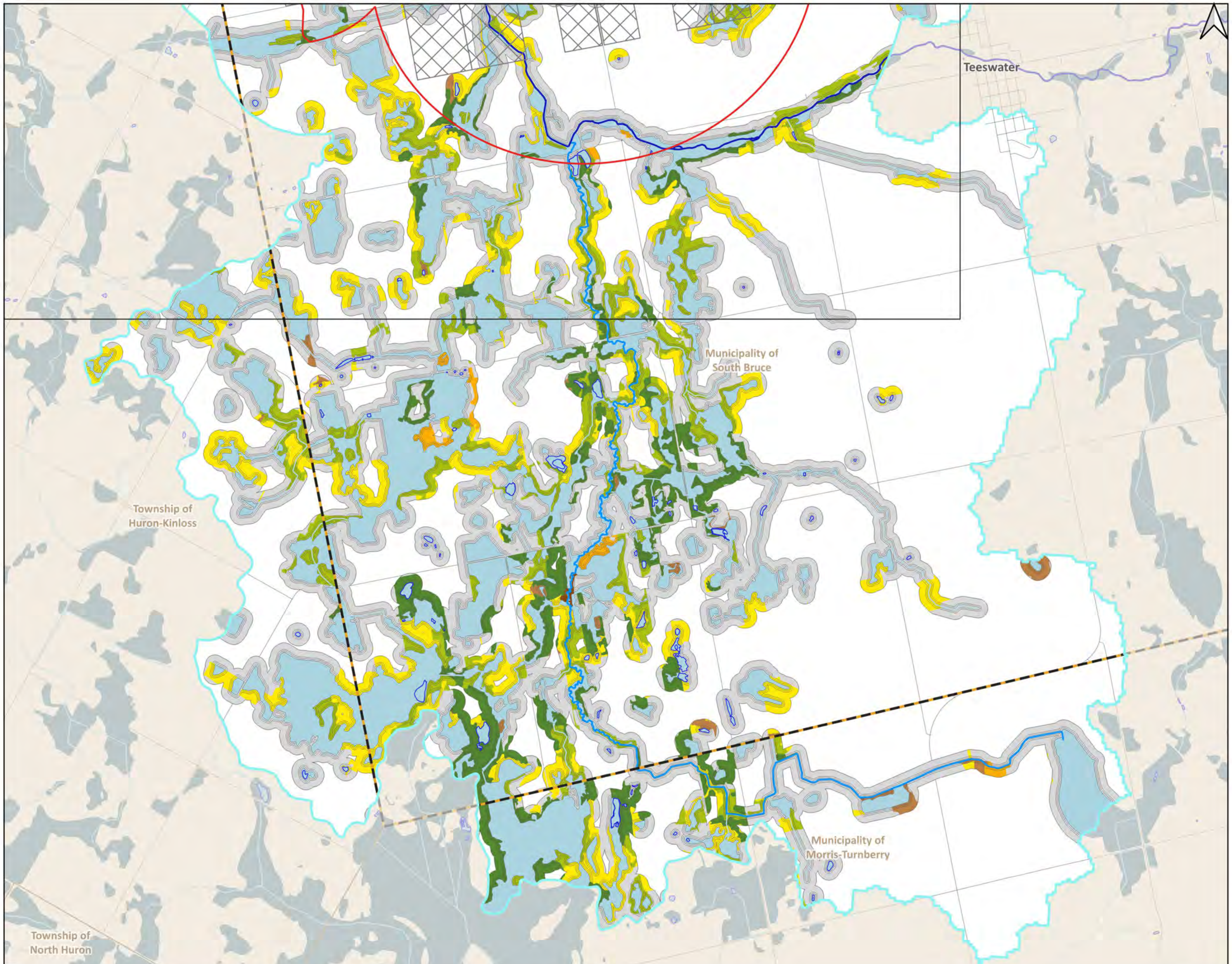
ZOETICA



Data received from:
Ontario GeoHub — Municipal Boundary - Lower and Upper Tiers (MMAH); OHN Waterbody (MNRF); OHN Watercourse (MNRF); ORN Road Element (MNRF)
NWMO — AOI; NWMO Purchased or Optioned Land; TerraNet Parcels
Wetlands and water features are mapped using ecosite data within the LSA_{ECO} and data available from Ontario GeoHub outside the LSA_{ECO}.

Project CRS: NAD83 / UTM zone 17N

Author: DM	Reviewed by: RC	Approved by: HB
December 12, 2023	Map ID: NWMO_BIS_D190	



NWMO Biodiversity Impact Studies

Ecosites within Riparian Buffers - Map 4

Figure D-4e

- Area of Interest (AOI)
- Local Study Area (LSA_{ECO})
- NWMO Purchased or Optioned Land
- Municipal Boundary
- South Bruce Boundary
- Local Road
- 15m, 30m, and 100m Buffers
- Teeswater River
- Alps Creek
- Other Watercourse
- Water Features
- Lake Shoreline
- Wetlands Outside LSA_{ECO}

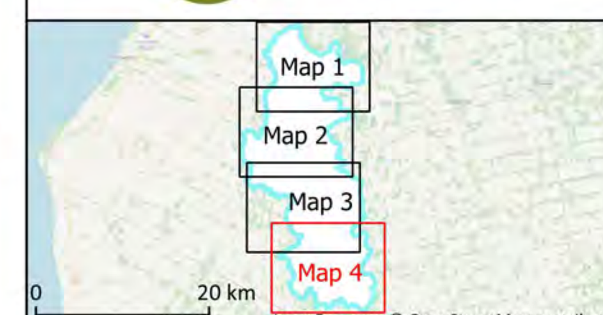
Ecosite Group

- Conifer
- Mixedwood
- Hardwood
- Plantation
- Shrub
- Meadow
- Field
- *Unmapped*

Grey areas within the buffers represent areas that do not have ecosite mapping completed.

1:40,000

0 500 1,000 m

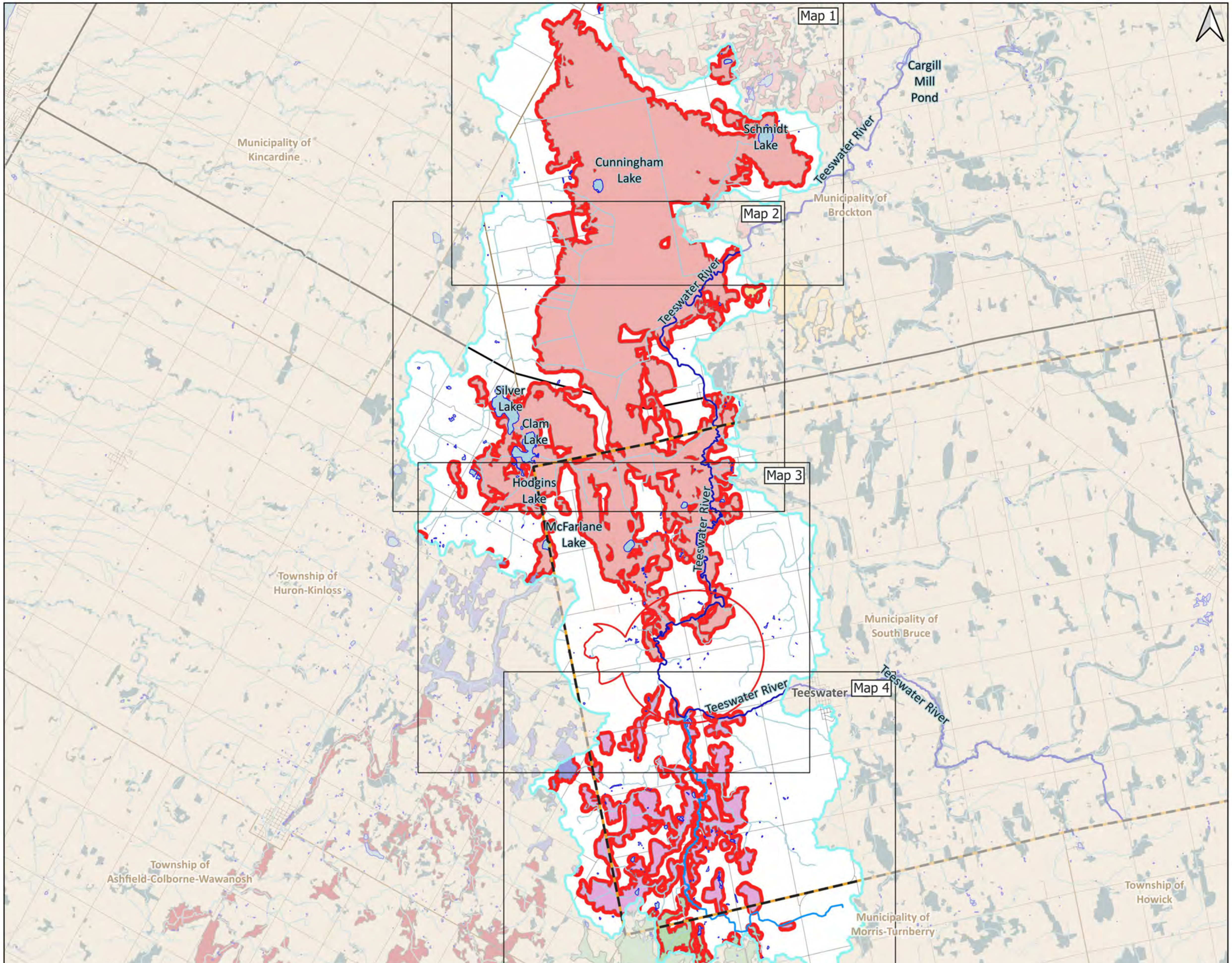


Data received from:
Ontario GeoHub — Municipal Boundary - Lower and Upper Tiers (MMAH); OHN Waterbody (MNRF); OHN Watercourse (MNRF); ORN Road Element (MNRF)
NWMO — AOI; NWMO Purchased or Optioned Land; TerraNet Parcels
Wetlands and water features are mapped using ecosite data within the LSA_{ECO} and data available from Ontario GeoHub outside the LSA_{ECO}.

Project CRS: NAD83 / UTM zone 17N

Author: DM	Reviewed by: RC	Approved by: HB

December 12, 2023	Map ID: NWMO_BIS_D190



NWMO Biodiversity Impact Studies

Ecosites within PSW Buffers - Overview Map

Figure D-5a

- Area of Interest (AOI)
- Local Study Area (LSA_{ECO})
- South Bruce Boundary
- Municipal Boundary
- Highway
- Local Road
- Watercourse
- Teeswater River
- Alps Creek
- Lake
- 0-120m Buffer
- Wetlands Outside LSA_{ECO}

Provincially Significant Wetland (PSW)

- Chepstow Swamp
- Greenock Swamp Wetland Complex
- Kinloss Creek
- Teeswater Wetland Complex
- Wingham Wetland Complex
- Other PSWs

1:125,000

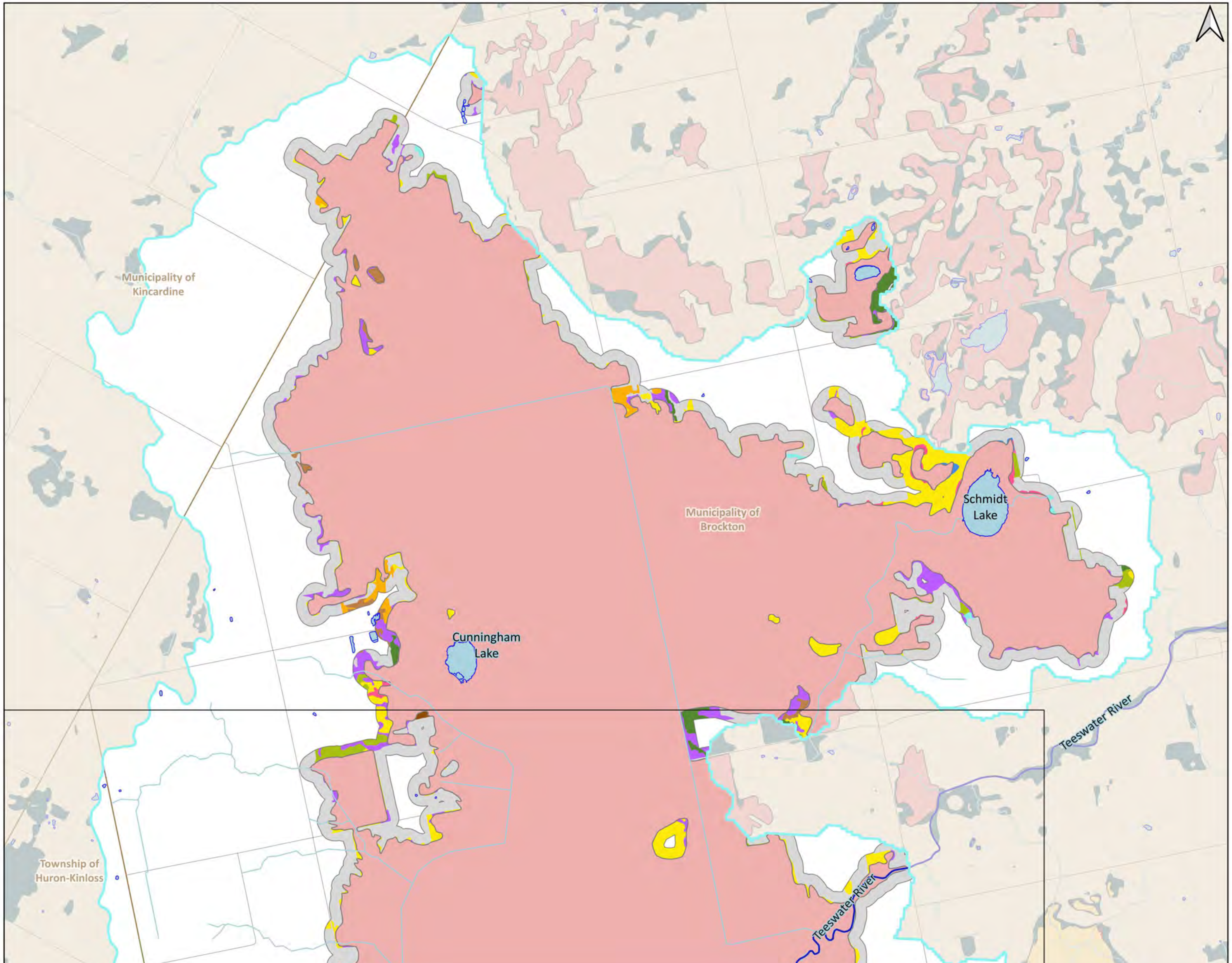
0 2 4 km

Inset Basemap © OpenStreetMap contributors

Data received from:
Ontario GeoHub — Municipal Boundary - Lower and Upper Tiers (MMAH); OHN Waterbody (MNRF); OHN Watercourse (MNRF); ORN Road Element (MNRF)
NWMO — AOI; NWMO Purchased or Optioned Land; TerraNet Parcels
Wetlands and water features are mapped using ecosite data within the LSA_{ECO} and data available from Ontario GeoHub outside the LSA_{ECO}.

Project CRS: NAD83 / UTM zone 17N

Author: DM	Reviewed by: RC	Approved by: HB
December 12, 2023	Map ID: NWMO_BIS_D190	



NWMO Biodiversity Impact Studies

Ecosites within PSW Buffers - Map 1

Figure D-5b

- Local Study Area (LSA_{ECO})
- Municipal Boundary
- Local Road
- Teeswater River
- Other Watercourse
- Lake
- 0-120m Buffer
- Wetlands Outside LSA_{ECO}

Provincially Significant Wetland (PSW)

- Chepstow Swamp
- Greenock Swamp Wetland Complex

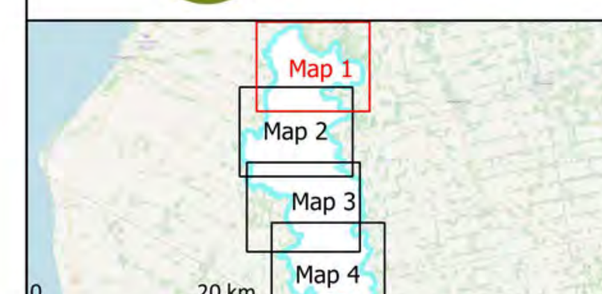
Ecosite Group

- Conifer
- Mixedwood
- Hardwood
- Plantation
- Conifer Swamp
- Mixedwood Swamp
- Hardwood Swamp
- Shrub Swamp
- Marsh
- Fen
- Shrub
- Meadow
- Field
- *Unmapped*

Grey areas within the buffer represent areas that do not have ecosite mapping completed.

1:40,000

0 500 1,000 m



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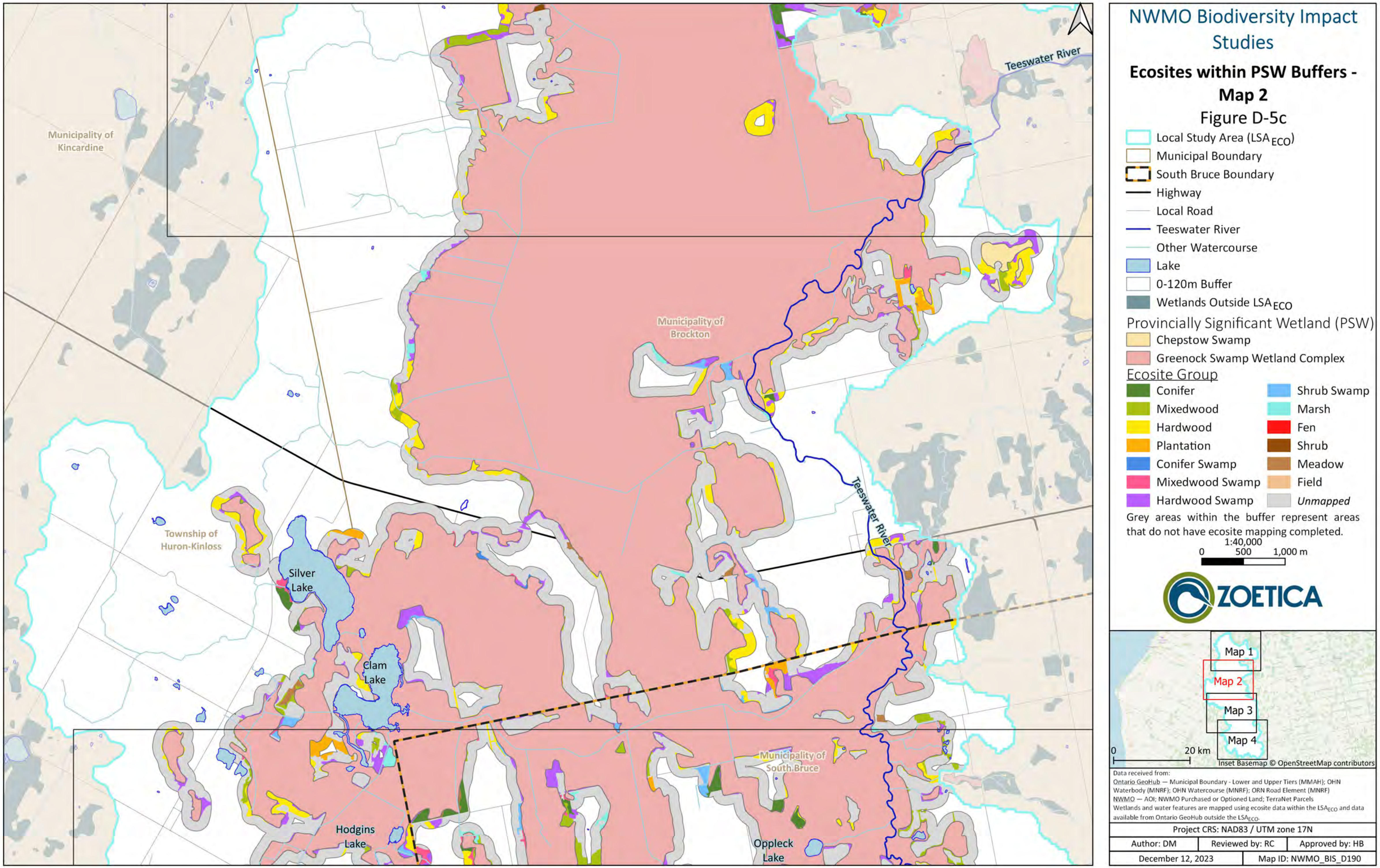
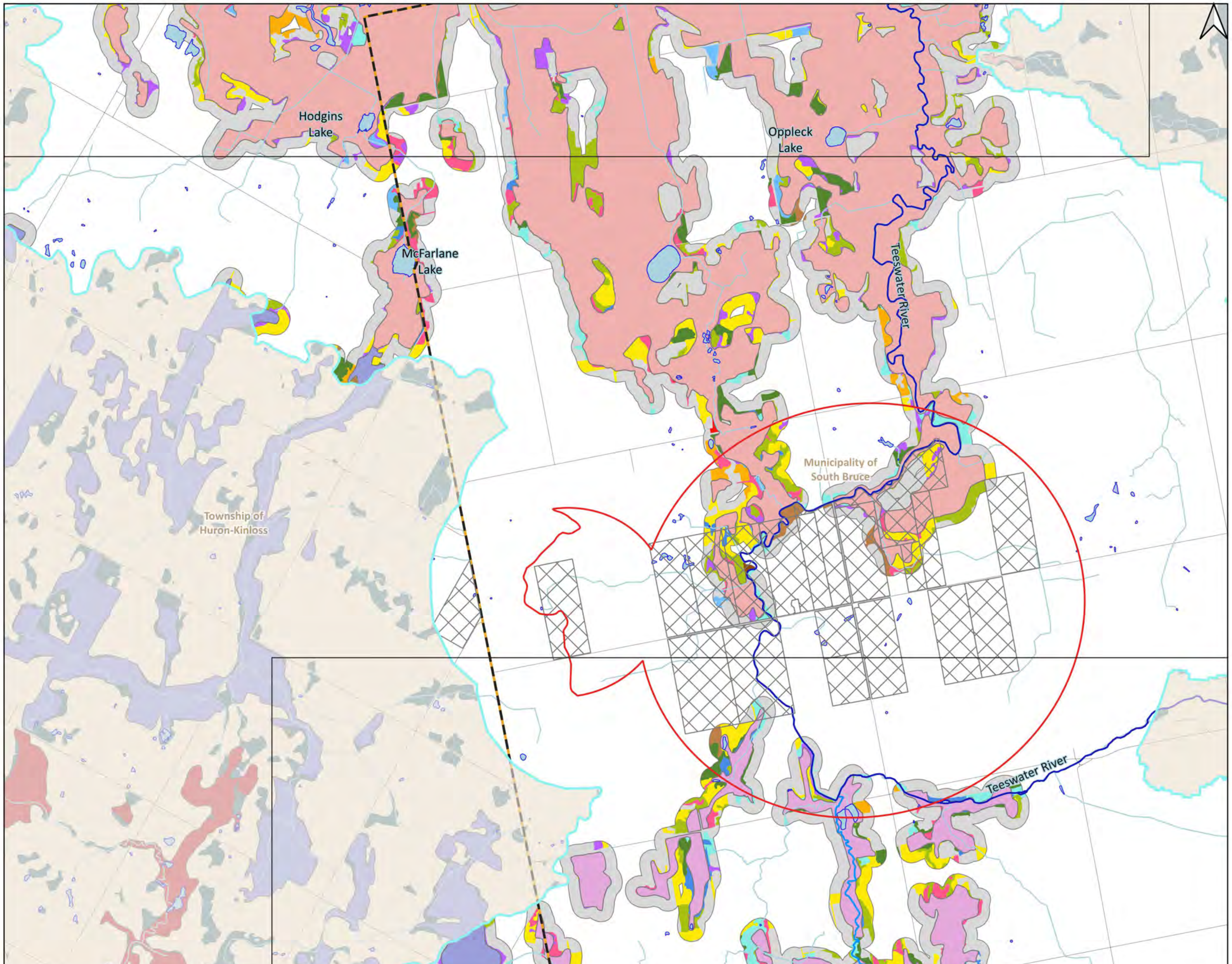
Data received from:
Ontario GeoHub — Municipal Boundary - Lower and Upper Tiers (MMAH); OHN Waterbody (MNRF); OHN Watercourse (MNRF); ORN Road Element (MNRF)
NWMO — AOI; NWMO Purchased or Optioned Land; TerraNet Parcels
Wetlands and water features are mapped using ecosite data within the LSA_{ECO} and data available from Ontario GeoHub outside the LSA_{ECO}.

Project CRS: NAD83 / UTM zone 17N		
Author: DM	Reviewed by: RC	Approved by: HB
December 12, 2023	Map ID: NWMO_BIS_D190	



NWMO Biodiversity Impact Studies
Ecosites within PSW Buffers - Map 2
Figure D-5c
Local Study Area (LSA ECO)
Municipal Boundary
South Bruce Boundary
Highway
Local Road
Teeswater River
Other Watercourse
Lake
0-120m Buffer
Wetlands Outside LSA ECO
Provincially Significant Wetland (PSW)
Chepstow Swamp
Greenock Swamp Wetland Complex
Ecosite Group
Conifer
Mixedwood
Hardwood
Plantation
Conifer Swamp
Mixedwood Swamp
Hardwood Swamp
Shrub Swamp
Marsh
Fen
Shrub
Meadow
Field
Unmapped
Grey areas within the buffer represent areas that do not have ecosite mapping completed.
1:40,000
0 500 1,000 m
ZOETICA
Map 1
Map 2
Map 3
Map 4
0 20 km
Inset Basemap © OpenStreetMap contributors
Data received from:
Ontario GeoHub — Municipal Boundary - Lower and Upper Tiers (MMAH); OHN Waterbody (MNRF); OHN Watercourse (MNRF); ORN Road Element (MNRF)
NWMO — AOI; NWMO Purchased or Optioned Land; TerraNet Parcels
Wetlands and water features are mapped using ecosite data within the LSA ECO and data available from Ontario GeoHub outside the LSA ECO.
Project CRS: NAD83 / UTM zone 17N
Author: DM
Reviewed by: RC
Approved by: HB
December 12, 2023
Map ID: NWMO_BIS_D190
Teeswater River
Municipality of Kincardine
Municipality of Brockton
Township of Huron-Kinloss
Silver Lake
Clam Lake
Hodgins Lake
Oppleck Lake
Municipality of South Bruce



NWMO Biodiversity Impact Studies

Ecosites within PSW Buffers - Map 3

Figure D-5d

- Area of Interest (AOI)
- Local Study Area (LSA_{ECO})
- Municipal Boundary
- South Bruce Boundary
- NWMO Purchased or Optioned Land
- Local Road
- Teeswater River
- Alps Creek
- Other Watercourse
- Lake
- 0-120m Buffer
- Wetlands Outside LSA_{ECO}

Provincially Significant Wetland (PSW)

- Greenock Swamp Wetland Complex
- Kinloss Creek
- Teeswater Wetland Complex
- Other PSWs

Ecosite Group

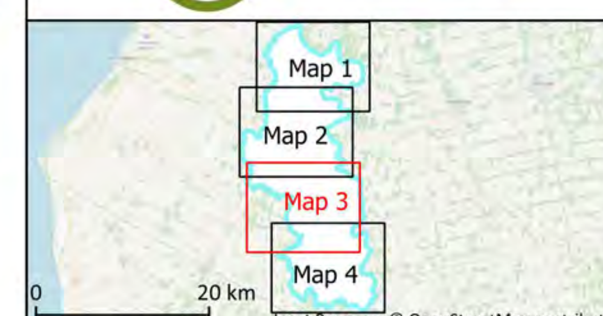
- Conifer
- Mixedwood
- Hardwood
- Plantation
- Conifer Swamp
- Mixedwood Swamp
- Hardwood Swamp
- Shrub Swamp
- Marsh
- Fen
- Shrub
- Meadow
- Field
- *Unmapped*

Grey areas within the buffer represent areas that do not have ecosite mapping completed.

1:40,000

0 500 1,000 m

ZOETICA



Data received from:
Ontario GeoHub — Municipal Boundary - Lower and Upper Tiers (MMAH); OHN Waterbody (MNRF); OHN Watercourse (MNRF); ORN Road Element (MNRF)
NWMO — AOI; NWMO Purchased or Optioned Land; TerraNet Parcels
Wetlands and water features are mapped using ecosite data within the LSA_{ECO} and data available from Ontario GeoHub outside the LSA_{ECO}.

Project CRS: NAD83 / UTM zone 17N		
Author: DM	Reviewed by: RC	Approved by: HB
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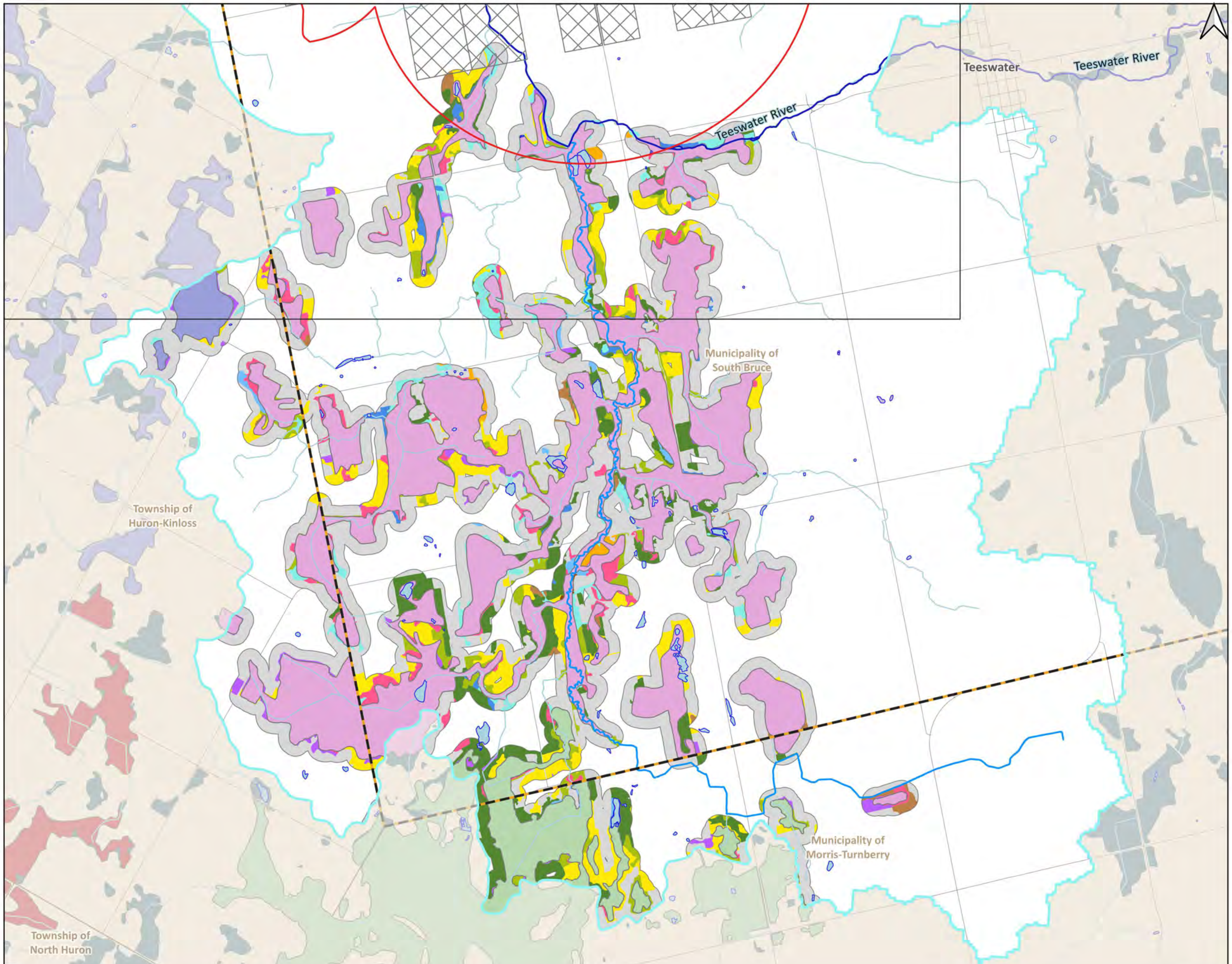


NWMO Biodiversity Impact Studies

Ecosites within PSW Buffers - Map 4

Figure D-5e

Area of Interest (AOI)
Local Study Area (LSA_{ECO})
Municipal Boundary
South Bruce Boundary
NWMO Purchased or Optioned Land
Local Road
Teeswater River
Alps Creek
Other Watercourse
Lake
0-120m Buffer
Wetlands Outside LSA_{ECO}

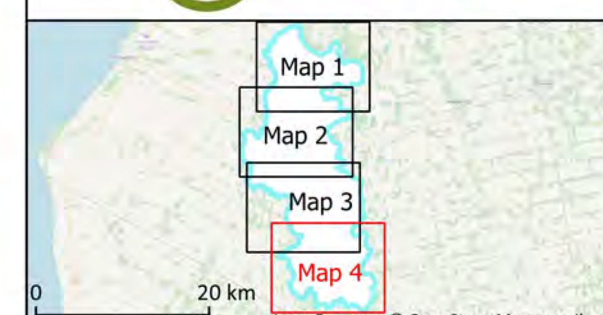
Provincially Significant Wetland (PSW)
Kinloss Creek
Teeswater Wetland Complex
Wingham Wetland Complex
Other PSWs

Ecosite Group
Conifer
Mixedwood
Hardwood
Plantation
Conifer Swamp
Mixedwood Swamp
Hardwood Swamp
Shrub Swamp
Marsh
Fen
Shrub
Meadow
Field
Unmapped

Grey areas within the buffer represent areas that do not have ecosite mapping completed.

1:40,000
0 500 1,000 m

ZOETICA

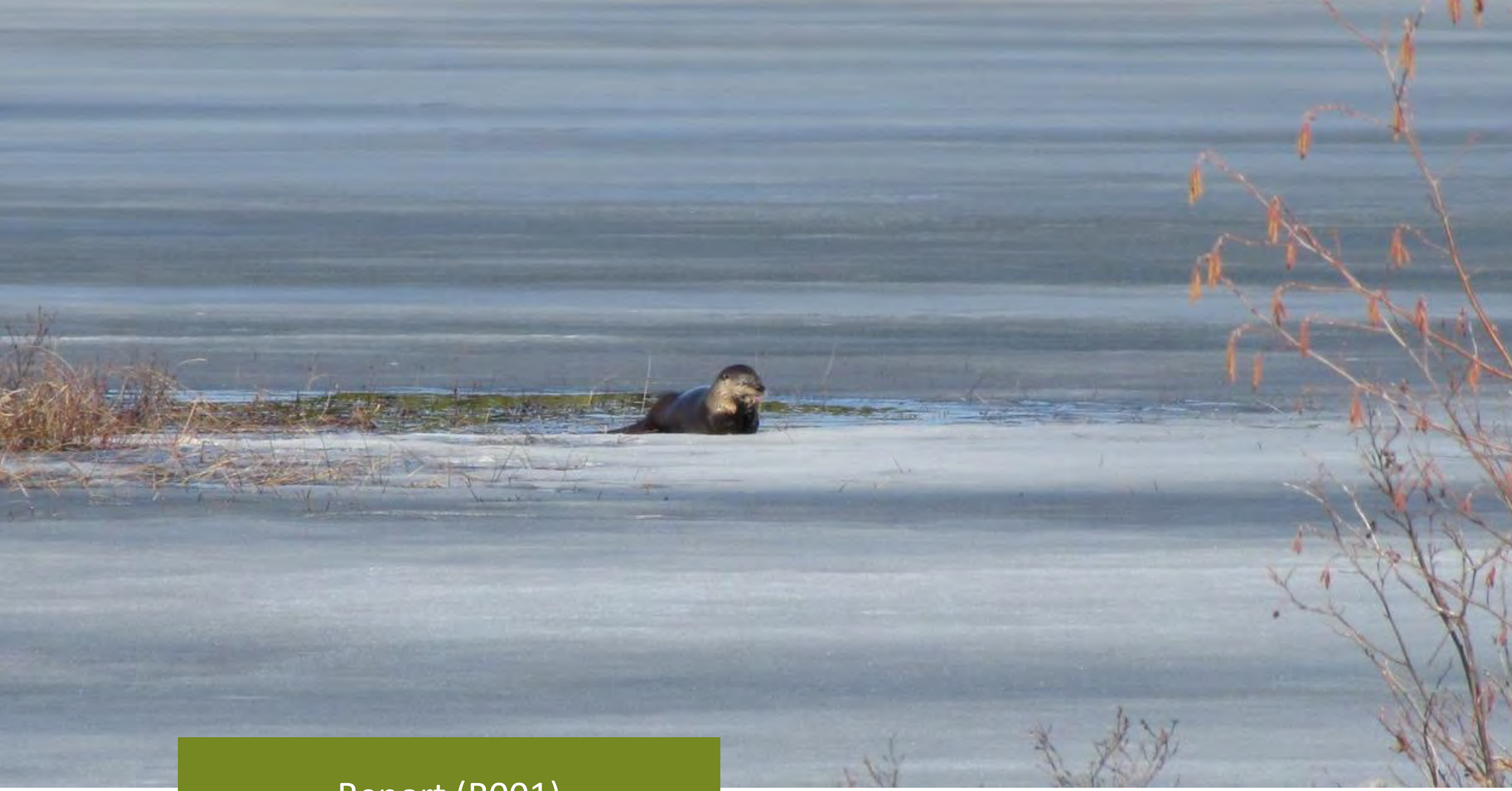


Data received from:
Ontario GeoHub — Municipal Boundary - Lower and Upper Tiers (MMAH); OHN Waterbody (MNRF); OHN Watercourse (MNRF); ORN Road Element (MNRF)
NWMO — AOI; NWMO Purchased or Optioned Land; TerraNet Parcels
Wetlands and water features are mapped using ecosite data within the LSA_{ECO} and data available from Ontario GeoHub outside the LSA_{ECO}.

Project CRS: NAD83 / UTM zone 17N

Author: DM | Reviewed by: RC | Approved by: HB

December 12, 2023 | Map ID: NWMO_BIS_D190



Report (R001)

BIODIVERSITY IMPACT STUDIES – SOUTHWESTERN ONTARIO REGION: 2023 BASELINE REPORT (CHAPTER 4: MAMMALS)

December 13, 2023

PREPARED BY Zoetica Environmental Consulting Services

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GLOSSARY AND ABBREVIATIONS

Adaptive management	Adaptive management is defined consistent with the CNSC's definition of adaptive management (REGDOC-3.6): A planned and systematic process for continuously improving management practices [primarily environmental] by learning from their outcomes. [For an environmental assessment (EA),] it involves, among other things, the implementation of new or modified mitigation measures over the life of the project to address unanticipated environmental effects. Note: The need to implement adaptive management measures may be determined through an effective follow-up program.
AOI	Area of Interest
AHM	Aquatic Habitat Mapping
BIS	Biodiversity Impact Studies
BPD	Biodiversity Impact Studies – Southwestern Ontario Region: Baseline Program Design
BPPA	Biodiversity Impact Studies – Southwestern Ontario Region: Best Practices and Preferred Approach
BV	Biodiversity Value; The biotic environmental components that will be considered for study within the Project's Biodiversity Impact Studies. A subset of biodiversity values will ultimately be scoped into the Biodiversity Impact Assessment as Valued Components.
Carnivore	An organism that mostly eats meat, or the flesh of animals
CNSC	Canadian Nuclear Safety Commission
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
Critical habitat	Habitat that is necessary for the survival or recovery of a listed wildlife species and that is identified as the species' critical habitat in the recovery strategy or in an action plan for the species (*Species at Risk Act*, S.C. 2002, c. 29). Identification of critical habitat is not a required component of a recovery strategy under the Ontario *Endangered Species Act*. However, the approach used to identify critical habitat, in conjunction with the best scientific information available, is recommended when developing a habitat regulation. A habitat regulation is a legal instrument under the *ESA* that prescribes an area that will be protected as the habitat of the species.
ECCC	Environment and Climate Change Canada
Ecodistrict	Third highest level of the ELC hierarchy (Crins et al. 2009). Subdivisions of an ecoregion, primarily identified by patterns of relief, geology, geomorphology, and substrate parent material.
Ecoregion	Second highest level of the ELC hierarchy (Crins et al. 2009). Large geographic areas primarily identified by sub-continental climatic regimes and bedrock geology.
Ecosite	Second lowest level of the ELC hierarchy (Crins et al. 2009). The land within an ecosite will generally contain similar substrate and vegetation.
Ecosystem services	Ecosystem services are the direct and indirect benefits to human well-being that the natural environment provides through healthy ecosystems. Ecosystem services include provisioning services such as the production of food and water, regulating services, such as the control of climate and disease, supporting services, such as nutrient cycles and oxygen production, and cultural services, such as spiritual and recreational benefits.

ECS	Ecoregional Criterion Schedule
eDNA	Environmental DNA (Deoxyribonucleic Acid)
ELC	Ecological Land Classification
EMBP	Environmental Media Baseline Program
ESA	Ontario *Endangered Species Act*
GBIF	Global Biodiversity Information Facility
GSWC	Greenock Swamp Wetland Complex
IA	Impact Assessment
LSA	Local Study Area
MECP	Ministry of the Environment, Conservation and Parks
MNRF	Ontario Ministry of Natural Resources and Forestry (formerly Ministry of Northern Development, Mines, Natural Resources and Forestry [NDMNRF])
NBCP	Toronto Zoo's Native Bat Conservation Program
NDMNRF	See entry for "MNRF"
NHIC	Ontario Natural Heritage Information Centre
NWMO	Nuclear Waste Management Organization
Restricted Species	Restricted species are commercially exploited or sensitive to disturbance; these species could be harmed if data are not stored and shared securely.
Rights-holders	First Nation and Métis communities who have asserted and or hold recognized treaty and/or Indigenous rights and whose Traditional Territories include the Project location.
RSA	Regional Study Area
SAR	Species at Risk; For the purposes of the BIS, SAR include species listed under Schedule 1 of the federal *Species at Risk Act* (*SARA*), species designated as Species at Risk in Ontario (SARO) and listed under the provincial *Endangered Species Act, 2007* (*ESA*), and species assessed as Extirpated, Endangered, Threatened, or Special Concern by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC).
SARA	Federal *Species at Risk Act*
SARO	Species at Risk in Ontario
SON	Saugeen Ojibway Nation
SRANK	Subnational Conservation Rank; the conservation status of a species or vegetation community within a particular province, territory, or state. In Ontario, the NHIC assigns SRANKs using the best available information and considering factors such as abundance, distribution, population trends, and trends (NDMNRF 2021a). Species assigned S1 (Critically Imperiled), S2 (Imperiled), S3 (Vulnerable), and SH (Possibly Extirpated) are considered provincially rare by the NHIC. See the NatureServe website for more information:

https://www.natureserve.org/nsexplorer/about-the-data/statuses/conservation-status-categories

SWH — Significant Wildlife Habitat; Defined in the Ontario Provincial Policy Statement, 2020 as:

> *Wildlife habitat* – areas where plants, animals and other organisms live, and find adequate amounts of food, water, shelter, and space needed to sustain their populations. Specific wildlife habitats of concern may include areas where species concentrate at a vulnerable point in their annual life cycle; and areas which are important to migratory and non-migratory species.
>
> *Significant* – in regards to wildlife habitat, ecologically important in terms of features, functions, representation, or amount, and contributing to the quality and diversity of an identifiable geographic area or natural heritage system.

Candidate SWH are areas that meet the ELC ecosite code(s) and/or habitat criteria outlined in the SWH ecoregional criterion schedule (ECS). Confirmed SWH are areas that meet the defining criteria outlined in the SWH ECS. Detailed field investigations are usually needed to confirm SWH.

TEM — Terrestrial Ecosystem Mapping

The Project — The Adaptive Phased Management Project is the Deep Geological Repository (DGR) and other required infrastructure for the safe, long-term management of Canada's used nuclear fuel.

TISG — Tailored Impact Statement Guidelines for Designated Projects Subject to the *Impact Assessment Act and the Nuclear Safety and Control Act*

Ungulate — The term roughly means "being hoofed" or "hoofed animal"

VC — Valued Component. For impact assessments of designated projects under the *Impact Assessment Act*, the Agency's Glossary of Terms defines VCs as "environmental, health, social, economic or additional elements or conditions of the natural and human environment that may be impacted by a proposed project and are of concern or value to the public, Indigenous peoples, federal authorities and interested parties. Valued components may be identified as having scientific, biological, social, health, cultural, traditional, economic, historical, archaeological and/or aesthetic importance."

WMU — Wildlife Management Unit

1.0 INTRODUCTION

Mammals play important roles in ecosystems and ecological communities. For example, mammals are integral to food webs as grazers, ecosystem engineers, and predators (Krebs et al. 2001, Baruzzi and Krofel 2017). Humans value mammals for various reasons, including for consumption as food, recreation (i.e., photographic tourism), and philosophical and spiritual reasons (Kellert et al. 1996, Boesch et al. 2017). Due to their importance to humans and ecosystems, it is important to consider the perspectives and values of First Nations, Métis, and local people when determining which values to study, and to ensure that impacts of proposed projects on mammal species and their habitats of importance do not contribute to further declines in species of conservation concern or those exhibiting population declines.

The Canadian Nuclear Safety Commission's (CNSC) Guidance on *Deep Geological Repository Site Characterization* includes wildlife, terrestrial habitat, and Species at Risk (SAR) as elements of terrestrial ecology that should be characterized in the Area of Interest (AOI (CNSC 2018)). In addition, the Tailored Impact Statement Guidelines Template (generic version, 'TISG Template[1]') identifies terrestrial wildlife and their habitat and SAR as elements of the biophysical environment that could be scoped into the Impact Assessment (IA) as Valued Components (VCs), which would require a detailed baseline description and project effects assessment in the impact statement (IAAC 2023). A full list of acts, regulations, and other biodiversity considerations is available in Appendix E of the *Biodiversity Impact Studies Southwestern Ontario Region: Best Practices and Preferred Approaches* (BPPA) Report (Zoetica 2021).

The main goal of this current Chapter 4 (Mammals) of the 2023 Biodiversity Impact Studies (BIS) Baseline Report is to provide information about the background context of mammals in the BIS study areas defined for the Saugeen Ojibway Nation (SON)-South Bruce siting area. This information will help to understand the "baseline" state of mammals in this region, as any future impacts or benefits from the Adaptive Phased Management Project (hereafter, 'the Project') evaluated in the IA would need to be considered as superimposed and contextualized within the scope of pre-existing trajectories and natural variability in population fluctuations. For the purposes of the Project's BIS, mammals are classified into five groups based on similar habitat requirements, function in the ecological community, or other aspects of ecology. These groups are:

1. Ungulates
2. Carnivores
3. Small Terrestrial Mammals
4. Semi-Aquatic Mammals
5. Bats

Common names and corresponding scientific names for animals mentioned in this report are included in Appendix A. Objectives and methods common to BIS studies for all mammal groups are included in Section 1.1 and 1.2. Sections 2.0 – 6.0 list additional objectives, methods, and results, if applicable, for the mammal groups under discussion within those sections.

1.1 General Objectives

The general objectives of mammal studies for the BIS are:

[1] Please see Chapter 1 for limitations of and planned updates to the TISG Template (IAAC 2023).

1. Determine the presence, distribution, and abundance of relevant Significant Wildlife Habitat (SWH) and other important habitat for select biodiversity values (BVs), with an emphasis on:
    a. Species of conservation concern, including SAR,
    b. Species of interest to stakeholders and rights-holders, and
    c. Indicator species.
2. Determine the potential presence and distribution of species of interest, including the select BVs listed in (1); and
3. Provide additional baseline data to help inform the Project's biodiversity IA and mitigation measures, and to assist in the potential development of monitoring program(s) to address environmental, regulatory, and stakeholder/rights-holder concerns.

The current Chapter 4 (Mammals) of the 2023 BIS Baseline Report begins to fulfil the requirements of the TISG Template required for mammals (see Appendix C in the BPPA Report (Zoetica 2021)).

While Zoetica™ has recommended the consideration of indicator species in the BPPA Report (Zoetica 2021), there are currently no candidate mammalian indicator species selected for the purposes of the 2023 BIS Baseline Report. Zoetica recommends that indicator species be determined after more information is gathered about potential Project impacts and species-habitat associations (e.g., through Tier 2 community composition studies) within the BIS study areas for mammals. See Section 4.2 of the BPPA Report for further discussion of indicator species (Zoetica 2021).

1.2 General Methods

Studies in 2021 and 2022 were directed at the collection of desk- and field- based Tier 1 data. This section addresses methods common to each mammal group. If BIS studies for a mammal group include additional methods, these are described within the mammal group-specific sections (Sections 2.0 - 6.0).

1.2.1 Study Areas

Descriptions and rationale for developing the BIS study areas for all BVs, including the mammal BVs, can be found in Section 3.0, Chapter 1 of the 2023 BIS Baseline Report, and Section 5.2 of the BPPA Report (Zoetica 2021). If the study area for a specific mammal group has additional notes, these are included within the group-specific sections of this report.

1.2.2 Collation of Species Observations and Habitat Data

Desk-based investigations of mammals began with identification of potential species of interest that may occur within the BIS study areas. Refer to Appendix D and Section 3.1 in the BPPA Report (Zoetica 2021) for a comprehensive list of SAR, including at-risk mammal species, and the methods used to compile this list[2]. Provincially rare species are indicated by their subnational rank (SRANK: S1, S2, S3, SH) and tracked by the Ontario Natural Heritage Information Centre (NHIC).

Zoetica proceeded with desk-based research and mapping by collating existing data from government, citizen science, and other biodiversity databases. For this 2023 BIS Baseline Report, data sources for

[2] For the purposes of the 2023 Baseline Report, conservation statuses described in text for at-risk species refer to their Species at Risk in Ontario (SARO) listings unless otherwise indicated. Conservation statuses are from the NHIC's Ontario species list, current to March 1, 2023, and updated for any discrepancies with provincial and federal SAR listings up to August 15, 2023. As such, species and status listings may differ from those presented in Zoetica's 2021 BPPA Report (Zoetica 2021).

verified species and habitat records included the NHIC; the Ontario Ministry of Natural Resources and Forestry (MNRF), and Global Biodiversity Information Facility (GBIF). As these datasets periodically pull observations from other biodiversity-related studies and programs (e.g., iNaturalist), they were deemed a good starting point to describe the biodiversity of mammal species and their habitats found or likely to be found in the study areas. In addition, Zoetica investigated findings from the previous preliminary environmental studies conducted for the SON-South Bruce siting area (Tulloch Environmental 2020, 2021). **Table 1-1** summarizes the datasets, data layers, and reports investigated for mammal species observations and habitat data for the 2023 BIS Baseline Report. The datasets listed were also analyzed for other BVs (discussed in other BIS chapters). Data reported on maps were limited to observations from 1970 onward as older observations were considered historic and not as reliable. See also Appendix A, Chapter 1 for data quality scoring.

Table 1-1 Spatial datasets analyzed and mapped (where available) for different mammal groups for the 2023 BIS baseline report.

Data Source / Owner	Dataset	Data Format	Date Accessed / Received	Contains Relevant[1] Data?
Tulloch Environmental *preliminary environmental studies for the Project*	July 2020 Site Reconnaissance (Tulloch Environmental 2020)	Report	10/2020	N
	October 2020 Natural Heritage Features (Tulloch Environmental 2021)	Report	04/2021	Y
Ontario Natural Heritage Information Centre (NHIC)	Species Occurrences	Shapefile	12/2020	N
	Wildlife Concentration Area Observation	Shapefile	12/2020	N
Ontario Ministry of Natural Resources and Forestry (MNRF)	Wildlife Activity Site	Shapefile	12/2020	N
	Wildlife Activity Area	Shapefile	12/2020	Y
	Karst	PDF Map	08/2022	N
	Abandoned Mines Information System	Geodatabase	03/2020	Y
	Beaver Dam - Discontinued	Shapefile	10/2021	Y
Global Biodiversity Information Facility (GBIF)	Species Occurrences	Comma Separated Values	10/2021	Y
Environment and Climate Change Canada (ECCC) and Ontario Ministry of the Environment, Conservation and Parks (MECP)[1]	Federal and Provincial SAR Recovery Strategies	Reports	Various	Y

Notes:

1. Zoetica determined dataset relevance based on geographic and temporal relevance, as well as relevance to mammals. For example, data that were not within the relevant BIS study areas, data that were too old to be considered relevant, or data that did not include records of mammal species were labelled “N” for not containing relevant data.
2. SAR recovery strategies are published by DFO and MNRF, but authors may differ. Refer to Appendix D of Zoetica’s BPPA Report (Zoetica 2021) for a full list of potentially occurring SAR that had provincial and/or federal recovery strategies available at the time of writing the BPPA Report (note: new documents are continually posted on the SARO website and *SARA* Public Registry). The most updated version of the recovery strategies for relevant species was reviewed and cited in this report.

If additional datasets relevant to species in applicable study areas are identified, they will be investigated in future years of the BIS baseline program. Future data collection overlapping with the BIS study areas may also provide data or data sources that can be integrated into future iterations of baseline reports.

1.2.3 Tier 1 Studies

Field studies conducted in 2022 focused on collecting Tier 1 foundational habitat data and species detections through environmental DNA (eDNA) metabarcoding[3] studies. Each field team also collected incidental observations of biodiversity, including mammals. Detailed methods for the Tier 1 studies are available in the *Biodiversity Impact Studies – Southwestern Ontario Region: Baseline Program Design* (BPD) Report and associated Standard Operating Procedures (SOPs) (Zoetica 2022). In addition to the utility of each study for understanding mammals and mammal habitat in the BIS study areas, incidental mammal observations collected during the terrestrial and aquatic field studies are also informative in describing biodiversity. Field data, once quality checked by the field data collection contractor, were provided to Zoetica for data analysis and interpretation. Data reviewed by Zoetica were assumed to be cleaned following a Quality Assurance / Quality Control procedure undertaken by the field data collection contractor and error-free.

1.2.3.1 Terrestrial Ecosystem Mapping

Terrestrial Ecosystem Mapping (TEM) work completed to date is described in Appendix B, Chapter 1. The refined ecosite dataset resulting from desk-based TEM work was used for delineating various types of ecosites used in planning other Tier 1 studies (e.g., Aquatic Habitat Mapping (AHM) studies (see Appendix D, Chapter 1) and determining candidate SWH for various BVs (see Appendix C, Chapter 1)).

1.2.3.2 Identification of Candidate SWH

Desk- and field-based candidate SWH identification work completed to date is described in Appendix C, Chapter 1. SWH types of relevance to ungulates, carnivores, and bats are discussed in Sections 2.1, 3.1, and 6.1 of this report. The Province of Ontario has no specific SWH assignments for small terrestrial mammals and semi-aquatic mammals.

1.2.3.3 Aquatic Habitat Mapping

AHM work completed to date is described in Appendix D, Chapter 1. Although AHM is focused on characterization of fish habitat in watercourses, waterbodies (ponds, lakes), and wetlands in the relevant aquatic study areas (see Section 3.0, Chapter 1), these data will also help identify important habitat for animals, including mammals, with aquatic or semi-aquatic life history components.

1.2.3.4 Environmental DNA Metabarcoding

eDNA work completed to date is described in Appendix E, Chapter 1. The two vertebrate primers used for eDNA studies were primarily intended to capture aquatic and semi-aquatic species such as fish, amphibians, and turtles (see Section 2.4 of the BPD Report (Zoetica 2022)); however, the primer may also detect mammal species.

1.2.4 Mapping Considerations

To protect sensitive species and ecosystems, spatial data and 2022 field data pertaining to provincially tracked (at-risk and rare) species and wildlife concentration areas (e.g., bat roosts) follows NHIC sensitivity standards and is not detailed enough to allow for precise geolocation.

[3] In all sections of this 2023 BIS Baseline Report, where eDNA studies and results are noted, they refer to the use of eDNA in combination with metabarcoding for multi-species identification.

Field crews recorded incidental observations during Tier 1 baseline field programs and were noted on different data forms (Incidental Observation Form or noted in TEM, AHM, or eDNA survey forms). Incidental observations varied in method of observation (audio, visual, etc.) and life history stage of organisms, and may have been recorded in transit to a site and thus not associated with habitat data. Expertise in species identification may have varied among field contractors working on different field programs. Thus, all pertinent information may not have been available (e.g., observation type, activity, demographics) or collected in a directly comparable manner (e.g., quantity). For mapping and interpretation purposes, Zoetica defaulted to ‘unspecified’ observation type, count of one individual, and adult individuals unless otherwise indicated. Zoetica also assumed one individual when a singular observation (e.g., “coyote”) was recorded in the field notes, and more than one individual if plural observations (e.g., “coyotes”) were recorded.

2.0 UNGULATES

2.1 Introduction

Ungulates are often important in IAs because of their ecological, economic, and human importance. Ungulates are "ecosystem engineers" that can substantially alter the environment by modifying vegetation, soil, and aquatic ecosystems through their behaviours, such as wallowing, rooting, urinating, excreting, grazing, and trampling (summarized in Baruzzi and Krofel 2017). The SON-South Bruce siting area falls within Cervid Ecological Zone (CEZ) E3 and Wildlife Management Unit (WMU) 84. These management zones contain important sustaining areas for wildlife such as feeding, wintering and calving sites for deer. White-tailed deer is the only native species of ungulate known to occur in and around the SON-South Bruce siting area. White-tailed deer is not listed as at-risk under Species at Risk in Ontario (SARO) or the Federal *Species at Risk Act* (*SARA*), nor is it recommended for listing by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC).

White-tailed deer are part of Ontario's wildlife management program (MNRF 2019a) and are used as indicator species for the Southern Region of Ontario (including the Great Lakes-St. Lawrence Forest Region) for the purposes of forest management (Holloway et al. 2004, MNRF 2015). White-tailed deer populations have been increasing in Ontario since the 1980s due to several factors:

- institution of a selective harvest system that protected adult females and improved reproductive rates;
- prolonged milder winters associated with climate change that decreased winter mortality and increased fawn production and survival;
- changes in the agricultural industry that resulted in crop fields being a valuable source of winter food for deer;
- land restoration programs that have generally improved deer habitat throughout southwestern and southern Ontario;
- prohibition of hunting activities on an increasing number of private properties (thus creating deer refuge areas); and
- successful efforts to control illegal harvesting of deer (Government of Ontario 2007).

White-tailed deer provide social and economic benefits to Ontario, with millions of dollars generated annually through hunting, wildlife-viewing, and tourism (MNRF 2019b). However, in southwestern Ontario, human-deer conflicts occur and include vehicle collisions, damage to agricultural crops and farming infrastructure, damage to suburban and residential property, and over-browsing in protected areas that can alter ecological processes and degrade SAR habitat (MNRF 2019b). Hunting of white-tailed deer is permitted in hunting areas within WMU 84 (MNRF 2020) and deer hunting (for sport and food) is a popular activity in the region. White-tailed deer generally hold cultural, spiritual, and social significance for Indigenous communities in Ontario, and venison is described as a sacred food for local Indigenous people in Youngblood (2017). Further engagement with local stakeholders and rights-holders is needed to ascertain the importance of white-tailed deer in the SON-South Bruce siting area.

Several SWH types apply to ungulates. Upon investigation of the SWH Ecoregional Criterion Schedule for Ecoregion 6E (hereafter '6E ECS', there are five ungulate-related SWH types of potential relevance to the SON-South Bruce siting area:

- Deer Winter Congregation Areas
- Deer Yarding Areas
- Deer Movement Corridors
- Seeps and Springs
- Special Concern and Rare Wildlife Species (OMNRF 2015).

The latter is not relevant as there are no Special Concern or provincially rare ungulate species expected within the BIS study areas; however, should provincial conservation statuses or subnational ranks change in the future, habitats for these species will need to be considered. All other SWH habitat types listed above apply to white-tailed deer.

Further details about candidate SWH investigations conducted to date and rationale for inclusion (or exclusion) of SWH types listed in the 6E ECS are presented in Appendix C, Chapter 1.

2.1.1 Objectives

All General Objectives listed in Section 1.1 apply to ungulates.

2.2 Methods

2.2.1 Study Areas

The BIS study areas for ungulates include a Local Study Area (LSA) defined as the terrestrial LSA (LSA_{TER}), and a Regional Study Area (RSA) defined as the RSA_{UNG}. A description and rationale for developing ungulate study areas can be found in Section 3.0, Chapter 1 of the 2023 BIS Baseline Report, and Section 5.2.2.4 of the BPPA Report (Zoetica 2021).

2.2.2 Presence, Distribution, and Abundance of Important Habitat

Collation of both existing and Tier 1 habitat data for ungulates proceeded as described in Sections 1.2.2 and 1.2.3.

2.2.3 Presence and Distribution of Species of Interest

Collation of existing observations and Tier 1 incidental observations for ungulates proceeded as described in Sections 1.2.2 and 1.2.3.

2.2.4 Additional Baseline Data to Inform the IA

Species lists were compiled from desk- and field-based studies (as per Section 1.2.2 and 1.2.3) as an initial investigation into the biodiversity of the BIS study areas.

2.3 Results

2.3.1 Presence, Distribution, and Abundance of Important Habitat

2.3.1.1 General Habitat Associations

Future Tier 2 studies aim to determine ungulate habitat associations within the BIS study areas. Discussion of general habitat associations will be included in future BIS Baseline Reports after Tier 2 studies have been completed (if the SON-South Bruce siting area is selected for the Project).

2.3.1.2 *Significant and Other Important Wildlife Habitats*

The MNRF has identified five White-tailed Deer Wintering Areas within the LSA_{TER} and RSA_{UNG}, some of which are considered confirmed SWH (see Section 4.1.13 and Figure D-12 in Appendix C, Chapter 1). Based on ecosite analyses, Deer Winter Congregation Areas, Deer Winter Yarding Areas, and Seeps and Springs could occur throughout the AOI and LSA_{TER}. A detailed discussion of candidate SWH within the LSA_{TER} is available in Appendix C, Chapter 1.

2.3.2 Presence and Distribution of White-tailed Deer

There are no existing observation data from the NHIC and GBIF datasets for ungulates within the AOI, LSA_{TER}, or RSA_{UNG}. During 2022 fieldwork, crews reported incidental observations of white-tailed deer (**Table B-1**).

2.4 Discussion

To meet the requirements of the TISG Template and the general objectives outlined in Section 1.1, the BIS Baseline Report presents results of desk-based ungulate habitat and species observations and preliminary results from Tier 1 terrestrial habitat assessments and incidental observations.

White-tailed deer was brought up as a potential indicator species during engagement (see Appendix B in the 2021 BPPA Report (Zoetica 2021)). White-tailed deer were observed during field work in 2022, and candidate and Confirmed SWH for white-tailed deer has been identified, specifically winter habitat (see Appendix C, Chapter 1). Other ungulates in the area may include wild pigs, which were added as Restricted invasive species under the Ontario *Invasive Species Act* in January 2022 (MNRF 2023). While there have been no records of wild pigs within the AOI, LSA_{TER}, or $RSA_{UNG,}$ wild pigs are important to monitor because they threaten native ecosystems (NDMNRF 2021b) and alter the behaviour of other wildlife (Lewis 2021). eDNA results did indicate presence of pig species, but these detections may indicate the presence of domestic pigs in farms that may interact with aquatic systems and allow for the transport of eDNA; these potential explanations are undergoing further investigation (see Section 5.2 of Appendix E, Chapter 1).

If the SON-South Bruce siting area is selected for additional baseline investigations for the Project, Tier 2 studies will aim to characterize ungulate population health more thoroughly within the AOI, LSA_{TER}, and RSA_{UNG}. Tier 2 studies may be designed based on results and needs identified from Tier 1, and study methods may include spotlight counts, camera surveys, and pellet group counts.

3.0 CARNIVORES

3.1 Introduction

Carnivores that occur in the SON-South Bruce siting area may be of importance to communities for hunting, trapping, and predator-prey dynamics. Larger carnivores are often considered keystone species as well as umbrella species; they are essential in regulating and maintaining ecosystems by keeping down herbivore populations that could otherwise graze or browse too heavily on vegetation and destroy community assemblages upon which other biodiversity values rely (e.g., (Noss et al. 1996). Saugeen Valley Conservation Authority (SVCA) staff noted that hunting is a popular activity in the region, and game mammals include coyotes and coyote-wolf hybrids. Further engagement with local stakeholders and rights-holders is needed to ascertain the importance of carnivore species in the SON-South Bruce siting area.

There are 12 terrestrial carnivore species that potentially occur in and around the SON-South Bruce siting area (see Section 5.2.3 of the BPPA report for a list of potentially occurring carnivore species (Zoetica 2021)). North American river otter and American mink, while carnivores, are considered in Section 5.0, Semi-Aquatic Mammals, due to their specific habitat associations with water and riparian areas, and due to the need to study these species using differing methods. Of the terrestrial carnivore species, three are designated as provincially and federally at risk: American badger (Southwestern Ontario population), eastern wolf, and gray fox. Cougar is listed as Endangered in Ontario, but data deficiencies have precluded a formal assessment of this species by COSEWIC.

Although black bears are omnivorous, they are taxonomically part of the order Carnivora and are grouped with carnivores for the purposes of the BIS. The methodology used for biodiversity baseline data collection and impact studies for black bears, if needed, and other members of the order Carnivora (i.e., carnivores) will generally be the same.

Within Ecoregion 6E, there are two types of SWH relevant to carnivores. First is Mast Producing Areas (for black bear). However, this designation only applies to Ecodistrict 6E-14, the Bruce Peninsula, which is outside of the RSA for carnivores (RSA_{CAR}). Tallgrass Prairie is a rare vegetation community – which may support the Endangered American badger. To date, no desk- or field-based observations have indicated the presence of candidate Tallgrass Prairie SWH within the AOI or LSA_{TER} (see Appendix C, Chapter 1, and Section 1.3.2, Chapter 2).

3.1.1 Objectives

All general objectives listed in Section 1.1 apply to carnivores.

3.2 Methods

3.2.1 Study Areas

The BIS study areas for carnivores include a local study area defined as the terrestrial LSA (LSA_{TER}) and a regional study area defined as the RSA_{CAR}. A description and rationale for developing carnivore study areas can be found in Section 3.0, Chapter 1 of the 2023 BIS Baseline Report, and Section 5.2.3.4 of the BPPA Report (Zoetica 2021).

3.2.2 Presence, Distribution, and Abundance of Important Habitat

Collation of both existing and Tier 1 habitat data for carnivores proceeded as described in Sections 1.2.2 and 1.2.3.

3.2.3 Presence and Distribution of Species of Interest

Collation of existing observations and Tier 1 incidental observations for carnivores proceeded as described in Sections 1.2.2 and 1.2.3.

Some carnivore species are secretive and elusive, therefore are difficult to detect. For these species, community surveys or questionnaires are recommended as a cost-effective way to gather preliminary information on species presence (RIC 1998, RISC 2007). The NWMO distributed 112 questionnaires via mail to properties within the LSA_{TER} with a known civic address. Questionnaires were based on a template available in the 2022 BPD Report and asked specifically about American badger and cougar sightings (Zoetica 2022).

3.2.4 Additional Baseline Data to Inform the IA

Species lists were compiled from desk- and field-based studies (as per Section 1.2.2 and 1.2.3) as an initial investigation into the biodiversity of the BIS study areas.

3.3 Results

3.3.1 Presence, Distribution, and Abundance of Important Habitat

3.3.1.1 General Habitat Associations

Future Tier 2 studies aim to determine carnivore habitat associations within the BIS study areas. Discussion of general habitat associations will be included in future BIS Baseline Reports after Tier 2 studies have been completed (if the SON-South Bruce siting area is selected for the Project).

3.3.1.2 Significant Wildlife Habitat

To date, desk- or field-based observations do not indicate the presence of important carnivore habitat within the AOI, LSA_{TER}, or RSA_{CAR} (see Appendix C, Chapter 1, and Section 1.3.2, Chapter 2).

3.3.2 Presence and Distribution of Species of Interest

3.3.2.1 Species of Conservation Concern

There are no verified occurrences of carnivore species of conservation concern within the AOI, LSA_{TER}, or RSA_{CAR} in the NHIC dataset. No carnivore species of conservation concern were detected during fieldwork in 2022. The NWMO received 14 responses to the carnivore questionnaire. Based on results of the survey, sightings of cougar and American badger occur within the LSA_{TER}. Thus, parts of the LSA_{TER} warrant further investigation for both species.

3.3.2.2 Species of Interest to Stakeholders and Rights-Holders, and Species of Potential Socio-economic Importance

At the time of writing the 2023 BIS Baseline Report (September 2023), Zoetica does not have sufficient information to identify carnivore species of interest to stakeholders and rights-holders in the SON-South Bruce siting area. Future iterations of the BIS Baseline Report will include details of the presence and distribution of any species of interest identified from further engagement.

3.3.3 Additional Baseline Data to Inform the IA

3.3.3.1 Community Characterization

Desk-based research indicated Canada lynx, fisher, and red fox observations in the RSA_{CAR}. None of these species are SAR or known species of interest. The fisher detection occurred in the past ten years, within the Greenock Swamp Wetland Complex (GSWC). The other detections either occurred before 1970 or did not have a date recorded for the observation. During 2022 fieldwork, crews reported incidental observations of coyote and fisher (**Table B-1**). eDNA did not detect mammalian carnivore species, although the genus *Canis* – which includes coyotes, wolves, and domestic dogs – was detected (see Appendix E, Chapter 1).

3.4 Discussion

To meet the requirements of the TISG Template and the general objectives outlined in Section 1.1, the BIS Baseline Report presents the results of desk-based carnivore habitat and species observations and preliminary results from Tier 1 terrestrial habitat assessments and incidental observations.

Changes in populations and occurrence of carnivores was brought up during engagement, although specific species and concerns were not detailed (see Appendix B of the BPPA report (Zoetica 2021)). To date, Tier 1 studies indicate the presence of two carnivore species based on incidental observations - coyote and fisher. Neither of these species is provincially rare, and carnivore SWH is not known to occur within the AOI, LSA_{TER}, or RSA_{CAR}. However, questionnaires indicated areas of the LSA_{TER} that warrant further investigation for American badger and cougar. If the SON-South Bruce siting area is selected for additional baseline investigations for the Project, Tier 2 studies will aim to characterize carnivore community composition more thoroughly within the AOI, LSA_{TER}, and RSA_{CAR}. More species may be detected as the BIS baseline program progresses and with continuing improvements with eDNA laboratory methods and bioinformatic analyses.

Tier 2 studies will be designed based on results from Tier 1, and may include snow track surveys, camera surveys, hair snag surveys, and aerial surveys. Sightings reported in community questionnaires will also be used to develop Tier 2 studies. Additional Tier 2 studies proposed to commence after site selection will aim to detect a wider variety of carnivores that inhabit areas within the RSA_{CAR} to aid in the community characterization included as part of the TISG Template. These sections will be included in future iterations of the BIS Baseline Report after Tier 2 surveys have been completed, if the SON-South Bruce siting area is selected for the Project.

4.0 SMALL TERRESTRIAL MAMMALS

4.1 Introduction

Small terrestrial mammals, even if not listed or protected by particular Acts, may be economically, socially, or culturally important. Small mammals can play a major ecological role as both consumers of vegetation and invertebrates, and prey items for carnivorous/omnivorous mammals, reptiles, and birds. Small mammals are thus integral to food web relationships and maintaining population levels of other biodiversity values. Hence, it is important that scoping of biodiversity values considers perspectives and values of First Nation, Métis, and local people when determining which values to study.

Small game and furbearers provide social and economic benefits to Ontario residents and tourists (MNRF 2019c); however, the prevalence of hunting/trapping of these species in the SON-South Bruce siting area requires further investigation. Youngblood (2017) reports that rabbit is one of the most common meat sources for local Indigenous people, and squirrel may also be harvested. Further engagement with local stakeholders and rights-holders is needed to ascertain the importance of small terrestrial mammals in the SON-South Bruce siting area. Engagement activities for the environmental baseline programs to date have not revealed community concerns specifically related to small terrestrial mammals beyond the general concerns expressed regarding the protection of SAR and the maintenance/enhancement of ecosystem resiliency.

There are 29 small- to medium-sized terrestrial mammal species that potentially occur in and around the SON-South Bruce siting area (see Section 5.2.4 of the BPPA report for a list of potentially occurring small terrestrial mammals (Zoetica 2021)). Additional small- to medium-sized mammal species such as beaver, muskrat, American water shrew, and star-nosed mole are considered in Section 5.0, Semi-Aquatic Mammals. Two species are provincially and federally listed: eastern mole and woodland vole are considered as Special Concern.

Small terrestrial mammals that are typically used as indicator species in the Southern Region (including the Great Lakes-St. Lawrence Forest Regions) of Ontario for the purposes of forest management include northern flying squirrel, southern flying squirrel, deer mouse, and southern red-backed vole (Holloway et al. 2004, MNRF 2015). Flying squirrel is also recognized as a keystone species due to its symbiotic relationship with mycorrhizal fungi and mature forests. Ontario's wildlife management program also includes snowshoe hare and gray squirrel as small game species (MNRF 2019a).

4.1.1 Objectives

All general objectives listed in Section 1.1 apply to small terrestrial mammals.

4.2 Methods

4.2.1 Study Areas

The BIS study areas for small terrestrial mammals include a local study area defined as the terrestrial LSA (LSA_{TER}). A description and rationale for developing small terrestrial mammal study areas can be found in Section 3.0, Chapter 1 of the 2023 BIS Baseline Report, and Section 5.2.4.4 of the BPPA Report (Zoetica 2021).

4.2.2 Presence, Distribution, and Abundance of Important Habitat

As there are no SWH indicated for small terrestrial mammals in the Criteria Schedule for Ecoregion 6E (OMNRF 2015), habitat mapping of potential SWH will not be undertaken for this group of BVs. Collation of other existing and Tier 1 habitat data for small terrestrial mammals proceeded as described in Sections 1.2.2 and 1.2.3.

4.2.3 Presence and Distribution of Species of Interest

Collation of existing observations and Tier 1 incidental observations for small terrestrial mammals proceeded as described in Sections 1.2.2 and 1.2.3.

4.2.4 Additional Baseline Data to Inform the IA

Species lists were compiled from desk- and field-based studies (as per Section 1.2.2 and 1.2.3) as an initial investigation into the biodiversity of the AOI and LSA_{TER}.

4.3 Results

4.3.1 Presence, Distribution, and Abundance of Important Habitat

4.3.1.1 General Habitat Associations

Based on investigations of the NHIC and MNRF wildlife datasets, there are no areas identified as important small terrestrial mammal habitat within the AOI or LSA_{TER}.

Future Tier 2 studies aim to determine small terrestrial mammal habitat associations within the BIS study areas. Discussion of general habitat associations will be included in future BIS Baseline Reports after Tier 2 studies have been completed if the SON-South Bruce siting area is selected for the Project.

4.3.1.2 Significant Wildlife Habitat

There are no SWH indicated for small terrestrial mammals in the 6E ECS (OMNRF 2015) as noted in Section 4.2.2.

4.3.2 Presence and Distribution of Species of Interest

4.3.2.1 Species of Conservation Concern

Preliminary desktop investigations made by Zoetica indicate that no small terrestrial mammal species of conservation concern are likely to be present in the LSA_{TER} due to requirements for specialized habitats that do not occur in the SON-South Bruce siting area (based on NHIC records). However, further research is needed to increase the confidence of this interpretation of existing information (e.g., by evaluating survey effort, locations, dates).

4.3.2.2 Species of Interest to Stakeholders and Rights-Holders, and Species of Potential Socio-economic Importance

At the time of writing the 2023 BIS Baseline Report (September 2023), Zoetica does not have sufficient information to identify the small terrestrial mammal species of interest to stakeholders and rights-holders in the SON-South Bruce siting area. Future iterations of the BIS Baseline Report will include details of the presence and distribution of any species of interest identified from further engagement.

4.3.3 Additional Baseline Data to Inform the IA

4.3.3.1 Community Characterization

A search of the NHIC and GBIF datasets revealed that there are no existing observation data of small terrestrial mammals within the AOI or LSA_{TER}. During field work in 2022, crews reported incidental observations of eastern chipmunk, raccoon, and red squirrel (**Table B-1**). eDNA detected short-tailed shrew, meadow vole, and raccoon in 2022 (see Appendix E, Chapter 1). Meadow vole, which was detected at 15 sites across the AOI, LSA_{AQU}, and RSA_{AQU}, has a barcode gap, increasing confidence in the validity of this detection (see Appendix A to Appendix E, Chapter 1).

4.4 Discussion

To meet the requirements of the TISG Template and the general objectives outlined in Section 1.1, the BIS Baseline Report presents the results of desk-based small terrestrial mammal habitat and species observations and preliminary results from Tier 1 studies and incidental observations.

Engagement activities conducted to date have not indicated particular concerns regarding small terrestrial mammals (see Appendix B of the BPPA report (Zoetica 2021)), but further engagement with stakeholders and rights-holders may reveal species of importance in the SON-South Bruce siting area. To date, three small terrestrial mammal species were observed incidentally during 2022 field work, and three species were detected with eDNA (see Appendix C to Appendix E, Chapter 1). None of the detected small terrestrial mammal species are provincially rare, and no small terrestrial mammal SWH is known to occur within the AOI or LSA_{TER}. However, if the SON-South Bruce siting area is selected for additional baseline investigations for the Project, Tier 2 studies will aim to characterize the small terrestrial mammal community more thoroughly within the AOI and LSA_{TER}. More species may be detected as the BIS baseline program progresses and with continuing improvements to eDNA laboratory methods and bioinformatic analyses.

Future work may include collaboration with the Project's Environmental Media Baseline Program (EMBP), as tissue sample collection will involve non-targeted small mammal trapping, which may allow for determining community composition and estimates of relative abundance in the AOI and LSA_{TER}. Additional Tier 2 studies may be designed based on results and needs identified from Tier 1. These sections will be included in future iterations of the BIS Baseline Report after Tier 2 surveys have been completed, if the SON-South Bruce siting area is selected for the Project.

5.0 SEMI-AQUATIC MAMMALS

5.1 Introduction

Semi-aquatic mammals, such as beaver, may have ecological and economic impacts, and are important to humans. Beavers are “ecosystem engineers” that can change the physical structure of the environment and they are also recognized as a keystone species (Naiman et al. 1988, Simberloff 1998). Ontario’s wildlife management program for small game and furbearer species includes beaver; beaver trapping is an important traditional and commercial activity that helps to manage human-wildlife conflicts, as beavers and beaver dams can affect hydrology and cause damage to infrastructure (MNRF 2019a).

Beaver and muskrat are harvested by trappers in the SON-South Bruce siting area, predominantly on private land (Golder Associates 2014). Beavers generally hold cultural, spiritual, and social significance for Indigenous communities in Ontario, and beaver may still be harvested by local Indigenous people (Youngblood 2017). However, further engagement with local stakeholders and rights-holders is needed to ascertain the importance of beavers and other semi-aquatic mammal species in the SON-South Bruce siting area. In addition, engagement with municipalities to gather knowledge of trappers collecting beavers through applications with the municipality to remove problematic beavers and their dams would be informative.

Other than beaver, there are five semi-aquatic mammal species that potentially occur in and around the SON-South Bruce siting area (see Section 5.2.5 of the BPPA report for a list of potentially occurring semi-aquatic mammals (Zoetica 2021)) based on their species ranges, none of which are provincially or federally listed as SAR.

5.1.1 Objectives

Several studies have been designed to collect baseline data to help inform the Project’s biodiversity IA. The objectives of semi-aquatic mammal studies for the BIS are to:

1. Achieve the general objectives listed in Section 1.1;
2. Determine the abundance and health of local beaver populations in the AOI, LSA_{AQU} and RSA_{SAM} compared to known estimates and trends in nearby and similar regions.

5.2 Methods

5.2.1 Study Areas

The BIS study areas for semi-aquatic mammals include a local study area defined as the aquatic LSA (LSA_{AQU}) and a regional study area defined as the RSA_{SAM}. A description and rationale for developing semi-aquatic mammal study areas can be found in Section 3.0, Chapter 1 of the 2023 BIS Baseline Report, and Section 5.2.5.4 of the BPPA Report (Zoetica 2021).

5.2.2 Presence, Distribution, and Abundance of Important Habitat

As there are no SWH indicated for semi-aquatic mammals in the Criteria Schedule for Ecoregion 6E (OMNRF 2015), habitat mapping of potential SWH will not be undertaken for this group of biodiversity values. Collation of other existing and Tier 1 habitat data for semi-aquatic mammals proceeded as described in Sections 1.2.2 and 1.2.3.

5.2.3 Presence and Distribution of Species of Interest

Collation of existing observations and Tier 1 incidental observations for semi-aquatic mammals proceeded as described in Sections 1.2.2 and 1.2.3.

5.2.4 Additional Baseline Data to Inform the IA

Species lists were compiled from desk- and field-based studies (as per Section 1.2.2 and 1.2.3) as an initial investigation into the biodiversity of the BIS study areas.

5.3 Results

5.3.1 Presence, Distribution, and Abundance of Important Habitat

5.3.1.1 General Habitat Associations

Eight observations of beaver dams in the LSA_{AQU} were found within the MNRF's Beaver Dam dataset, which is discontinued and was last updated in July 2008. The records in the dataset thus have not been verified to ensure that they are still present or active. Nevertheless, Zoetica has included these records as a starting point, as beavers often return to suitable habitat areas previously occupied by the species. All eight beaver dams in the Beaver Dam dataset were recorded in the LSA_{AQU} (see Figure F-1 in Appendix D, Chapter 1), and none occurred in the AOI. Beaver dams in the LSA_{AQU} were primarily south of the AOI, with one reported in the GSWC (north of the AOI) south of Cunningham Lake (see Figure F-1 in Appendix D, Chapter 1).

During AHM field studies, five beaver dams and one beaver lodge were reported in the AOI on tributaries to the Teeswater River in the northwest portion of the AOI (see Figure F-1a in Appendix D, Chapter 1). In the LSA_{AQU} south (upstream) of the AOI, one beaver dam was reported on Alps Creek and four beaver lodges were on a small lake north of the Wingham Wetland Complex (see Figure F-1b in Appendix D, Chapter 1). Downstream of the AOI in the northern portion of the LSA_{AQU}, three beaver dams were located on Schmidt Creek, one beaver dam was reported on a wetland connected with Schmidt Creek, and three beaver dams and a beaver lodge were located on Kinlough Creek (see Figure F-1c in Appendix D, Chapter 1). In the RSA_{AQU}, one beaver dam was reported at the northern end of Cargill Mill Pond (see Figure F-1c in Appendix D, Chapter 1). Tier 2 studies may include revisiting beaver dams in the LSA_{AQU} – those detected during AHM field studies and those reported in the MNRF beaver dam database – to determine whether they are active, abandoned, or destroyed.

5.3.1.2 Significant Wildlife Habitat

To date, there are no SWH indicated for semi-aquatic mammals in the 6E ECS (OMNRF 2015) as noted in Section 5.2.2.

5.3.2 Presence and Distribution of Species of Interest

5.3.2.1 Species of Conservation Concern

There are no semi-aquatic mammal species of conservation concern that potentially occur within the AOI, LSA_{AQU}, or RSA_{SAM}.

5.3.2.2 Species of Interest to Stakeholders and Rights-Holders, and Species of Potential Socio-economic Importance

At the time of writing the 2023 BIS Baseline Report (September 2023), Zoetica does not have sufficient information to identify the semi-aquatic mammal species of interest to stakeholders and rights-holders in the SON-South Bruce siting area. Future iterations of the BIS Baseline Report will include details of the presence and distribution of any species of interest identified from further engagement.

5.3.3 Additional Baseline Data to Inform the IA

5.3.3.1 Community Characterization

A search of the NHIC and GBIF datasets revealed that there are no existing observation data of semi-aquatic mammals within the AOI, LSA_{AQU}, or RSA_{SAM}. During field work in 2022, crews reported observations of American mink, beaver, muskrat, and North American river otter (**Table B-1**). Beaver, muskrat, star-nosed mole, and North American river otter were also detected with eDNA (see Appendix E, Chapter 1).

5.4 Discussion

To meet the requirements of the TISG Template, the general objectives outlined in Section 1.1, and the semi-aquatic mammal-specific objectives listed in Section 5.1.1, the BIS Baseline Report presents the results of desk-based semi-aquatic mammal habitat and species observations and preliminary results from Tier 1 habitat assessments and incidental observations.

Engagement activities conducted to date have not indicated particular concerns regarding semi-aquatic mammals (see Appendix B of the BPPA report (Zoetica 2021)), but further engagement with stakeholders and rights-holders may reveal species of importance in the SON-South Bruce siting area. To date, incidental observations by field crews and eDNA results indicate the presence of five semi-aquatic mammals. eDNA analysis showed evidence of widespread distribution of beaver and muskrat in the AOI, LSA_{AQU}, and reference sites, in all types of aquatic habitats (see Appendix C to Appendix E, Chapter 1). In addition, beaver has a barcode gap, strengthening evidence that these detections were true positives (see Appendix A to Appendix E, Chapter 1). None of the detected semi-aquatic mammal species are provincially rare, and no semi-aquatic mammal SWH is known to occur within the AOI, LSA_{AQU}, or RSA_{SAM}. However, if the SON-South Bruce siting area is selected for additional baseline investigations for the Project, Tier 2 studies will aim to characterize semi-aquatic mammal community composition more thoroughly within the AOI, LSA_{AQU}, or RSA_{SAM}. More species may be detected as the BIS baseline program progresses and with continuing improvements with eDNA laboratory methods and bioinformatic analyses.

Future work may include collaboration with the Project's EMBP, as tissue sample collection may involve non-targeted mammal trapping, which may allow for determining community composition and estimates of relative abundance in the AOI, LSA_{AQU}, and RSA_{SAM}. Tier 2 studies may also include verifying records of beaver dams noted in the MNRF Beaver Dam dataset, to determine if these structures still exist. Additional Tier 2 studies will be designed based on results and needs identified from Tier 1. These sections will be included in future iterations of the BIS Baseline Report after Tier 2 surveys have been completed, if the SON-South Bruce siting area is selected for the Project.

6.0 BATS

6.1 Introduction

Bats play an important role in ecological functions. As the primary predators of night-flying insects, bats provide important ecosystem services by controlling insect populations. Bat populations worldwide have undergone rapid declines; in North America, these declines have largely been attributed to White Nose Syndrome (WNS (Austin et al. 2010)), habitat loss and fragmentation (Duchamp and Swihart 2008), wind turbines (Arnett et al. 2008), and climate change (Adams 2010). It is important that new developments do not contribute to further declines in these species.

There are eight bat species that occur or potentially occur around the SON-South Bruce siting area (**Table 6-1**). Of these, three are designated as provincially and federally Endangered: little brown myotis, northern myotis, and tri-colored bat. Eastern small-footed myotis is listed as Endangered in Ontario but has not yet been assessed by COSEWIC. Silver-haired bat, eastern red bat, and hoary bat are designated as Endangered by COSEWIC (COSEWIC 2023), but at the time of this report (September 2023) have not been assigned a status in Ontario nor listed on Schedule 1 of *SARA*. Four of the eight bat species are restricted and cannot be mentioned by name when discussing methods or results.

For Ecoregion 6E, there are three potential SWHs for bats (OMNRF 2015):

- Bat Hibernaculum and
- Bat Maternity Colony
- Special Concern and Rare (S1, S2, S3) Animal Species.

Not all species listed in **Table 6-1** are necessarily relevant to the SON-South Bruce siting area. Although there are currently no Special Concern or not-at-risk but provincially rare (subnational rank S1, S2, S3, SH) bat species that potentially occur in the BIS study areas, the three species recently designated as Endangered by COSEWIC (silver-haired bat, eastern red bat, and hoary bat) may fall under one or both categories in the future.

Further details about candidate SWH investigations conducted to date and rationale for inclusion (or exclusion) of SWH types listed in the 6E ECS are presented in Appendix C, Chapter 1.

6.1.1 Objectives

All the general objectives listed in Section 1.1 apply to bats.

Table 6-1. Bat species that potentially occur in and around the SON-South Bruce siting area. Existing recovery strategies and the status of known critical habitat within the BIS study area(s) for bats are indicated for applicable species. Although none of the bat species have NHIC records within the BIS study area(s), there may be information from other databases, inventories, or studies (outside of NHIC records); these data sources need to be investigated further.

	Scientific Name	SARO	SRANK	*SARA*	COSEWIC	GRANK	Provincial Recovery Strategy	Provincial Government Response Statement	Federal Recovery Strategy	Known Critical Habitat[1] in Study Area?	Source(s)
Big Brown Bat	*Eptesicus fuscus*	-	S4	-	-	G5	-	-	-	-	-
Silver-haired Bat[2]	*Lasionycteris noctivagans*	-	S4	-	END	G3G4	-	No	No	Undefined[3]	-
Eastern Red Bat[2]	*Lasiurus borealis*	-	S4	-	END	G3G4	-	No	No	Undefined[3]	-
Hoary Bat[2]	*Lasiurus cinereus*	-	S4	-	END	G3G4	-	No	No	Undefined[3]	-
Eastern Small-footed Myotis	*Myotis leibii*	END	S2S3	-	-	G4	Yes	Yes	-	No	(Humphrey 2017)
Little Brown Myotis	*Myotis lucifugus*	END	S3	END	END	G3G4	Yes	Yes	Yes	No	(ECCC 2018, Humphrey and Fotherby 2019)
Northern Myotis	*Myotis septentrionalis*	END	S3	END	END	G2G3	Yes	Yes	Yes	No	(ECCC 2018, Humphrey and Fotherby 2019)
Tri-colored Bat	*Perimyotis subflavus*	END	S3?	END	END	G3G4	Yes	Yes	Yes	No	(ECCC 2018, Humphrey and Fotherby 2019)

Notes:
Abbreviations: SARO = Species at Risk in Ontario; *SARA* = Federal *Species at Risk Act*; COSEWIC = Committee on the Status of Endangered Wildlife in Canada; ECCC = Environment and Climate Change Canada
Conservation status ranks: END = Endangered; S1/G1 = Critically Imperiled, S2/G2 = Imperiled, S3/G3 = Vulnerable, S4/G4 = Apparently Secure, S5/G5 = Secure

1. Critical Habitat is defined as habitat that is necessary for the survival or recovery of a listed wildlife species and that is identified as the species' critical habitat in the recovery strategy or in an action plan for the species (Species at Risk Act, S.C. 2002, c. 29).
2. Designated as Endangered by COSEWIC in May 2023.
3. Though Endangered, this species does not have a recovery strategy or action plan defining critical habitat at the time of writing the 2023 BIS Baseline Report (September 2023).

6.2 Methods

6.2.1 Study Areas

The BIS study areas for bats include a local study area defined as the terrestrial LSA (LSA_{TER}) and a regional study area defined as the RSA_{BAT}. A description and rationale for developing bat study areas can be found in Section 3.0, Chapter 1 of the 2023 BIS Baseline Report, and Section 5.2.6.4 of the BPPA Report (Zoetica 2021).

6.2.2 Presence, Distribution, and Abundance of Important Habitat

Collation of both existing and Tier 1 habitat data for bats proceeded as described in Sections 1.2.2 and 1.2.3.

As part of previous preliminary environmental work for the Project, reconnaissance for natural heritage features in support of ongoing borehole site exploration was conducted in 2020 (Tulloch Environmental 2020, 2021). This site exploration included visual searches for suitable habitat for several species, including bats.

The NWMO is in partnership with the Native Bat Conservation Program (NBCP) at the Toronto Zoo to gain a better understanding of bat ecology for species found in Ontario. Bat monitoring conducted by the NBCP in the SON-South Bruce siting area in 2020 and 2021 indicated that a maternity colony/roost for restricted species M1[4] likely occurs within the RSA_{BAT} (which includes the AOI) (Thorne et al. 2021). The federal and provincial recovery strategies for three species of Endangered bats include provisions for the protection of habitat (ECCC 2018, Humphrey and Fotherby 2019). The NWMO seeks to protect the habitats of listed species on NWMO-owned lands; therefore, the NWMO requested that suitable foraging habitat be identified in accordance with the provincial recovery strategy's recommendations for developing a habitat regulation (Humphrey and Fotherby 2019).

6.2.3 Presence and Distribution of Species of Interest

The NBCP's research included collecting and analysing acoustic data. Acoustic data analysis can indicate the potential for bat roosts and other types of habitat (Thorne et al. 2021). Three preliminary reports based on data analyzed by the NBCP researchers are included in this report (see Sections 6.3.2.1 and 6.3.3.1).

6.2.4 Additional Baseline Data to Inform the IA

Species lists were compiled from desk- and field-based studies (as per Section 1.2.2 and 1.2.3) as an initial investigation into the biodiversity of the BIS study areas.

[4] Due to their sensitive nature, detections of restricted species are not described in detail nor made discernable on maps.

6.3 Results

6.3.1 Presence, Distribution, and Abundance of Important Habitat

6.3.1.1 General Habitat Associations

Tulloch Environmental identified potential for bats of restricted species M1 to be inhabiting a vacant homestead inside the RSA_{BAT}, although field staff did not venture inside the homestead in compliance with health and safety planning (Tulloch Environmental 2021).

The NBCP researchers radio-tracked one adult female of restricted species M1 in 2021 (see Section 6.3.2.1). From radiotelemetry, NBCP researchers determined that the bat was roosting in a building in the RSA_{BAT} during the day, and it is possible that the building hosted a maternity colony (Sparrow-Scinocca et al. 2022).

Figure C-1 displays foraging habitat for restricted species M1. Suitable foraging habitat includes all forests, wetlands, waterbodies, and watercourses buffered by 40 m to include edge habitats. The provincial recovery strategy recommends the inclusion of meadows, thickets, savannahs, and old fields within 40 m of forests for foraging habitat (Humphrey and Fotherby 2019). The Teeswater River system, active farms, and other lands in the surrounding area could provide foraging value for bats, which may be investigated in future years.

6.3.1.1 Significant Wildlife Habitat

Based on ecosite analyses, Bat Maternity Colonies could potentially occur throughout the RSA_{BAT}. A detailed discussion of candidate SWH within the LSA_{TER} is available in Appendix C, Chapter 1. Bat species of conservation concern are also discussed in Section 6.3.2.1 below.

6.3.2 Presence and Distribution of Species of Interest

6.3.2.1 Species of Conservation Concern

The NHIC and GBIF datasets do not include any bat observations within the RSA_{BAT}. However, in studies conducted by NBCP researchers from 2020 – 2022, acoustic monitoring northwest of the community of Teeswater detected eastern red bat, silver-haired bat, hoary bat, and restricted species M1 across multiple sampling locations, including inside and outside of the RSA_{BAT} (Thorne et al. 2021, Sparrow-Scinocca et al. 2022, Thorne 2023). Eastern red bat, silver-haired bat, and hoary bat were all detected within the AOI. Restricted species M2 and M3 were also detected at one location each in 2021 (Sparrow-Scinocca et al. 2022).

In 2020, restricted bat species M1 was observed by NBCP researchers in the greatest numbers at a location inside the RSA_{BAT}, and the location also exhibited the most consistent nightly activity. Nightly activity peaked in late August and early September (Thorne et al. 2021). In addition, as the first observations of restricted species M1 consistently occurred 30 min after sunset in July, Thorne et al. (2021) suggested that a maternity colony may be present nearby (see Section 6.3.1 for more information). Also in 2020, there were a high number of detections of hoary bat (Thorne et al. 2021). Hoary bats were most active in July, while eastern red bat and silver-haired bat activity was higher in August and September.

In 2021 and 2022, NBCP researchers monitored three locations in the RSA_{BAT}. NBCP researchers detected eastern red bat, hoary bat, silver-haired bat, and restricted species M1 at all three locations monitored. Like the results in 2020, detections of restricted species M1 in 2021 consistently occurred 30 min after sunset, suggesting a maternity colony may be nearby. In 2021, a single recording of restricted species M3 occurred at two locations in the RSA_{BAT}, and restricted species M2 was detected at one site. Preliminarily, these recordings appear to be of sufficient quality to be reliable (Sparrow-Scinocca et al. 2022).

NBCP researchers used the acoustic monitoring information from 2020 and 2021 to guide selection of areas for trap and release in 2021. Based on this information, NBCP researchers successfully caught and affixed a radio transmitter to one adult female of restricted species M1. Information on habitat data collected from tracking this individual is included in Section 6.3.1.1. In addition to the radio-tracked adult female, NBCP researchers captured (but did not track) one adult male, seven additional adult females, and one juvenile female of restricted species M1 at a site inside the RSA_{BAT}. The presence of juveniles in July is evidence that restricted species M1 is reproducing in the area (Sparrow-Scinocca et al. 2022).

6.3.2.2 *Species of Interest to Stakeholders and Rights-Holders, and Species of Potential Socio-economic Importance*

At the time of writing the 2023 BIS Baseline Report (September 2023), Zoetica does not have sufficient information to identify the bat species of interest to stakeholders and rights-holders in the SON-South Bruce siting area. Future iterations of the BIS Baseline Report will include details of the presence and distribution of any species of interest identified from further engagement.

6.3.3 Additional Baseline Data to Inform the IA

6.3.3.1 *Community Characterization*

In addition to the species listed in Section 6.3.2.1, NBCP acoustic surveys in 2020 – 2022 detected big brown bat across the three sampling locations in the RSA_{BAT} (Thorne et al. 2021, Sparrow-Scinocca et al. 2022). In 2021, NBCP researchers captured and released a total of 35 big brown bats across three netting locations in the RSA_{BAT} (Sparrow-Scinocca et al. 2022). Some of the big brown bats captured in June were more heavily pregnant than expected for that time of year. In the 2021 Bat Activities Report, Sparrow-Scinocca et al. (2022) speculate that bats emerged earlier in the area compared to other parts of their range. Five of the captured big brown bats were juveniles, providing evidence that bats were reproducing in the area (Sparrow-Scinocca et al. 2022). Bat species were not detected incidentally during field studies in 2022, nor were bats species detected with eDNA.

6.4 Discussion

To meet the requirements of the TISG Template and the general objectives outlined in Section 1.1, the BIS Baseline Report presents the results of desk-based bat habitat and species observations and preliminary results from Tier 1 habitat assessments and incidental observations. To date, seven bat species have been detected within the RSA_{BAT}, including six species of conservation concern (see Section 6.3.2.1). At the time of writing the 2023 BIS Baseline Report (September 2023), one additional restricted bat species was identified as potentially occurring in the SON-South Bruce siting area but was not detected in the NBCP programs within the BIS study areas.

Bat monitoring conducted by the NBCP provided data regarding bat presence from acoustic monitoring, radiotracking, and mist netting (Thorne et al. 2021, Sparrow-Scinocca et al. 2022). NBCP acoustic surveys detected several bat species, including SAR (Sparrow-Scinocca et al. 2022). In addition, NBCP researchers concluded that it is highly possible that the tagged individual of restricted species M1 is roosting in a maternity colony located in a building (Sparrow-Scinocca et al. 2022). Although bat maternity colonies inside buildings are not considered to be SWH (OMNRF 2015), the habitat of Threatened or Endangered bat species would be protected under the Ontario *Endangered Species Act (ESA)*. Reproductive adult females of restricted species M1 are known to both have high fidelity to maternity roosting sites as well as use multiple roosts during one maternity season (Humphrey and Fotherby 2019). To date, candidate SWH has been identified for Bat Maternity Colony in the AOI, LSA_{TER}, and RSA_{BAT}. A detailed discussion of SWH is available in Appendix C, Chapter 1.

If the SON-South Bruce siting area is selected for additional baseline investigations for the Project, Tier 2 studies will aim to characterize bat community composition more thoroughly within the AOI, LSA_{TER}, and RSA_{BAT}, and may include visual observations and acoustic monitoring. Additional datasets, such as the North American Bat Monitoring Program (NABat) and the Québec Centre for Biodiversity Science's (QCBS) Neighbourhood Bat Watch, will be investigated and incorporated into baseline data maps in future years of the BIS baseline program, where possible. Additional Tier 2 studies may be designed based on results and needs identified from Tier 1; for example, information about candidate SWH may be used to help design Tier 2 field surveys to evaluate candidate maternity colony and roost sites.

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APPENDIX A – SCIENTIFIC NAMES

Table A-1. Scientific names for species mentioned in this current Chapter 4 (Mammals).

Common Name	Scientific Name
Ungulates	
White-tailed Deer	*Odocoileus virginianus*
Pig (domestic and feral)	*Sus scrofa*
Carnivores	
Coyote	*Canis latrans*
Eastern Wolf	*Canis lupus lycaon*
Fisher	*Pekania pennanti*
Canada lynx	*Lynx canadensis*
Cougar (Eastern population)	*Puma concolor couguar*
American Badger (*jacksoni* subspecies)	*Taxidea taxus jacksoni*
Gray Fox	*Urocyon cinereoargenteus*
Black Bear	*Ursus americanus*
Red Fox	*Vulpes vulpes*
Small Terrestrial Mammals	
Short-tailed Shrew	*Blarina brevicauda*
Northern Flying Squirrel	*Glaucomys sabrinus*
Southern Flying Squirrel	*Glaucomys volans*
Snowshoe Hare	*Lepus americanus*
Meadow Vole	*Microtus pennsylvanicus*
Woodland Vole	*Microtus pinetorum*
Southern Red-backed Vole	*Myodes gapperi*
Deer Mouse	*Peromyscus maniculatus*
Raccoon	*Procyon lotor*
Eastern Mole	*Scalopus aquaticus*
Eastern Gray Squirrel	*Sciurus carolinensis*
Eastern Chipmunk	*Tamias striatus*
American Red Squirrel	*Tamiasciurus hudsonicus*
Semi-Aquatic Mammals	
American Beaver	*Castor canadensis*
Star-nosed Mole	*Condylura cristata*
North American River Otter	*Lontra canadensis*
American Mink	*Neogale vison*
Muskrat	*Ondatra zibethicus*
American Water Shrew	*Sorex palustris*
Bats	
Big Brown Bat	*Eptesicus fuscus*
Silver-haired Bat	*Lasionycteris noctivagans*
Eastern Red Bat	*Lasiurus borealis*
Hoary Bat	*Lasiurus cinereus*
Eastern Small-footed Myotis	*Myotis leibii*
Little Brown Myotis	*Myotis lucifugus*
Northern Myotis	*Myotis septentrionalis*
Tri-colored Bat	*Perimyotis subflavus*

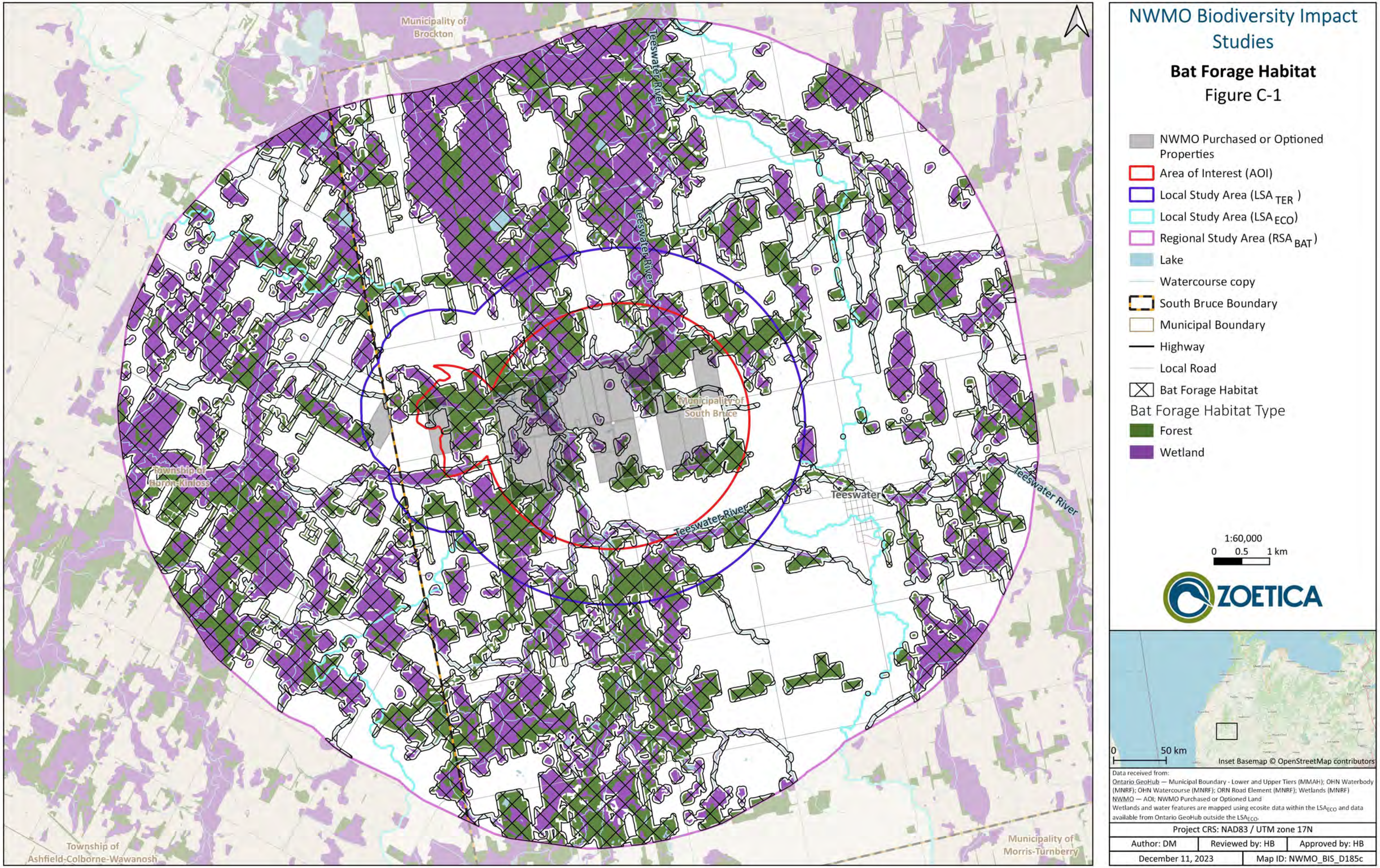
APPENDIX B – INCIDENTAL OBSERVATIONS AND DETECTIONS OF MAMMAL SPECIES

Table B-1. Incidental observations of mammals during TEM, AHM, and eDNA field surveys in 2022, and detections of mammals with eDNA in 2022.

Common Name	Scientific Name	Species of Interest			Method of Detection		eDNA Study Area of Detection[1, 2]		
		SAR	Rare	Introduced or Invasive	Incidental Observation	eDNA	AOI	LSA_{AQU}	Outside LSA_{AQU}
Ungulates									
White-tailed Deer	*Odocoileus virginianus*	N	N	N	Y	N	--	--	--
Carnivores									
Coyote	*Canis latrans*	N	N	N	Y	N	--	--	--
Fisher	*Pekania pennanti*	N	N	N	Y	N	--	--	--
Small Terrestrial Mammals									
Northern Short-tailed Shrew	*Blarina brevicauda*	N	N	N	N	Y	Y	ND	ND
Meadow Vole	*Microtus pennsylvanicus*	N	N	N	N	Y	Y	Y	ND
Raccoon	*Procyon lotor*	N	N	N	Y	Y	Y	Y	Y
Eastern Chipmunk	*Tamias striatus*	N	N	N	Y	N	--	--	--
Red Squirrel	*Tamiasciurus hudsonicus*	N	N	N	Y	Y	ND	ND	Y
Semi-Aquatic Mammals									
Beaver	*Castor canadensis*	N	N	N	Y	Y	Y	Y	Y
Star-Nosed Mole	*Condylura cristata*	N	N	N	N	Y	Y	Y	ND
North American River Otter	*Lontra canadensis*	N	N	N	Y	Y	ND	Y	ND
American Mink	*Neogale vison*	N	N	N	Y	N	--	--	--
Muskrat	*Ondatra zibethicus*	N	N	N	Y	Y	Y	Y	Y

Notes:
1. Study area of detection is included if the species was detected with eDNA; eDNA cannot verify absence, therefore non-detections are specified with "ND". See Appendix E, Chapter 1 for details about eDNA sampling protocols, study areas, and results.
2. For the purposes of this table, the indicated study area excludes overlap with other study area(s) that may be encompassed within its boundaries.

APPENDIX C – MAP OF BAT FORAGING HABITAT


NWMO Biodiversity Impact Studies
Bat Forage Habitat
Figure C-1
NWMO Purchased or Optioned Properties
Area of Interest (AOI)
Local Study Area (LSA_{TER})
Local Study Area (LSA_{ECO})
Regional Study Area (RSA_{BAT})
Lake
Watercourse copy
South Bruce Boundary
Municipal Boundary
Highway
Local Road
Bat Forage Habitat
Bat Forage Habitat Type
Forest
Wetland
1:60,000
0 0.5 1 km
ZOETICA
Municipality of Brockton
Teeswater River
Municipality of South Bruce
Township of Huron-Kinloss
Teeswater
Township of Ashfield-Colborne-Wawanosh
Municipality of Morris-Turnberry
0 50 km
Inset Basemap © OpenStreetMap contributors
Data received from:
Ontario GeoHub — Municipal Boundary - Lower and Upper Tiers (MMAH); OHN Waterbody (MNRF); OHN Watercourse (MNRF); ORN Road Element (MNRF); Wetlands (MNRF)
NWMO — AOI; NWMO Purchased or Optioned Land
Wetlands and water features are mapped using ecosite data within the LSA_{ECO} and data available from Ontario GeoHub outside the LSA_{ECO}.
Project CRS: NAD83 / UTM zone 17N
Author: DM
Reviewed by: HB
Approved by: HB
December 11, 2023
Map ID: NWMO_BIS_D185c

Report (R001)

BIODIVERSITY IMPACT STUDIES – SOUTHWESTERN ONTARIO REGION: 2023 BASELINE REPORT (CHAPTER 5: HERPETOFAUNA)

December 13, 2023

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GLOSSARY AND ABBREVIATIONS

AHM	Aquatic Habitat Mapping
ANSI	Area of Natural and Scientific Interest
AOI	Area of Interest
BIS	Biodiversity Impact Studies
BPD	Biodiversity Impact Studies – Southwestern Ontario Region: Baseline Program Design
BPPA	Biodiversity Impact Studies – Southwestern Ontario Region: Best Practices and Preferred Approach
BV	Biodiversity Value. The biotic environmental components that will be considered for study within the Project's Biodiversity Impact Studies. A subset of biodiversity values will ultimately be scoped into the biodiversity Impact Assessment as Valued Components.
CNSC	Canadian Nuclear Safety Commission
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
Critical habitat	Habitat that is necessary for the survival or recovery of a listed wildlife species and that is identified as the species' critical habitat in the recovery strategy or in an action plan for the species (*Species at Risk Act*, S.C. 2002, c. 29). Identification of critical habitat is not a required component of a recovery strategy under the Ontario *Endangered Species Act*. However, the approach used to identify critical habitat, in conjunction with the best scientific information available, is recommended when developing a habitat regulation. A habitat regulation is a legal instrument under the *ESA* that prescribes an area that will be protected as the habitat of the species.
ECCC	Environment and Climate Change Canada
Ecoregion	Second highest level of the ELC hierarchy (Crins et al. 2009). Large geographic areas primarily identified by sub-continental climatic regimes and bedrock geology.
Ecosite	Second lowest level of the ELC hierarchy (Crins et al. 2009). The land within an ecosite will generally contain similar substrate and vegetation.
Ecosite classification dataset	The dataset of ecosite classification created for the BIS using South Western Ontario Orthophotography Project (SWOOP) 2020 imagery.
ECS	Ecoregional Criterion Schedule
eDNA	Environmental DNA
ELC	Ecological Land Classification
Environmentally significant area	With respect to habitat for terrestrial wildlife, the TISG Template requires a description of environmentally significant areas, which include National Parks, Areas of Natural and Scientific Interest, National Wildlife Areas, World Biosphere Reserves or UNESCO Natural World Heritage Sites (IAAC 2020, NDMNRF 2021).
EO	Element Occurrence. An EO is an area of land and/or water where a species or vegetation community is or was present. EOs represent areas important to the conservation of a species or vegetation community. In Ontario, the NHIC generates each EO from one or

	more observations, based on international EO specifications developed by NatureServe (NDMNRF 2021).
ESA	Ontario *Endangered Species Act*
GBIF	Global Biodiversity Information Facility
GIS	Geographic Information System
GSWC	Greenock Swamp Wetland Complex
Herpetofauna	The reptiles and amphibians of a particular region, habitat, or geological period.
IA	Impact Assessment
LSA	Local Study Area LSA_{TER} = Terrestrial Local Study Area LSA_{AQU} = Aquatic Local Study Area LSA_{ECO} = Local Study Area for Ecosystem Function and Services
MECP	Ontario Ministry of the Environment, Conservation and Parks
MNRF	Ontario Ministry of Natural Resources and Forestry
NHIC	Ontario Natural Heritage Information Centre
NWMO	Nuclear Waste Management Organization
ORAA	Ontario Reptile and Amphibian Atlas
Rights-holders	First Nation and Métis communities who have asserted and or hold recognized treaty and/or Indigenous rights and whose traditional territories include the project location.
Restricted species/element	Restricted species are commercially exploited or sensitive to disturbance; these species could be harmed if data are not stored and shared securely.
RSA	Regional Study Area RSA_{HRP} = Regional Study Area for Terrestrial Herpetofauna $RSA_{HRP-AQU}$ = Regional Study Area for Aquatic or Semi-aquatic Herpetofauna
SAR	Species at Risk. For the purposes of the BIS, SAR include species listed under Schedule 1 of the federal *Species at Risk Act* (*SARA*), species designated as Species at Risk in Ontario (SARO) and listed under the provincial *Endangered Species Act, 2007* (*ESA*), and species assessed as Extirpated, Endangered, Threatened, or Special Concern by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC).
SARA	Federal *Species at Risk Act*
SARO	Species at Risk in Ontario
SON	Saugeen Ojibway Nation
SON-South Bruce siting area	Used to describe the broader area surrounding the defined area within which the Project may be located. The SON-South Bruce siting area is the general area surrounding the Municipality of South Bruce and includes the traditional territory of Saugeen Ojibway Nation (SON) in southwestern Ontario.
SOP	Standard Operating Procedure

Species of conservation concern	Includes provincially and/or federally listed SAR (Extirpated, Endangered, Threatened, Special Concern) and provincially rare (SRANK S1, S2, S3, SH) species. Regionally rare species may also be scoped in if identified by stakeholders and/or rights-holders as VCs.
Species of interest	Includes species of conservation concern, culturally important species, indicator species, and invasive species (where applicable).
SRANK	Subnational Rank. SRANK is the conservation status of a species or vegetation community within a particular province, territory, or state. In Ontario, the NHIC assigns SRANKs using the best available information and considering factors such as abundance, distribution, population trends, and trends (NDMNRF 2021). Species assigned S1 (Critically Imperiled), S2 (Imperiled), S3 (Vulnerable), and SH (Possibly Extirpated) are considered provincially rare by the NHIC. See the NatureServe website for more information: https://www.natureserve.org/nsexplorer/about-the-data/statuses/conservation-status-categories
SWH	Significant Wildlife Habitat. Defined in the Ontario Provincial Policy Statement, 2020 as: *Wildlife habitat* – areas where plants, animals and other organisms live, and find adequate amounts of food, water, shelter and space needed to sustain their populations. Specific wildlife habitats of concern may include areas where species concentrate at a vulnerable point in their annual life cycle; and areas which are important to migratory and non-migratory species. *Significant* – in regard to wildlife habitat, ecologically important in terms of features, functions, representation or amount, and contributing to the quality and diversity of an identifiable geographic area or natural heritage system. Candidate SWH are areas that meet the ELC ecosite code(s) and/or habitat criteria outlined in the SWH ecoregional criterion schedule (ECS). Confirmed SWH are areas that meet the defining criteria outlined in the SWH ECS. Detailed field investigations are usually needed to confirm SWH.
TEM	Terrestrial Ecosystem Mapping
The Project	The Adaptive Phased Management Project is the Deep Geological Repository and other required infrastructure for the safe, long-term management of Canada's used nuclear fuel.
TISG	Tailored Impact Statement Guidelines. 'TISG Template' refers to the Tailored Impact Statement Guidelines Template (generic version) (IAAC 2023).
UNESCO	United Nations Educational, Scientific and Cultural Organization
VC	Valued Component. For impact assessments of designated projects under the *Impact Assessment Act*, the Agency's Glossary of Terms defines VCs as "environmental, health, social, economic or additional elements or conditions of the natural and human environment that may be impacted by a proposed project and are of concern or value to the public, Indigenous peoples, federal authorities and interested parties. Valued components may be identified as having scientific, biological, social, health, cultural, traditional, economic, historical, archaeological and/or aesthetic importance."

1.0 INTRODUCTION

Herpetofauna consist of amphibians (e.g., frogs, toads, salamanders, newts) and reptiles (e.g., turtles, snakes, lizards). Ontario is home to 63 species of herpetofauna, with the largest portion of species occupying the southern-most parts of the province. Amphibians and reptiles are recognized as especially sensitive to environmental changes and as species that largely utilize both terrestrial and aquatic habitats to complete their life cycles. This, in turn, makes them good candidates for indicator species of well-managed, clean, and functional wildlife habitat.

The Canadian Nuclear Safety Commission's (CNSC) *Guidance on Deep Geological Repository Site Characterization* includes wildlife, terrestrial habitat, and species at risk (SAR) as elements of terrestrial ecology that should be characterized in the Area of Interest (AOI) (CNSC 2018b). In addition, the Tailored Impact Statement Guidelines Template (generic version) ('TISG Template')[1] identifies terrestrial wildlife and their habitat and SAR as elements of the biophysical environment that could be scoped into the Impact Assessment (IA) as Valued Components (VCs), which would require a detailed baseline description and project effects assessment in the impact statement (IAAC 2023). With respect to the aquatic habitat of semi-aquatic species (such as amphibians, turtles, and gartersnakes), the characterization of fish habitat (see Chapter 8) will also serve to describe the baseline conditions for these herpetofauna. A full list of regulatory requirements pertaining to biodiversity is available in Appendix E of the *Biodiversity Impact Studies – Southwestern Ontario Region: Best Practices and Preferred Approach* (BPPA) Report (Zoetica 2021).

Herpetofauna that are considered biodiversity values (BVs) for the Adaptive Phased Management Project's (hereafter, 'the Project') Biodiversity Impact Studies (BIS) include: species that are indicators of ecosystem health, species of conservation concern (including SAR and provincially rare species), and species of interest to stakeholders and rights-holders. Species of conservation concern, along with culturally important and invasive species (where applicable), are currently included as "species of interest" for all BVs for the purposes of the BIS. For the current Chapter 5 (Herpetofauna) of this 2023 BIS Baseline Report, mapping is limited to SAR and provincially rare species. Although herpetofauna were mentioned during engagement, the cultural importance of species cannot be ascertained by Zoetica™ at this time, as this task requires further coordination with other disciplines studying the potential impacts of the Project. A review of engagement conducted to date that is of relevance to the BIS is presented in Appendix B of the BPPA Report (Zoetica 2021). There are currently no herpetofauna species classified as invasive in Ontario. The scope of species of interest for BIS baseline reporting will be expanded in future years to include culturally important and indicator species when more information is gathered through Tier 2 studies and engagement.

1.1 General Objectives

The general objectives of herpetofauna studies for the BIS are to:

1. Determine the presence, distribution, and abundance of relevant Significant Wildlife Habitat (SWH) and other important habitat for select BVs, with an emphasis on:
    a. Species of conservation concern, including SAR,
    b. Species of interest and potential importance to local stakeholders and rights-holders,

[1] Please see Chapter 1 for limitations of and planned updates to the TISG Template.

   c. Indicator species;
2. Determine the potential presence and distribution of species of interest, including the select BVs listed in (1); and,
3. Provide additional baseline data to help inform the Project's biodiversity IA and mitigation measures, and to assist in the potential development of monitoring program(s) to address environmental, regulatory, and stakeholder/rights-holder concerns.

The current Chapter 5 (Herpetofauna) begins to fulfill the requirements of the TISG Template required for herpetofauna (as components of terrestrial wildlife) and their habitat (see Appendix C in the BPPA Report (Zoetica 2021)).

1.2 General Methods

1.2.1 Study Areas

The BIS study areas for herpetofauna include the AOI, terrestrial local study area (LSA_{TER}), and two regional study areas (RSA_{HRP} and $RSA_{HRP\text{-}AQU}$). Different RSAs are used depending on the life history requirements of the species or species grouping (i.e., needing terrestrial habitat only or terrestrial and aquatic). The $RSA_{HRP\text{-}AQU}$ is comprised of the outer boundaries of the RSA_{HRP} and the aquatic LSA (LSA_{AQU}). See Section 3.0 in Chapter 1 of the 2023 BIS Baseline Report and Section 5.2.8.5 of the BPPA Report (Zoetica 2021) for more details on study area descriptions and rationale.

For the Tier 1 baseline studies, desk-based ecosite classification and subsequent field verification were completed as part of Terrestrial Ecosystem Mapping (TEM) (see Appendix B, Chapter 1), and only covered the LSA for ecosystem functions and services (LSA_{ECO}). The LSA_{ECO} encompasses both the LSA_{TER} and portions of the RSA_{HRP} and $RSA_{HRP\text{-}AQU}$. Analyses involving ecosite data (e.g., to identify candidate SWH for amphibians and reptiles) were thus limited to the LSA_{ECO}; however, mapping of species and important wildlife habitat records extended into the RSAs.

1.2.2 Collation of Species Observations and Habitat Data

Zoetica began desk-based investigations of herpetofauna by identifying species of interest that could potentially occur within the BIS study areas. Refer to Appendix D and Section 3.1 of the BPPA Report (Zoetica 2021) for a comprehensive list of SAR, including at-risk herpetofauna species, and the methods used to compile this list. Provincially rare species are indicated by their subnational rank (SRANK; S1, S2, S3, SH) and tracked by the Ontario Natural Heritage Information Centre (NHIC).[2]

Zoetica proceeded with desk-based research and mapping by collating existing data from government, citizen science, and other biodiversity databases. For this 2023 BIS Baseline Report, data sources for verified species and habitat records included the NHIC, Ontario Ministry of Natural Resources and Forestry (MNRF), and the Global Biodiversity Information Facility (GBIF). As these datasets periodically pull observations from other biodiversity-related projects and programs (e.g., iNaturalist, Canadian Museum of Nature Amphibian and Reptile Collection), they were deemed to be a good starting point to describe

[2] For the purposes of this BIS Baseline Report chapter, conservation statuses described in text for at-risk species refer to their Species at Risk in Ontario (SARO) listings unless otherwise indicated. Conservation statuses are from the NHIC's Ontario species list, current to March 1, 2023, and updated for any discrepancies with provincial and federal SAR listings up to August 15, 2023. As such, species and status listings may differ from those presented in Zoetica's 2021 BPPA Report (Zoetica 2021).

the biodiversity of herpetofauna species and their habitats that are found or are likely to be found in the BIS study areas.

In addition, Zoetica investigated findings from the previous preliminary environmental studies conducted for the Project in the Saugeen Ojibway Nation (SON)-South Bruce siting area (Tulloch Environmental 2020, 2021). Spatial data collected for these environmental studies were not incorporated into Zoetica's baseline maps; however, Tulloch Environmental's 2020 and 2021 reports and maps are available upon request from the NWMO. **Table 1-1** summarizes the datasets, data layers, and reports investigated and analyzed for herpetofauna species observations and habitat data for the 2023 BIS Baseline Report.

Table 1-1. Spatial datasets and reports analyzed for herpetofauna for the 2023 BIS Baseline Report.

Data Source / Owner	Dataset	Data Format	Date Accessed / Received	Contains relevant[1] data?
Tulloch Environmental *Preliminary environmental studies for Project*	July 2020 Site Reconnaissance (Tulloch Environmental 2020)	Unpublished Report	10/2020	Y
	October 2020 Natural Heritage Features (Tulloch Environmental 2021)	Unpublished Report	04/2021	Y
Ontario Natural Heritage Information Centre (NHIC)	Species Occurrences	Shapefile	12/2020	Y
	Wildlife Concentration Area Observation	Shapefile	12/2020	N
Ontario Ministry of Natural Resources and Forestry (MNRF)	Wildlife Activity Site	Shapefile	12/2020	N
	Wildlife Activity Area	Shapefile	12/2020	N
	Greenock Swamp ANSI Report (Johnson 1994a, 1994b)	Reports	10/2020	Y
Global Biodiversity Information Facility (GBIF)	Species Occurrences	Comma Separated Values	10/2021	Y
Environment and Climate Change Canada (ECCC) and Ontario Ministry of the Environment, Conservation and Parks (MECP)[2]	Federal and Provincial SAR Recovery Strategies	Reports	Various	Y

Notes:

1. Zoetica determined dataset relevance based on geographic and temporal relevance, as well as relevance to herpetofauna. For example, data that were not within the relevant BIS study areas, data that were too old to be considered relevant, or data that did not include records of amphibian or reptile species were labelled "N" for not containing relevant data.
2. SAR recovery strategies are published by the ECCC and MECP but authors may differ. Refer to Appendix D of the BPPA Report (Zoetica 2021) for a full list of potentially occurring SAR that had provincial and/or federal recovery strategies available at the time of writing the BPPA Report (note: new documents are continually posted on the SARO website and *SARA* Public Registry). The most updated versions of the recovery strategies for relevant species were reviewed and cited in this 2023 Baseline Report.

A full list of the species mentioned in this report, including common and scientific names, is available in **Table A-1** in Appendix A. All map figures are presented in Appendix B.

Additional datasets, such as the Ontario Reptile and Amphibian Atlas (ORAA)[3], will be investigated and incorporated into baseline data maps in future years of the BIS baseline program, where possible.

1.2.3 Tier 1 Studies

Field studies conducted in 2022 focused on collecting Tier 1 foundational habitat data and species detections through environmental DNA (eDNA) metabarcoding studies and incidental observations. Detailed methods for the Tier 1 studies are available in the *Biodiversity Impact Studies – Southwestern Ontario Region: Baseline Program Design* (BPD) Report and associated Standard Operating Procedures (SOPs) (Zoetica 2022). In addition to the utility of each Tier 1 study outlined below for understanding herpetofauna and herpetofauna habitat in the BIS study areas, incidental observations collected during the terrestrial and aquatic field studies are also informative in describing biodiversity.

1.2.3.1 Terrestrial Ecosystem Mapping

TEM work completed to date is described in Appendix B, Chapter 1. The ecosite classification dataset resulting from TEM work was used for desk-based identification of candidate SWH.

1.2.3.2 Identification of Candidate SWH

Desk- and field-based candidate SWH identification work completed to date is described in Appendix C, Chapter 1. SWH types of relevance to herpetofauna are outlined in Sections 2.0 and 3.0 of this report.

1.2.3.3 Aquatic Habitat Mapping

Aquatic Habitat Mapping (AHM) work completed to date is described in Appendix D, Chapter 1. Although AHM is focused on characterization of fish habitat, these data will also help identify important aquatic habitats for turtles and amphibians.

1.2.3.4 Environmental DNA Metabarcoding

eDNA metabarcoding studies completed to date are described in Appendix E, Chapter 1. The two vertebrate primers used for eDNA metabarcoding studies were primarily intended to capture aquatic and semi-aquatic species such as fish, amphibians, and turtles (see Section 2.6 of the BPD Report (Zoetica 2022)).

1.2.4 Mapping Considerations

To protect sensitive species and ecosystems, NHIC spatial data and 2022 field data pertaining to provincially tracked (at-risk and rare) species are represented by a 1 km grid, rather than a point or polygon, as per the NHIC's Sensitive Data Location Standards (NHIC n.d.). Descriptive reporting also follows sensitivity standards and is not detailed enough to allow for precise geolocation.

GBIF data were limited to observations from 1970 onward as older observations were considered historic and not as reliable. See also Appendix A, Chapter 1 for data quality scoring. When there were multiple entries with a count of one at the same location, Zoetica assumed the entries were all the same individual to avoid double-counting and erroneously reporting that multiple individuals were present.

[3] Zoetica explored the publicly available ORAA webmap to help identify herpetofauna species potentially occurring in the SON-South Bruce siting area; however, the full spatial dataset was not available for use in baseline data analyses or reporting.

Incidental observations were recorded during various Tier 1 baseline field programs and were noted on different data forms (Incidental Observation Form or noted in TEM, AHM, or eDNA survey forms). Incidental observations varied in method of observation (audio, visual, etc.) and life history stage of organisms, and may have been recorded in transit to a site and thus not associated with habitat data. As well, expertise in species identification may have varied among field contractors working on different field programs. Thus, not all pertinent information may have been available (e.g., observation type, activity, demographics) or collected in a directly comparable manner (e.g., quantity). For mapping and interpretation purposes, Zoetica defaulted to 'unspecified' observation type, count of one individual, and adult individuals unless otherwise indicated. Zoetica also assumed one individual when a singular observation (e.g., "frog") was recorded in the field notes, and more than one individual if plural observations (e.g., "frogs") were recorded.

For both desk- and field-based species observation data, only the species and locations (masked for sensitive data, where needed) are presented on the maps in Appendix B. Additional information about count, observation type, and source type (i.e., which Tier 1 program the incidental observation came from) is presented in the supplemental table for each map in Appendix B.

2.0 AMPHIBIANS

2.1 Introduction

Amphibians include frogs, toads, salamanders, and newts. Amphibian species potentially occurring in the SON-South Bruce siting area, based on range maps and existing observations, are presented in Table 5-26 of the BPPA Report (Zoetica 2021). This list includes three at-risk species (western chorus frog, Jefferson salamander, unisexual *Ambystoma* [Jefferson salamander dependent population]) and four species that could be used as indicators of forest and/or wetland health (McLaren et al. 1998) and carried forward to the Project's IA (eastern newt, blue-spotted salamander, gray treefrog, and eastern red-backed salamander; see Table 5-27 in the BPPA Report (Zoetica 2021)).

Several SWH types apply to amphibians. Based on the SWH Ecoregional Criterion Schedule for Ecoregion 6E (hereafter '6E ECS') (OMNRF 2015), there are five amphibian-related SWH types of potential relevance to the SON-South Bruce siting area:

- Amphibian Breeding Habitat (Woodland)
- Amphibian Breeding Habitat (Wetland)
- Amphibian Movement Corridors
- Seeps and Springs
- Special Concern and Rare Species

However, there are currently no Special Concern or provincially rare amphibian species expected within the BIS study areas for amphibians. Therefore, this SWH type will not be discussed further for amphibians unless species conservation statuses change over the course of the BIS baseline program. Further details about candidate SWH investigations conducted to date and rationale for inclusion (or exclusion) of SWH types listed in the 6E ECS are presented in Appendix C, Chapter 1.

2.1.1 Objectives

All general objectives listed in Section 1.1 apply to amphibians.

2.2 Methods

2.2.1 Study Areas

The BIS study areas for amphibians include the AOI, LSA_{TER}, and $RSA_{HRP\text{-}AQU}$ (see figures and descriptions in Section 3.0, Chapter 1).

2.2.2 Presence, Distribution, and Abundance of Important Habitat

Collation of both existing and Tier 1 habitat data for amphibians proceeded as described in Sections 1.2.2 and 1.2.3.

2.2.3 Presence and Distribution of Species of Interest

Collation of existing observations and Tier 1 incidental observations for amphibian species of interest proceeded as described in Sections 1.2.2 and 1.2.3. Amphibians may also be detected through eDNA metabarcoding studies (see Appendix E, Chapter 1).

2.2.4 Additional Baseline Data to Inform the IA

Species lists were compiled from desk- and field-based studies (as per Section 1.2.2 and 1.2.3) as an initial investigation into the biodiversity of amphibians in the BIS study areas.

2.3 Results

2.3.1 Presence, Distribution, and Abundance of Important Habitat

2.3.1.1 General Habitat Associations

Future Tier 2 studies aim to determine amphibian-habitat associations within the BIS study areas. Discussion of general habitat associations will be included in future BIS Baseline Reports after Tier 2 studies have been completed (if the SON-South Bruce siting area is selected for the Project).

2.3.1.2 Significant Wildlife Habitat

Various candidate SWH types of relevance to amphibians have been found throughout the AOI, LSA_{TER}, and $RSA_{HRP\text{-}AQU}$ based on ecosite matches, some or all habitat criteria being met, or records of species and/or habitat features. Of note, there is strong evidence from both TEM/SWH and AHM surveys to support confirmed SWH for Seeps and Springs, which are important feeding and drinking areas for a variety of wildlife species, including salamanders. A detailed discussion of confirmed and candidate SWH is available in Appendix C, Chapter 1.

Tier 1 AHM field studies will help identify important aquatic habitats for amphibians and refine the locations of candidate Amphibian Breeding Habitat SWH by providing ground-truthed information about wetland/waterbody size, types and abundance of cover (e.g., vegetation, logs), and incidental observations. AHM work completed to date discussed in Appendix D, Chapter 1.

2.3.1.3 Environmentally Significant Areas

Based on existing information, there are no National Parks, National Wildlife Areas, World Biosphere Reserves, or United Nations Educational, Scientific and Cultural Organization (UNESCO) Natural World Heritage Sites that may be impacted by the Project (see Section 1.3.1 in Chapter 9). However, the provincially significant Greenock Swamp Area of Natural and Scientific Interest (ANSI) and regionally significant Turnberry Swamp ANSI overlap with the BIS study areas for herpetofauna (**Figure B-1**). Amphibians and reptiles observed during the Greenock Swamp ANSI Life Science Inventory are included in **Table C-1** and **Table C-2**, respectively; and any species of interest found are presented in Sections 2.3.2 (Amphibians) and 3.3.2 (Reptiles). At the time of writing this 2023 BIS Baseline Report (September 2023), an ANSI report for Turnberry Swamp had not been made available to Zoetica.

2.3.2 Presence and Distribution of Species of Interest

2.3.2.1 Species of Conservation Concern

To date, only one amphibian species of conservation concern has been observed within the BIS study areas (**Figure B-2**; **Table B-1**). Western chorus frog (Great Lakes - St. Lawrence - Canadian Shield population) is not listed as a Species at Risk in Ontario (SARO) under the Ontario *Endangered Species Act* (*ESA*) but is considered Threatened under the federal *SARA* and has a federal recovery strategy available (EC 2015). From the GBIF dataset, western chorus frog was detected within the Greenock Swamp Wetland Complex (GSWC) in the $RSA_{HRP\text{-}AQU}$ (outside the AOI and LSA_{TER}) in late April 2018. As western chorus frogs breed in the early spring, with the peak of calling activity in April (Ontario Nature 2022), this observation may indicate the presence of breeding habitat in the area and further investigation is needed. Western chorus frog was also recorded within the Greenock Swamp ANSI, which overlaps the $RSA_{HRP-AQU}$ and northern parts of the LSA_{TER}, as part of the ANSI Life Science Inventory (Johnson 1994a).

2.3.2.2 Species of Interest to Stakeholders and Rights-Holders, and Species of Potential Socio-economic Importance

No specific amphibian species have been mentioned by stakeholders or rights-holders to date. However, certain frog species may be preferred for harvesting, as Youngblood (2017) reports that frog's legs are a meat source for local Indigenous communities in the Grey and Bruce counties. It was noted during engagement conducted for the Project that there used to be lots of frogs in the SON-South Bruce siting area, but they seem to be disappearing (see Appendix B in the BPPA Report (Zoetica 2021)). The socio-economic or socio-ecological importance of amphibian species to local communities and/or Indigenous communities will be sought through future engagement.

2.3.2.3 Indicator Species

To date, all four amphibian species used as forest indicators by the MNRF (see Section 2.1 in Chapter 5 and Table 5-27 in the BPPA Report (Zoetica 2021)) have been observed within the AOI, LSA_{TER} and/or $RSA_{HRP-AQU}$ (**Table C-1**). However, Zoetica recommends that indicator species for the purposes of the BIS be determined after more information is gathered about potential project impacts and species-habitat associations (e.g., through Tier 2 community composition studies) within the BIS study areas for herpetofauna. See Sections 4.2 and 5.2.7.1 of the BPPA Report (Zoetica 2021) for further discussion of indicator species.

2.3.3 Additional Baseline Data to Inform the IA

2.3.3.1 Community Characterization

A total of 14 amphibian species have been detected within the BIS study areas based on desk- and field-based investigations conducted to date (**Table C-1**). None of the existing GBIF observations occurred within the AOI. However, eight amphibian species were detected within the AOI through 2022 field observations and/or eDNA metabarcoding analyses: American bullfrog, American toad, eastern newt, gray treefrog, green frog, northern leopard frog, spring peeper, and wood frog. In addition, pickerel frog is a new detection for the BIS study areas; this species was observed once in the Teeswater Wetland Complex in the $RSA_{HRP-AQU}$ during 2022 field studies.

2.4 Discussion

Section 2.0 of Chapter 5 (Herpetofauna) of the 2023 BIS Baseline Report focused on desk-based analyses of amphibian habitat and species observations and preliminary results from Tier 1 terrestrial and aquatic habitat assessments and incidental observations. To date, 14 amphibian species have been detected within the AOI, LSA_{TER}, or $RSA_{HRP-AQU}$, including one at-risk species (**Table C-1**). Four species that could potentially be used as indicators of forest and/or wetland health (McLaren et al. 1998) – eastern newt, eastern red-backed salamander, gray treefrog, blue-spotted salamander – have been detected within the BIS study areas. Only two of these species, eastern newt and gray treefrog, have been observed within the AOI; however, Zoetica recommends selecting indicator species after more baseline data are collected.

Although 2022 field data for amphibians were limited to incidental observations and eDNA metabarcoding analyses (i.e., rather than targeted amphibian surveys), 10 of the 13 species known to be present in the BIS study areas through desk-based research have already been observed. Eight of these amphibian species were observed within the AOI; pickerel frog and eastern red-backed salamander were only detected within the $RSA_{HRP-AQU}$ during 2022 field studies. Only two salamanders (blue-spotted salamander and spotted salamander) and the federally at-risk western chorus frog have not been detected through these initial Tier 1 BIS field studies. Where a species has only been detected using desk-based data, caution should be taken as those data could be as old as 1970, and the conditions supporting the species' presence in the area may have changed.

Baseline data for amphibian species of conservation concern are currently limited to an existing GBIF observation from 2018 (**Figure B-2**) and the Greenock Swamp ANSI Life Science Inventory (Johnson 1994a) record of western chorus frog (Great Lakes – St. Lawrence – Canadian Shield population). Critical habitat for western chorus frog has been identified in southwestern Ontario in the federal recovery strategy; however, the nearest 10 x 10 km square is located east of Goderich, outside the $RSA_{HRP-AQU}$ (see Figure A-7 in (EC 2015)).

Candidate SWH have been identified for Amphibian Breeding Habitats (Woodland and Wetlands), Amphibian Movement Corridors, and Seeps and Springs within the AOI, LSA_{TER}, and $RSA_{HRP-AQU}$. Of note, there are likely confirmed Seeps and Springs SWH within the AOI and LSA_{TER}. Large groups of green frogs and wood frogs were observed during 2022 field studies, especially in the northern portion of the GSWC, which may suggest nearby breeding ponds and/or migration routes. A detailed discussion of SWH is available in Appendix C, Chapter 1.

2.4.1 Next Steps

If the SON-South Bruce siting area is selected for the Project, Tier 2 studies will aim to characterize amphibian biodiversity more thoroughly within the BIS study areas. Refer to Section 5.2.8 of the BPPA Report (Zoetica 2021) for more information. Study methods may include ground- and aquatic-based visual encounter surveys (the latter of which includes egg mass surveys), supplemented with drift fences, auditory surveys, and aquatic traps, as needed. Autonomous song meters continuously deployed for bird studies in wetland habitats will also capture calling amphibians. Confirmation of candidate SWH (described in Appendix C, Chapter 1) will focus on areas within the extent of direct and indirect project impacts (i.e., AOI and LSA_{TER}).[4] In addition, further discussions with knowledgeable stakeholders and rights-holders will help determine the locations of sensitive habitats for amphibians. However, access limitations will continue to be a factor in determining which areas can be surveyed. The NWMO continues to engage with local landowners to gain permission to access their properties. Zoetica is providing input to the NWMO regarding priority locations within which they should seek access based on the baseline information collected to date.

[4] As described in Zoetica's BPPA Report (Zoetica 2021), the NWMO defined the AOI as the area within which the Project footprint will be located, and Zoetica designed the LSA_{TER} as a 1 km buffer around the AOI to capture potential indirect impacts of the Project on the terrestrial environment. The focal areas for Tier 2 studies may change depending on the Project Description (which is not yet available) and further information about potential project effects.

3.0 REPTILES

3.1 Introduction

Reptiles include snakes, lizards, and turtles. Reptile species potentially occurring in the SON-South Bruce siting area, based on range maps and existing observations, are presented in Table 5-26 of the BPPA Report (Zoetica 2021). This list includes 13 at-risk reptiles (seven turtles and six snakes) and one species that could be used as an indicator of forest health (McLaren et al. 1998) and carried forward to the Project's IA (northern ring-necked snake; see Table 5-27 in the BPPA Report (Zoetica 2021)). There are currently no provincially rare reptile species expected within the BIS study areas for reptiles.

Several SWH types apply to reptiles. Based on the 6E ECS (OMNRF 2015), there are four reptile-related SWH types of potential relevance to the SON-South Bruce siting area:

- Turtle Wintering Areas
- Turtle Nesting Areas
- Reptile Hibernaculum
- Special Concern and Rare Species

Further details about candidate SWH investigations conducted to date and rationale for inclusion (or exclusion) of SWH types listed in the 6E ECS are presented in Appendix C, Chapter 1.

3.1.1 Objectives

All general objectives listed in Section 1.1 apply to reptiles.

3.2 Methods

3.2.1 Study Areas

The BIS study areas for reptiles include the AOI, LSA_{TER}, the RSA_{HRP} for terrestrial species, and the $RSA_{HRP\text{-}AQU}$ for species that have aquatic life history stages, such as turtles and gartersnakes (see figures and descriptions in Section 3.0, Chapter 1).

3.2.2 Presence, Distribution, and Abundance of Important Habitat

Collation of existing habitat data and collection of Tier 1 habitat data for reptiles proceeded as described in Sections 1.2.2 and 1.2.3.

3.2.3 Presence and Distribution of Species of Interest

Collation of existing observations and Tier 1 incidental observations for reptile species of interest proceeded as described in Sections 1.2.2 and 1.2.3.

3.2.4 Additional Baseline Data to Inform the IA

Species lists were compiled from desk- and field-based studies (as per Section 1.2.2 and 1.2.3) as an initial investigation into the biodiversity of reptiles in the BIS study areas.

3.3 Results

3.3.1 Presence, Distribution, and Abundance of Important Habitat

3.3.1.1 General Habitat Associations

Future Tier 2 studies aim to determine reptile-habitat associations within the BIS study areas. Discussion of general habitat associations will be included in future BIS Baseline Reports after Tier 2 studies have been completed (if the SON-South Bruce siting area is selected for the Project).

3.3.1.2 Significant Wildlife Habitat

Various candidate SWH types of relevance to reptiles have been found throughout the AOI, LSA_{TER}, and RSA_{HRP} or $RSA_{HRP\text{-}AQU}$ based on ecosite matches, some or all habitat criteria being met, or records of species and/or habitat features. Of note, the NHIC has mapped habitat for snapping turtle (Special Concern) within the BIS study areas, and Turtle Nesting Areas may be present along the Teeswater River within the AOI. A detailed discussion of candidate SWH is available in Appendix C, Chapter 1. Special Concern reptile species are also discussed in Section 3.3.2.1.

During previous preliminary environmental studies conducted for the Project, Tulloch Environmental suggested that abandoned farmsteads/homesteads within the AOI could support common snake species but are unlikely to support SAR (Tulloch Environmental 2020, 2021). The field ecologists also assessed a farmstead as being “satisfactory” as a snake hibernaculum; however, as the structure was only recently vacated at the time of their survey, they did not believe the habitat would qualify as candidate SWH (Tulloch Environmental 2020, 2021).

Tier 1 AHM field studies may also help identify important aquatic habitats for turtles. For example, AHM data could help refine the locations of candidate Turtle Wintering Area SWH by providing ground-truthed habitat information (e.g., wetland/waterbody/watercourse size, depth, flow, substrate, dissolved oxygen) and incidental observations. AHM work completed to date discussed in Appendix D, Chapter 1.

3.3.1.3 Critical Habitat and Environmentally Significant Areas

Two Endangered turtle species, the spotted turtle and wood turtle, have critical habitat squares that overlap the entirety of the AOI, LSA_{TER}, and $RSA_{HRP\text{-}AQU}$ (see **Figure B-1**). Whether critical habitat for spotted turtle or wood turtle occurs within the BIS study areas needs to be determined through discussions with Environment and Climate Change Canada (ECCC) and/or the Ontario Ministry of Environment, Conservation and Parks (MECP). Both spotted turtle and wood turtle have federal recovery strategies available (wherein critical habitat is identified) (ECCC 2018, 2020), as well as provincial recovery strategies (OWTRT 2010, MECP 2019) and government response statements (MECP 2010, 2020). There is also a habitat regulation (O. Reg. 242/08) under the Ontario *ESA* for the wood turtle; however, it does not currently apply to areas within the County of Bruce.

3.3.2 Presence and Distribution of Species of Interest

3.3.2.1 Species of Conservation Concern

To date, four reptile species of conservation concern have been observed within the AOI, LSA_{TER}, RSA_{HRP} and/or $RSA_{HRP\text{-}AQU}$ (**Table 3-1**), all of which are SAR. No provincially rare reptiles have been observed within the BIS study areas.

Table 3-1. Summary list of reptile species of interest recorded within the AOI, LSA_{TER}, and RSA_{HRP} or $RSA_{HRP-AQU}$.

Common Name	Species of Interest[1]			Method of Detection			BIS Study Area[2]		
	SAR	Prov. Rare	Engage.	Desk-based	2020 Studies[3]	2022 Field Incidental	AOI	LSA_{TER}	RSA_{HRP} / $RSA_{HRP-AQU}$
Eastern Milksnake	Y	-	-	Y	-	Y	**Y**	-	Y
Eastern Ribbonsnake	Y	-	-	Y	-	Y	-	-	Y
Midland Painted Turtle	Y	-	-	Y	-	Y	**Y**	Y	Y
Snapping Turtle	Y	-	-	Y	-	Y	Y	Y	Y

Notes:
1. Species of conservation concern (at-risk and provincially rare) and species mentioned during engagement are noted, where applicable.
2. For the purposes of this table, the indicated study area excludes overlap with other study area(s) that may be encompassed within its boundaries. Cells shaded grey and with bold font indicate new detections in the study area based on 2022 field studies (i.e., not previously detected in the study area through desk-based research). For species of conservation concern, the study area(s) of field observations and NHIC records are based on overlap with the 1 km grid square, not the actual point or polygon location.
3. Data were collated from the previous preliminary environmental field studies conducted in July and October 2020 by Tulloch Environmental at boreholes 1 and 2 within the AOI (Tulloch Environmental 2020, 2021).

During 2022 field studies, midland painted turtle, eastern milksnake, and potentially snapping turtle were observed within the AOI (**Figure B-3**; **Table B-2**); the latter two species had not been previously reported in the AOI based on existing datasets. Midland painted turtle and eastern milksnake are not SARO-listed but these species are considered Special Concern under the federal *SARA*. The incidental field observations of snapping turtle, including remnants of suspected snapping turtle eggs (discussed further as candidate SWH in Section 4.3.4 of Appendix C, Chapter 1), corroborate important habitat for snapping turtle known from existing datasets: the NHIC has designated a large area encompassing five Provincially Significant Wetlands – Kinloss Creek and Greenock Swamp, Teeswater, Dickies Creek, and Wingham Wetland Complexes – and other wetlands as a "Verified extant (viability not assessed)" Element Occurrence (EO) for snapping turtle (**Figure B-4**). The NHIC 1 km grids for snapping turtle habitat overlap almost the entire AOI and LSA_{TER}, and the majority of the $RSA_{HRP-AQU}$. This species was not observed outside the AOI during 2022 field studies; however, existing GBIF records show the presence of snapping turtle in various parts of the $RSA_{HRP-AQU}$ outside the LSA_{TER} (**Figure B-4**; **Table B-3**).

The GBIF dataset includes reports of eastern milksnake at various locations throughout the RSA_{HRP}. In addition, eastern ribbonsnake (Great Lakes population; Special Concern) has been recorded near the Wingham Wetland Complex in the southern part of the RSA_{HRP} (GBIF observation; **Figure B-4**) and in the central part of the GSWC (2022 field observation; **Figure B-3**). Finally, midland painted turtle was observed at Meyer Lake near the northern boundary of the $RSA_{HRP-AQU}$ during 2022 field studies (**Figure B-3**).

Zoetica's previous investigations of NHIC observation (not occurrence) data for development of the BPPA Report (Zoetica 2021)[5] found that midland painted turtle has been documented within the LSA_{TER} (Teeswater River) and $RSA_{HRP-AQU}$ (McGlinn Lake and Wraith's Lake). The three records range from

[5] At the time of writing the BPPA Report (Zoetica 2021), both NHIC observation and occurrence data were investigated. Zoetica has since received an updated version of the NHIC occurrence dataset for baseline reporting, and has requested but not yet received an updated NHIC observation dataset. Once received by Zoetica, NHIC observations will be included in future iterations of the BIS Baseline Report.

observations of "many" turtles in 1977, approximately 50 turtles in 1997, and a single individual last observed in 2017. The NHIC has designated all three records as EO Candidates. Midland painted turtle was also recorded within the Greenock Swamp ANSI during the ANSI Life Science Inventory (Johnson 1994a).

Although there are critical habitat squares indicated for spotted turtle and wood turtle that overlap with the AOI, LSA_{TER}, and $RSA_{HRP\text{-}AQU}$ (see Section 3.3.1.3 and **Figure B-1**), there were no EOs for either SAR in the NHIC dataset made available to Zoetica. However, spotted turtle and wood turtle are considered restricted species/elements in terms of sharing and presenting spatial data, and it could be that these highly sensitive data are obscured to avoid increasing the risk of illegal collection, which has been identified as a significant threat to both species in Ontario (OWTRT 2010, MECP 2019). Nonetheless, since critical habitat identified by ECCC overlaps the BIS study areas, future Tier 2 studies (if the SON-South Bruce siting area is selected for the Project) will include surveys for these species.

3.3.2.1 Species of Interest to Stakeholders and Rights-Holders, and Species of Potential Socio-economic Importance

A number of herpetofauna species in southern Ontario are of conservation concern, including the wood turtle and spotted turtle (both Endangered) for which illegal collection has been identified as a significant threat; these and other reptiles may also be of concern to stakeholders and rights-holders. A few reptile species were mentioned during engagement conducted for the Project (see Appendix B in the BPPA Report (Zoetica 2021)). Eastern hog-nosed snake (Threatened) was mentioned as a unique species that tends to inhabit riparian habitats near new developments, and queensnake (Endangered) was also noted as having been observed within the Maitland Valley Conservation Authority's jurisdiction. Based on desk-based research and 2022 field data, neither species has been reported within the BIS study areas to date.

Engagement participants also noted that there used to be many reptiles in the SON-South Bruce siting area, but they seem to be disappearing. The socio-economic or socio-ecological importance of additional reptile species to local communities and/or Indigenous communities will be sought through future engagement. Local information on SAR presence and distribution would be invaluable for the Project's IA.

3.3.2.1 Indicator Species

To date, the northern ring-necked snake, a species used as a forest indicator by the MNRF (see Section 3.1 in Chapter 5 and Table 5-27 in the BPPA Report (Zoetica 2021)), has not been observed in the BIS study areas. Zoetica recommends that indicator species, if needed, be determined after more information is gathered about potential project impacts and species-habitat associations (e.g., through Tier 2 community composition studies) within the BIS study areas for herpetofauna. See Sections 4.2 and 5.2.7.1 of the BPPA Report (Zoetica 2021) for further discussion of indicator species.

3.3.3 Additional Baseline Data to Inform the IA

3.3.3.1 Community Characterization

Seven reptile species have been detected within the BIS study areas based on desk-based investigations conducted to date (**Table C-2**). None of the existing GBIF observations occurred within the AOI (though the extensive NHIC EO for snapping turtle overlaps the AOI). However, four reptile species – snapping turtle, midland painted turtle, eastern milksnake, and northern watersnake – were detected within the AOI through 2022 field observations.

3.4 Discussion

Chapter 5 (Herpetofauna), Section 3.0 of the 2023 BIS Baseline Report focused on desk-based analyses of reptile habitat and species observations and preliminary results from Tier 1 terrestrial and aquatic habitat assessments and incidental observations. To date, seven reptile species, including four at-risk species, have been detected within the AOI, LSA_{TER}, RSA_{HRP}, or $RSA_{HRP\text{-}AQU}$ (**Table C-2**). Critical habitats for spotted turtle and wood turtle overlap the BIS study areas (and the greater SON-South Bruce siting area); however, spatial data for these species are highly sensitive/restricted and may not have been shared with Zoetica.

Although 2022 field data for reptiles were limited to incidental observations (there were no reptile detections through eDNA metabarcoding analyses), six of the seven species known to be present in the BIS study areas through desk-based research have already been observed. Four of these reptile species, including three SAR (eastern milksnake, snapping turtle, and midland painted turtle), were observed within the AOI during 2022 field studies. Only the northern red-bellied snake, with one GBIF record in the RSA_{HRP} from 2021, has not been detected through these initial Tier 1 BIS field studies.

The NHIC has mapped an extensive EO for snapping turtle overlapping the SON-South Bruce siting area **Figure B-4**, which indicates candidate SWH for Special Concern and Rare Wildlife Species. This "Verified Extant" EO includes 169 observations of snapping turtle from 1981 to 2004. The NHIC data are supported by more recent observations from the GBIF dataset (2018-2021) and the 2022 Tier 1 BIS field studies **Figure B-3**. Of note, field surveyors found remnants of suspected snapping turtle eggs along the Teeswater River within the AOI. These findings and other incidental observations of unidentified turtle nests/eggs provide supporting evidence for Turtle Nesting Areas SWH. Turtle Wintering Areas SWH also likely exists within the NHIC EO for snapping turtle. However, details regarding known or potential overwintering or nesting areas are not indicated in the EO record and further field studies and/or discussions with NHIC are needed. Furthermore, candidate SWH for Reptile Hibernaculum has been identified within the AOI, LSA_{TER}, RSA_{HRP}, and $RSA_{HRP\text{-}AQU}$. A detailed discussion of SWH is available in Appendix C, Chapter 1.

3.4.1 Next Steps

If the SON-South Bruce siting area is selected for the Project, Tier 2 studies will aim to characterize reptile biodiversity more thoroughly within the BIS study areas. Refer to Section 5.2.8 of the BPPA Report (Zoetica 2021) for more information. Study methods may include visual encounter surveys, supplemented with drift fences and pit and funnel traps, as needed. Confirmation of candidate SWH (described in Appendix C, Chapter 1), including habitats for Special Concern and provincially rare species, will focus on areas within the extent of direct and indirect project impacts (i.e., AOI and LSA_{TER}).[4] In addition, further discussions with knowledgeable stakeholders and rights-holders will help determine the locations of sensitive habitats for reptiles. However, access limitations will continue to be a factor in determining which areas can be surveyed. The NWMO continues to engage with local landowners to gain permission to access their properties. Zoetica is providing input to the NWMO regarding priority locations within which they should seek access based on the baseline information collected to date.

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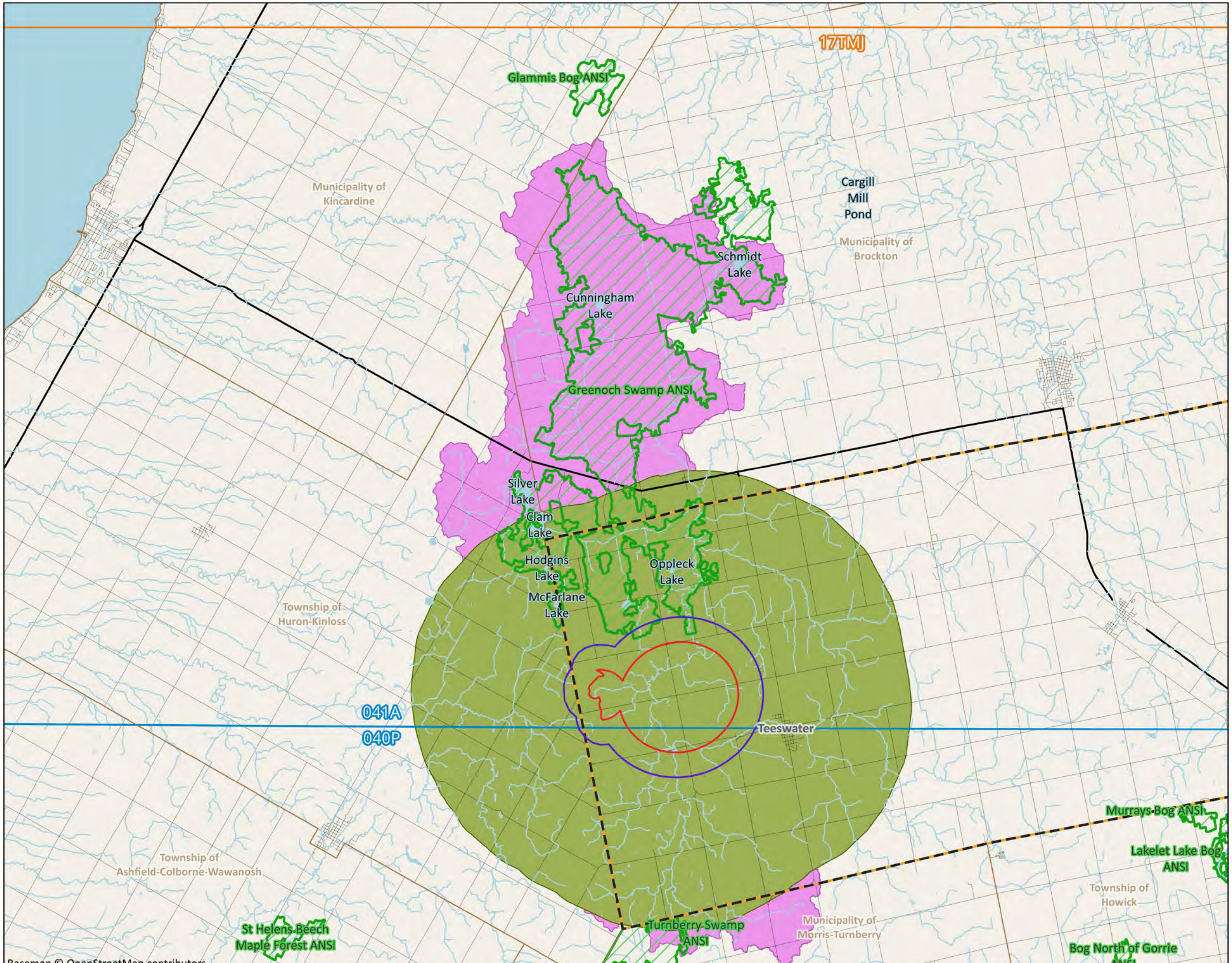
APPENDIX A – SPECIES LIST

Table A-1. Common and scientific names for species mentioned in this report. Species names follow the NHIC's Ontario species lists, current to March 1, 2023.

Common Name	**Scientific Name**
AMPHIBIANS	
Unisexual Ambystoma (Jefferson Salamander dependent population)	*Ambystoma hybrid* pop. 1
Jefferson Salamander	*Ambystoma jeffersonianum*
Blue-spotted Salamander	*Ambystoma laterale*
Spotted Salamander	*Ambystoma maculatum*
American Toad	*Anaxyrus americanus*
Gray Treefrog	*Dryophytes versicolor*
Four-toed Salamander	*Hemidactylium scutatum*
American Bullfrog	*Lithobates catesbeianus*
Green Frog	*Lithobates clamitans*
Pickerel Frog	*Lithobates palustris*
Northern Leopard Frog	*Lithobates pipiens*
Wood Frog	*Lithobates sylvaticus*
Eastern Newt	*Notophthalmus viridescens*
Eastern Red-backed Salamander	*Plethodon cinereus*
Spring Peeper	*Pseudacris crucifer*
Western Chorus Frog (Great Lakes - St. Lawrence - Canadian Shield population)	*Pseudacris maculata* pop. 1
REPTILES	
Snapping Turtle	*Chelydra serpentina*
Midland Painted Turtle	*Chrysemys picta marginata*
Spotted Turtle	*Clemmys guttata*
Northern Ring-necked Snake	*Diadophis punctatus edwardsii*
Wood Turtle	*Glyptemys insculpta*
Eastern Hog-nosed Snake	*Heterodon platirhinos*
Eastern Milksnake	*Lampropeltis triangulum*
Northern Watersnake	*Nerodia sipedon sipedon*
Queensnake	*Regina septemvittata*
Northern Red-bellied Snake	*Storeria occipitomaculata occipitomaculata*
Eastern Ribbonsnake	*Thamnophis saurita*
Eastern Gartersnake	*Thamnophis sirtalis sirtalis*

APPENDIX B – MAP FIGURES AND SUPPLEMENTAL DATA TABLES



NWMO Biodiversity Impact Studies

Critical Habitat and Environmentally Significant Areas for Herpetofauna

Figure B-1

- Area of Interest (AOI)
- Local Study Area (LSA_{TER})
- Regional Study Area ($RSA_{HRP-AQU}$)
- Watercourse
- Lake
- South Bruce Boundary
- Municipal Boundary
- Highway
- Local Road
- Life Science Areas of Natural and Scientific Interest (ANSI)
- 100 x 100 km standardized UTM grid squares within which critical habitat for Spotted Turtle is found
- 1:250 000 standardized NTS map sheets within which critical habitat for Wood Turtle is found

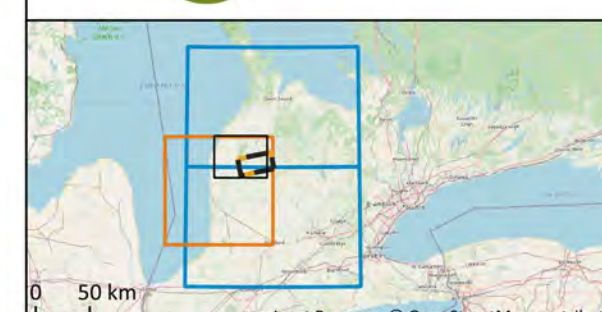
This map shows the extent of known critical habitat for Wood Turtle and Spotted Turtle. Mapping is limited to the squares/map sheet that overlap with the $RSA_{HRP-AQU}$.

The $RSA_{HRP-AQU}$ includes the area covered by the RSA_{HRP} (green area) plus the area encompassed by the LSA used for aquatic biodiversity values (pink area).

1:150,000

0 2 4 km

ZOETICA

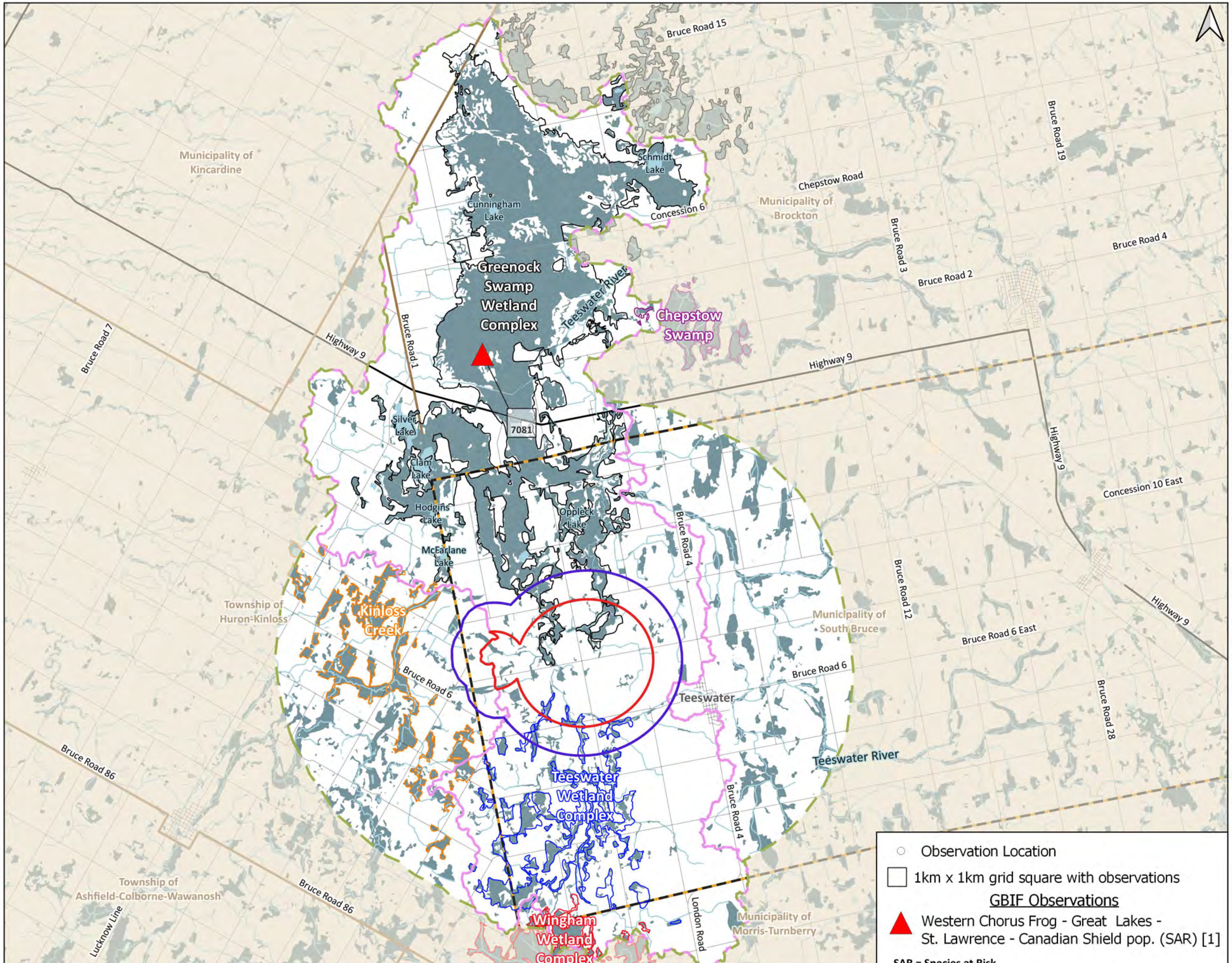


Data received from:
Ontario GeoHub — OHN Waterbody (NDMNRF); OHN Watercourse (NDMNRF); ORN Road Segment (NDMNRF); UTM (Universal Transverse Mercator) 100 KM Grid (MNRF)
NWMO — AOI
Canada Open Data Portal — Indexes of the National Topographic System of Canada (Natural Resources Canada)

Project CRS: NAD83 / UTM zone 17N

Author: DM	Reviewed by: CC	Approved by: HB

September 28, 2023 — Map ID: NWMO_BIS_D189



NWMO Biodiversity Impact Studies

Species of Interest Desk-based Observations: Amphibians

Figure B-2

- Area of Interest (AOI)
- Local Study Area (LSA_{TER})
- Local Study Area (LSA_{AQU})
- Regional Study Area ($RSA_{HRP-AQU}$)
- Lake
- Wetland
- Watercourse
- Highway
- Local Road
- Municipal Boundary
- South Bruce Boundary

Of all wetlands shown, only Provincially Significant Wetlands (PSWs) are labelled. The colour of the outline surrounding PSWs matches the colour of the respective PSW label.

PSW boundaries may not match wetland boundaries due to changes in aquatic habitat coverage since their creation compared to 2022.

1:130,000

0 2 4 km

ZOETICA

Data received from:
Ontario GeoHub — OHN Waterbody (MNRF); OHN Watercourse (MNRF); MNRF Road Segments (MNRF); Municipal Boundary · Lower and Single Tier (MMAH); Wetlands (MNRF)
NWMO — AOI
GBIF.org — GBIF Occurrence Download · Accessed Oct., 2021
Wetlands and water features are mapped using ecosite data within the LSA_{ECO} and data available from Ontario GeoHub outside the LSA_{ECO}.

Project CRS: NAD83 / UTM zone 17N

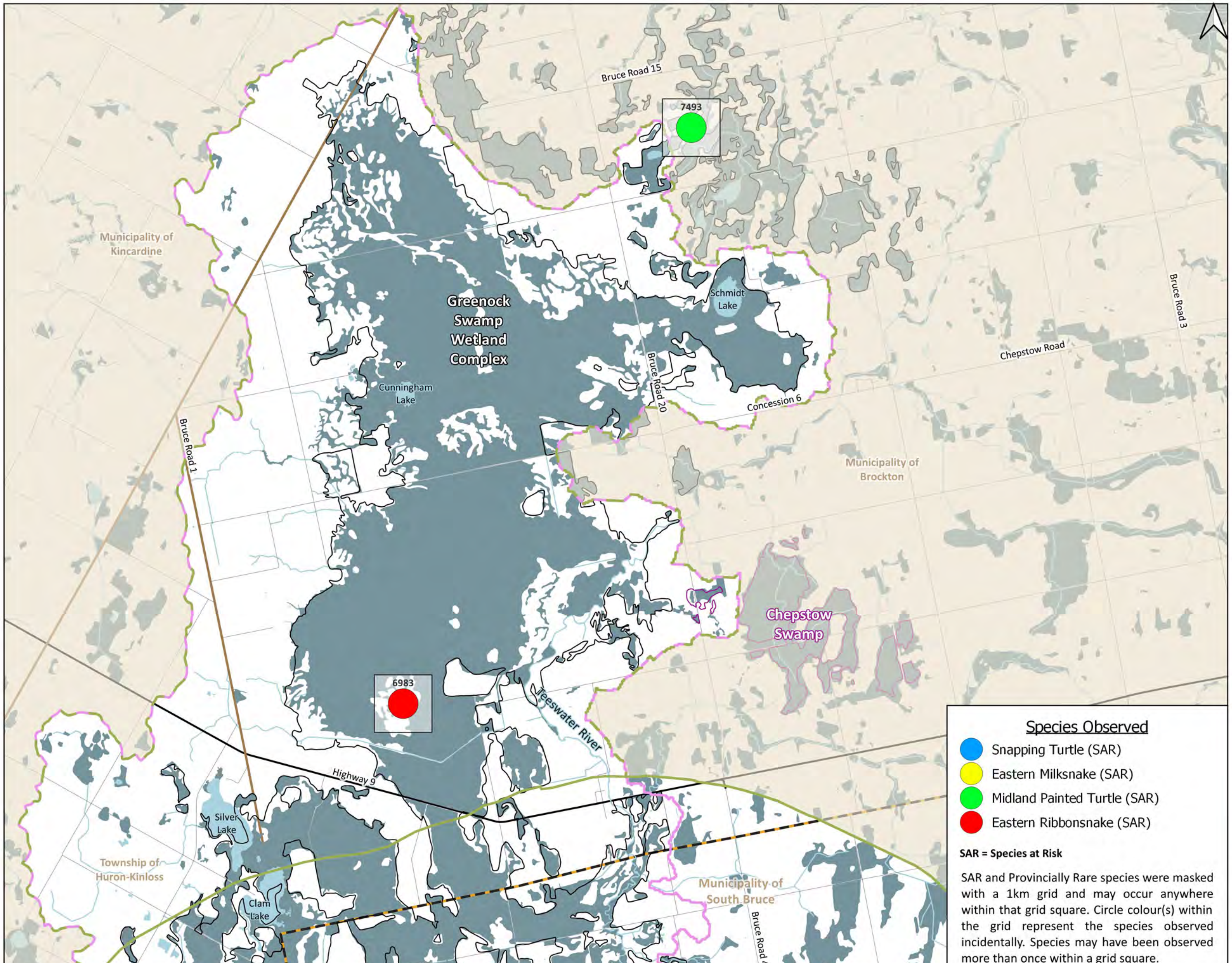
Author: AH	Reviewed by: CC	Approved by: HB
December 12, 2023	Map ID: NWMO_BIS_A080	

Table B-1. Supplemental data for desk-based observations of amphibian species of interest within the BIS study areas.[1,2]

Grid	Source	Species	Count[3]	AOI	LSA_{TER}	$RSA_{HRP-AQU}$
7081	GBIF	Western Chorus Frog - Great Lakes - St. Lawrence - Canadian Shield population	U	0	0	1

Notes:

1. Refer to Figure B-2 for the grid location. Coordinates are not provided due to the sensitive nature of SAR.
2. For the purposes of this table, the indicated study area includes overlap with other study area(s) that may be encompassed within its boundaries. 1 = detected, 0 = not detected
3. Count of "U" = unspecified



NWMO Biodiversity Impact Studies

Species of Interest Field Observations: Reptiles - North $RSA_{HRP\text{-}AQU}$

Figure B-3a

- Area of Interest (AOI)
- Local Study Area (LSA_{TER})
- Local Study Area (LSA_{AQU})
- Regional Study Area (RSA_{HRP})
- Regional Study Area ($RSA_{HRP\text{-}AQU}$)
- Lake
- Wetland
- Watercourse
- Highway
- Local Road
- Municipal Boundary
- South Bruce Boundary

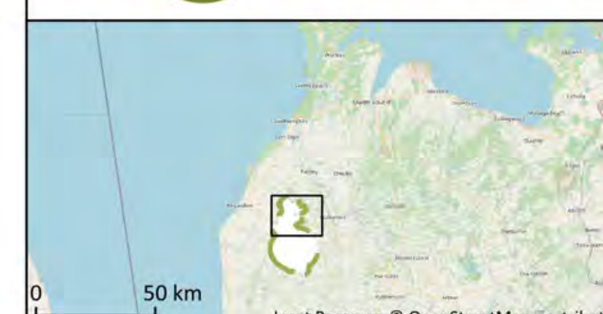
Of all wetlands shown, only Provincially Significant Wetlands (PSWs) are labelled. The colour of the outline surrounding PSWs matches the colour of the respective PSW label.

PSW boundaries may not match wetland boundaries due to changes in aquatic habitat coverage since their creation compared to 2022.

1:65,000

0 1 2 km

ZOETICA



Data received from:
Ontario GeoHub — OHN Waterbody (MNRF); OHN Watercourse (MNRF); MNRF Road Segments (MNRF); Municipal Boundary Lower and Single Tier (MMAH); Wetlands (MNRF)
NWMO — AOI; NWMO Purchased or Optioned Land; 2022 SB TEM Ecosite Data Export V4 (Tulloch)
Wetlands and water features are mapped using ecosite data within the LSA_{ECO} and data available from Ontario GeoHub outside the LSA_{ECO}.

Project CRS: NAD83 / UTM zone 17N		
Author: AH	Reviewed by: CC	Approved by: HB
December 12, 2023	Map ID: NWMO_BIS_A118a	

Species Observed

- Snapping Turtle (SAR)
- Eastern Milksnake (SAR)
- Midland Painted Turtle (SAR)
- Eastern Ribbonsnake (SAR)

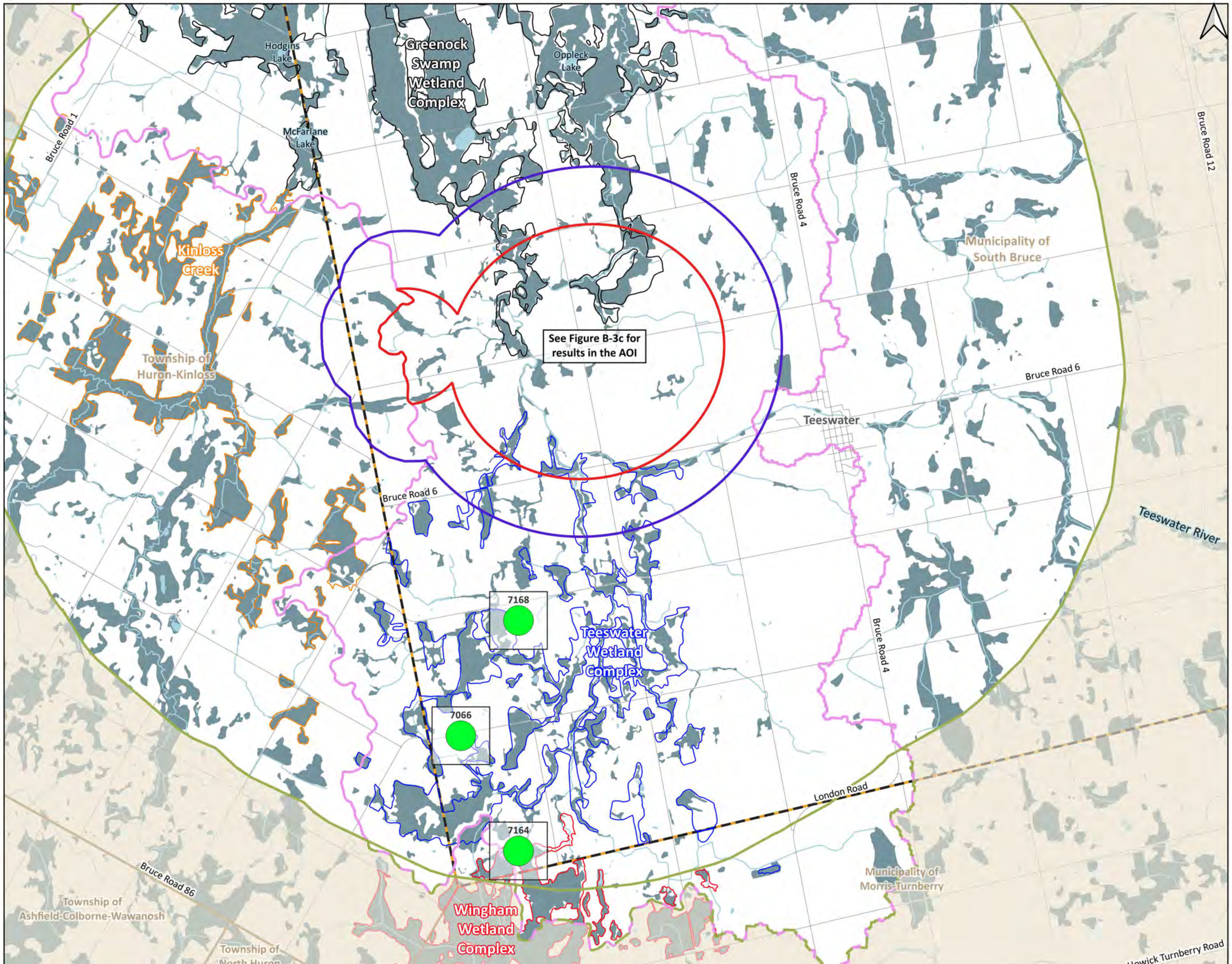
SAR = Species at Risk

SAR and Provincially Rare species were masked with a 1km grid and may occur anywhere within that grid square. Circle colour(s) within the grid represent the species observed incidentally. Species may have been observed more than once within a grid square.

NWMO Biodiversity Impact Studies

Species of Interest Field Observations: Reptiles - South $RSA_{HRP-AQU}$

Figure B-3b



- Area of Interest (AOI)
- Local Study Area (LSA_{TER})
- Local Study Area (LSA_{AQU})
- Regional Study Area (RSA_{HRP})
- Regional Study Area ($RSA_{HRP-AQU}$)
- Lake
- Wetland
- Watercourse
- Highway
- Local Road
- South Bruce Boundary
- Municipal Boundary

See Figure B-3a for Full Legend

Of all wetlands shown, only Provincially Significant Wetlands (PSWs) are labelled. The colour of the outline surrounding PSWs matches the colour of the respective PSW label.

PSW boundaries may not match wetland boundaries due to changes in aquatic habitat coverage since their creation compared to 2022.

1:65,000

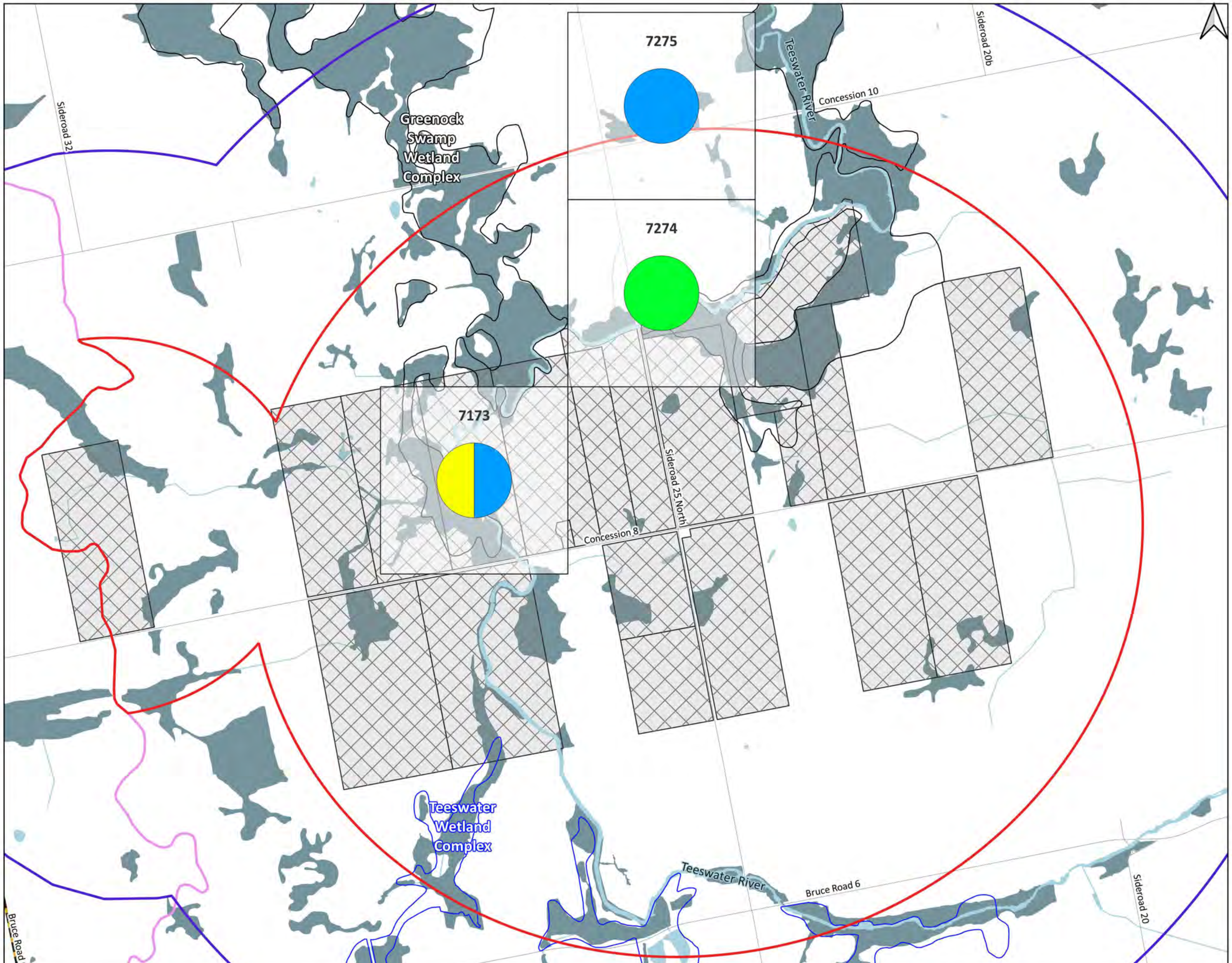
0 1 2 km

ZOETICA

Data received from:
Ontario GeoHub — OHN Waterbody (MNRF); OHN Watercourse (MNRF); MNRF Road Segments (MNRF); Municipal Boundary - Lower and Single Tier (MMAH); Wetlands (MNRF)
NWMO — AOI; NWMO Purchased or Optioned Land; 2022 SB TEM Ecosite Data Export V4 (Tulloch)
Wetlands and water features are mapped using ecosite data within the LSA_{ECO} and data available from Ontario GeoHub outside the LSA_{ECO}.

Project CRS: NAD83 / UTM zone 17N

Author: AH	Reviewed by: CC	Approved by: HB
December 12, 2023	Map ID: NWMO_BIS_A118b	



NWMO Biodiversity Impact Studies

Species of Interest Field Observations: Reptiles - AOI

Figure B-3c

- Area of Interest (AOI)
- Local Study Area (LSA_{TER})
- Local Study Area (LSA_{AQU})
- Regional Study Area (RSA_{HRP})
- Regional Study Area ($RSA_{HRP-AQU}$)
- Lake
- Wetland
- Watercourse
- Highway
- Local Road
- South Bruce Boundary
- Municipal Boundary
- NWMO Purchased or Optioned Land

See Figure B-3a for Full Legend

Of all wetlands shown, only Provincially Significant Wetlands (PSWs) are labelled. The colour of the outline surrounding PSWs matches the colour of the respective PSW label.

PSW boundaries may not match wetland boundaries due to changes in aquatic habitat coverage since their creation compared to 2022.

1:20,000

0 0.5 1 km

ZOETICA

Data received from:
Ontario GeoHub — OHN Waterbody (MNRF); OHN Watercourse (MNRF); MNRF Road Segments (MNRF); Municipal Boundary Lower and Single Tier (MMAH); Wetlands (MNRF)
NWMO — AOI; NWMO Purchased or Optioned Land; 2022 SB TEM Ecosite Data Export V4 (Tulloch)
Wetlands and water features are mapped using ecosite data within the LSA_{ECO} and data available from Ontario GeoHub outside the LSA_{ECO}.

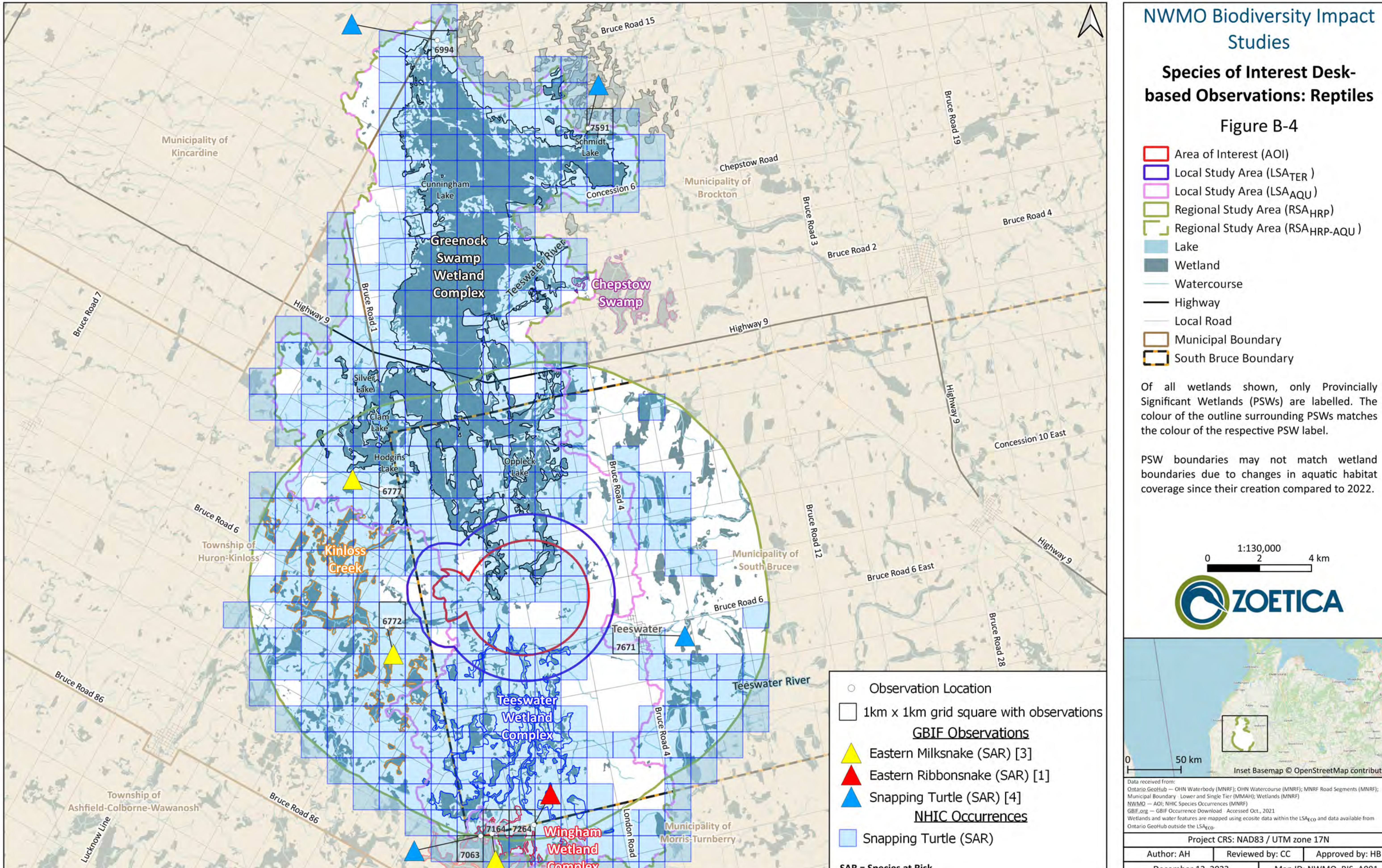
Project CRS: NAD83 / UTM zone 17N

Author: AH	Reviewed by: CC	Approved by: HB
December 12, 2023	Map ID: NWMO_BIS_A118c	

Table B-2. Supplemental data for 2022 field-based observations of reptile species of interest within the BIS study areas.[1,2]

Grid	Species	Observation Type[3]	Count	Source Type[4]	AOI	LSA_{TER}	RSA_{HRP} / $RSA_{HRP\text{-}AQU}$
6983	Eastern Ribbonsnake	Visual (juv)	1	Incidental	0	0	1
7066	Midland Painted Turtle	Visual	1	AHM	0	0	1
7164	Midland Painted Turtle	Visual	1	AHM	0	0	1
7168	Midland Painted Turtle	Visual	>1	eDNA	0	0	1
7168	Midland Painted Turtle	Visual	>1	eDNA	0	0	1
7168	Midland Painted Turtle	Visual	>1	eDNA	0	0	1
7173	Snapping Turtle	Eggs	>1	Incidental	1	1	1
7173	Eastern Milksnake	Visual (juv)	1	Incidental	1	1	1
7274	Midland Painted Turtle	Visual	1	AHM	1	1	1
7275	Snapping Turtle	Visual	1	Incidental	1	1	1
7275	Snapping Turtle	Unspecified	1	eDNA	1	1	1
7493	Midland Painted Turtle	Visual (juv)	1	Incidental	0	0	1
7493	Midland Painted Turtle	Visual	1	SWH	0	0	1

Notes:
1. Refer to Figure B-3 for the grid locations of masked observations. Coordinates are not provided due to the sensitive nature of SAR.
2. For the purposes of this table, the indicated study area includes overlap with other study area(s) that may be encompassed within its boundaries. 1 = detected, 0 = not detected
3. Abbreviations for observation types: juv = juvenile
4. All 2022 field species observations are considered incidental; however, the source type is presented to allow interpretation of field effort and visited locations. "eDNA" refers to field observations and not the results of metabarcoding analyses.



NWMO Biodiversity Impact Studies
Species of Interest Desk-based Observations: Reptiles
Figure B-4
Area of Interest (AOI)
Local Study Area (LSA$_{TER}$)
Local Study Area (LSA$_{AQU}$)
Regional Study Area (RSA$_{HRP}$)
Regional Study Area (RSA$_{HRP-AQU}$)
Lake
Wetland
Watercourse
Highway
Local Road
Municipal Boundary
South Bruce Boundary
Of all wetlands shown, only Provincially Significant Wetlands (PSWs) are labelled. The colour of the outline surrounding PSWs matches the colour of the respective PSW label.
PSW boundaries may not match wetland boundaries due to changes in aquatic habitat coverage since their creation compared to 2022.
1:130,000
0 2 4 km
ZOETICA
0 50 km
Inset Basemap © OpenStreetMap contributors
Data received from:
Ontario GeoHub — OHN Waterbody (MNRF); OHN Watercourse (MNRF); MNRF Road Segments (MNRF); Municipal Boundary Lower and Single Tier (MMAH); Wetlands (MNRF)
NWMO — AOI; NHIC Species Occurrences (MNRF)
GBIF.org — GBIF Occurrence Download Accessed Oct., 2021
Wetlands and water features are mapped using ecosite data within the LSA$_{ECO}$ and data available from Ontario GeoHub outside the LSA$_{ECO}$.
Project CRS: NAD83 / UTM zone 17N
Author: AH
Reviewed by: CC
Approved by: HB
December 12, 2023
Map ID: NWMO_BIS_A081
Observation Location
1km x 1km grid square with observations
GBIF Observations
Eastern Milksnake (SAR) [3]
Eastern Ribbonsnake (SAR) [1]
Snapping Turtle (SAR) [4]
NHIC Occurrences
Snapping Turtle (SAR)
SAR = Species at Risk
Bruce Road 15
6994
7591
Schmidt Lake
Cunningham Lake
Chepstow Road
Concession 6
Municipality of Brockton
Municipality of Kincardine
Bruce Road 19
Bruce Road 3
Bruce Road 4
Bruce Road 2
Greenock Swamp Wetland Complex
Teeswater River
Chepstow Swamp
Bruce Road 1
Highway 9
Bruce Road 7
Silver Lake
Clam Lake
Hodgins Lake
Oppleck Lake
6777
Concession 10 East
Bruce Road 6
Township of Huron-Kinloss
Kinloss Creek
Bruce Road 12
Municipality of South Bruce
Bruce Road 6 East
6772
Teeswater
7671
Bruce Road 86
Bruce Road 28
Teeswater Wetland Complex
Township of Ashfield-Colborne-Wawanosh
7164
7264
7063
Wingham Wetland Complex
London Road
Municipality of Morris-Turnberry
Lucknow Line

Table B-3. Supplemental data for desk-based observations of reptile species of interest within the BIS study areas.[1,2]

Grid	Source	Species	Count[3]	AOI	LSA_{TER}	RSA_{HRP} / $RSA_{HRP-AQU}$
6772	GBIF	Eastern Milksnake	U	0	0	1
6777	GBIF	Eastern Milksnake	U	0	0	1
6994	GBIF	Snapping Turtle	U	0	0	1
7063	GBIF	Snapping Turtle	U	0	0	1
7164	GBIF	Eastern Milksnake	U	0	0	1
7264	GBIF	Eastern Ribbonsnake	U	0	0	1
7591	GBIF	Snapping Turtle	U	0	0	1
7671	GBIF	Snapping Turtle	U	0	0	1

Notes:
1. Refer to Figure B-4 for the grid location. Coordinates are not provided due to the sensitive nature of SAR.
2. For the purposes of this table, the indicated study area includes overlap with other study area(s) that may be encompassed within its boundaries. 1 = detected, 0 = not detected
3. Count of “U” = unspecified

APPENDIX C – HERPETOFAUNA DETECTED IN THE BIS STUDY AREAS

The following tables present the amphibian and reptile species detected within the applicable BIS study areas. Explanatory notes and common abbreviations are provided below:

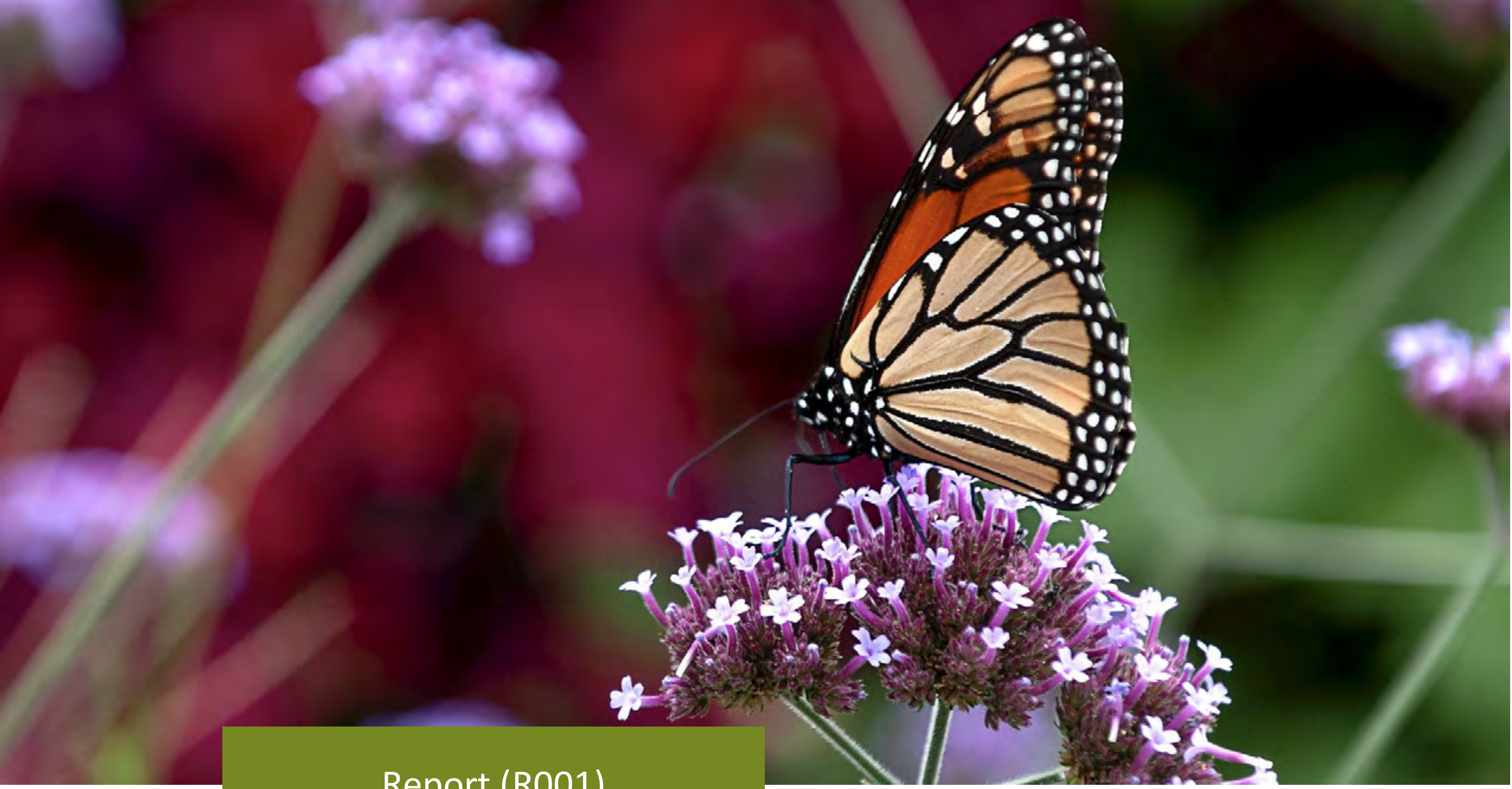
- The first column of each table denotes the Species of Interest (SOI) for the purposes of the BIS; specifically, whether the species is Endangered, Threatened, or Special Concern ("SAR"); provincially rare ("Rare"); and/or mentioned during engagement ("Engage."). Additional details about the species' subnational rank (SRANK) and provincial (SARO) and federal (COSEWIC and SARA) SAR listings are provided in the right-most columns.
- The method(s) of detection are presented for each species, including desktop studies of existing biodiversity databases (e.g., GBIF, NHIC), previous preliminary environmental studies conducted in July and October 2020 by Tulloch Environmental at boreholes 1 and 2 within the AOI (Tulloch Environmental 2020, 2021), 2022 field incidental observations, and Tier 1 eDNA metabarcoding analysis results (the latter for amphibians only; no reptiles have been detected to date).
- For the purposes of these tables, the indicated study area (i.e., AOI, LSA_{TER}, RSA_{HRP} or $RSA_{HRP-AQU}$) excludes overlap with other study area(s) that may be encompassed within its boundaries. Cells shaded grey and with **bold** font indicate new detections in the study area based on 2022 field studies (i.e., not previously detected in the study area through desk-based research). For species of conservation concern, the study area(s) of field observations and NHIC records are based on overlap with the 1 km grid square, not the actual point or polygon location.
- Conservation status ranks: THR = Threatened, SC = Special Concern, NAR = Not at Risk; S4 = Apparently Secure, S5 = Secure.

Table C-1. List of amphibian species recorded within the AOI, LSA_{TER}, and $RSA_{HRP-AQU}$. See definitions and other explanatory notes on page C-1.

SOI?	Common Name	Desk-based	2020 Studies	2022 Field Incidental	Tier 1 eDNA	AOI	LSA_{TER}	$RSA_{HRP-AQU}$	SRANK	SARO	COSEWIC	SARA
-	American Bullfrog	Y	-	Y	-	**Y**	-	Y	S4	-	-	-
-	American Toad	Y	-	Y	-	**Y**	-	Y	S5	-	-	-
-	Blue-spotted Salamander	Y	-	-	-	-	-	Y	S4	-	-	-
-	Eastern Newt	Y	-	Y	Y	**Y**	-	Y	S5	-	-	-
-	Eastern Red-backed Salamander	Y	-	Y	Y	-	Y	Y	S5	-	-	-
-	Four-toed Salamander	Y	-	-	Y	-	-	Y	S4	NAR	NAR	-
-	Gray Treefrog	Y	-	Y	-	**Y**	-	Y	S5	-	-	-
-	Green Frog	Y	-	Y	-	**Y**	Y	Y	S5	-	-	-
-	Northern Leopard Frog	Y	-	Y	-	**Y**	-	Y	S5	NAR	NAR	-
-	**Pickerel Frog**	**-**	**-**	**Y**	**-**	**-**	**-**	**Y**	**S4**	**NAR**	**NAR**	**-**
-	Spotted Salamander	Y	-	-	-	-	-	Y	S4	-	-	-
-	Spring Peeper	Y	-	Y	-	**Y**	-	Y	S5	-	-	-
SAR	Western Chorus Frog - Great Lakes - St. Lawrence - Canadian Shield population	Y	-	-	-	-	-	Y	S4	NAR	THR	THR
-	Wood Frog	Y	-	Y	Y	**Y**	**Y**	Y	S5	-	-	-

Table C-2. List of reptile species recorded within the AOI, LSA_{TER}, RSA_{HRP}, and $RSA_{HRP\text{-}AQU}$. See definitions and other explanatory notes on page C-1.

SOI?	Common Name	Desk-based	2020 Studies	2022 Field Incidental	AOI	LSA_{TER}	RSA_{HRP} / $RSA_{HRP\text{-}AQU}$	SRANK	SARO	COSEWIC	SARA
-	Eastern Gartersnake	Y	-	Y	-	-	Y	S5	-	-	-
SAR	Eastern Milksnake	Y	-	Y	**Y**	-	Y	S4	NAR	SC	SC
SAR	Eastern Ribbonsnake	Y	-	Y	-	-	Y	S4	SC	SC	-
SAR	Midland Painted Turtle	Y	-	Y	**Y**	Y	Y	S4	-	SC	SC
-	Northern Red-bellied Snake	Y	-	-	-	-	Y	S5	-	-	-
-	Northern Watersnake	Y	-	Y	**Y**	-	Y	S5	NAR	NAR	-
SAR	Snapping Turtle	Y	-	Y	Y	Y	Y	S4	SC	SC	SC



Report (R001)

BIODIVERSITY IMPACT STUDIES – SOUTHWESTERN ONTARIO REGION: 2023 BASELINE REPORT (CHAPTER 6: TERRESTRIAL INVERTEBRATES)

December 13, 2023

PREPARED BY Zoetica Environmental Consulting Services

SUBMITTED TO Michelle Nearing
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Cover Image: Monarch by stanbalik on pixabay

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GLOSSARY AND ABBREVIATIONS

AHM	Aquatic Habitat Mapping
AOI	Area of Interest
ANSI	Area of Natural and Scientific Interest
BIS	Biodiversity Impact Studies
BPD	Biodiversity Impact Studies – Southwestern Ontario Region: Baseline Program Design
BPPA	Biodiversity Impact Studies – Southwestern Ontario Region: Best Practices and Preferred Approach
BV	Biodiversity Value. The biotic environmental components that will be considered for study within the Project's Biodiversity Impact Studies. A subset of biodiversity values will ultimately be scoped into the biodiversity Impact Assessment as Valued Components.
CNC	Canadian National Collection of Insects, Arachnids, and Nematodes
CNSC	Canadian Nuclear Safety Commission
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
EAB	Emerald ash borer
ECCC	Environment and Climate Change Canada
Ecoregion	Second highest level of the ELC hierarchy (Crins et al. 2009). Large geographic areas primarily identified by sub-continental climatic regimes and bedrock geology.
Ecosite	Second lowest level of the ELC hierarchy (Crins et al. 2009). The land within an ecosite will generally contain similar substrate and vegetation.
Ecosite classification dataset	The dataset of ecosite classification created for the BIS using South Western Ontario Orthophotography Project (SWOOP) 2020 imagery.
ECS	Ecoregional Criterion Schedule
EDDMapS	Early Detection and Distribution Mapping System
eDNA	Environmental DNA
ELC	Ecological Land Classification
GBIF	Global Biodiversity Information Facility
IA	Impact Assessment
LSA	Local Study Area LSA_{TER} = Terrestrial Local Study Area LSA_{AQU} = Aquatic Local Study Area LSA_{ECO} = Local Study Area for ecosystem function and services
MECP	Ontario Ministry of the Environment, Conservation and Parks
MNRF	Ontario Ministry of Natural Resources and Forestry

NHIC	Ontario Natural Heritage Information Centre
NWMO	Nuclear Waste Management Organization
Rights-holders	First Nation and Métis communities who have asserted and or hold recognized treaty and/or Indigenous rights and whose traditional territories include the project location.
SAR	Species at Risk. For the purposes of the BIS, SAR include species listed under Schedule 1 of the federal *Species at Risk Act* (*SARA*), species designated as Species at Risk in Ontario (SARO) and listed under the provincial *Endangered Species Act, 2007* (*ESA*), and species assessed as Extirpated, Endangered, Threatened, or Special Concern by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC).
SARA	Federal *Species at Risk Act*
SARO	Species at Risk in Ontario
SON	Saugeen Ojibway Nation
SON-South Bruce siting area	Used to describe the broader area surrounding the defined area within which the Project may be located. The SON-South Bruce siting area is the general area surrounding the Municipality of South Bruce and includes the traditional territory of Saugeen Ojibway Nation (SON) in southwestern Ontario.
SOP	Standard Operating Procedure
Species of conservation concern	Includes provincially and/or federally listed SAR (Extirpated, Endangered, Threatened, Special Concern) and provincially rare (SRANK S1, S2, S3, SH) species. Regionally rare species may also be scoped in if identified by stakeholders and/or rights-holders as VCs.
Species of interest	Includes species of conservation concern, culturally important species, indicator species, and invasive species (where applicable).
SRANK	Subnational Rank. SRANK is the conservation status of a species or vegetation community within a particular province, territory, or state. In Ontario, the NHIC assigns SRANKs using the best available information and considering factors such as abundance, distribution, population trends, and trends (NDMNRF 2021). Species assigned S1 (Critically Imperiled), S2 (Imperiled), S3 (Vulnerable), and SH (Possibly Extirpated) are considered provincially rare by the NHIC. See the NatureServe website for more information: https://www.natureserve.org/nsexplorer/about-the-data/statuses/conservation-status-categories
SWH	Significant Wildlife Habitat. Defined in the Ontario Provincial Policy Statement, 2020 as: *Wildlife habitat* – areas where plants, animals and other organisms live, and find adequate amounts of food, water, shelter and space needed to sustain their populations. Specific wildlife habitats of concern may include areas where species concentrate at a vulnerable point in their annual life cycle; and areas which are important to migratory and non-migratory species. *Significant* – in regard to wildlife habitat, ecologically important in terms of features, functions, representation or amount, and contributing to the quality and diversity of an identifiable geographic area or natural heritage system. Candidate SWH are areas that meet the ELC ecosite code(s) and/or habitat criteria outlined in the SWH ecoregional criterion schedule (ECS). Confirmed SWH are areas that

	meet the defining criteria outlined in the SWH ECS. Detailed field investigations are usually needed to confirm SWH.
TEM	Terrestrial Ecosystem Mapping
The Project	The Adaptive Phased Management Project is the Deep Geological Repository and other required infrastructure for the safe, long-term management of Canada's used nuclear fuel.
TISG	Tailored Impact Statement Guidelines. 'TISG Template' refers to the Tailored Impact Statement Guidelines Template (generic version) (IAAC 2022).
VC	Valued Component. For impact assessments of designated projects under the *Impact Assessment Act*, the Agency's Glossary of Terms defines VCs as "environmental, health, social, economic or additional elements or conditions of the natural and human environment that may be impacted by a proposed project and are of concern or value to the public, Indigenous peoples, federal authorities and interested parties. Valued components may be identified as having scientific, biological, social, health, cultural, traditional, economic, historical, archaeological and/or aesthetic importance."

1.0 TERRESTRIAL INVERTEBRATES

1.1 Introduction

Terrestrial invertebrates perform important ecosystem functions as decomposers, predators, prey, parasites, herbivores, and pollinators. Some terrestrial invertebrates are categorized as invasive and/or pest species, which can be capable of damaging large tracts of forests (e.g., budworm species) and/or negatively affecting the health of wildlife and humans (e.g., ticks). Invertebrates often respond to environmental changes more rapidly than species higher up the food chain, thus, they can be indicators of ecological sustainability for forest management (Taylor and Doran 2001) and umbrella species for conservation and management purposes (Roberge and Angelstam 2004).

Neither the Canadian Nuclear Safety Commission's (CNSC) *Guidance on Deep Geological Repository Site Characterization* (CNSC 2018) nor the Tailored Impact Statement Guidelines Template (generic version) ('TISG Template'[1]; (IAAC 2022)) explicitly identifies terrestrial invertebrates as important elements to characterize, except for species at risk (SAR). However, as the selection of valued components (VCs) must consider social, cultural, health, and economic values, terrestrial invertebrate species and/or communities may be scoped into the impact assessment (IA) as VCs, requiring a baseline description. A full list of regulatory requirements pertaining to biodiversity is available in Appendix E of the *Biodiversity Impact Studies – Southwestern Ontario Region: Best Practices and Preferred Approaches* (BPPA) Report (Zoetica 2021).

Terrestrial invertebrates that are considered biodiversity values (BVs) for the Adaptive Phased Management Project's (hereafter, 'the Project') Biodiversity Impact Studies (BIS) include: species that are indicators of ecosystem health, invasive species, species of conservation concern (including SAR and provincially rare species), and species of interest to stakeholders and rights-holders. Species of conservation concern, along with culturally important and invasive species (where applicable), are currently included as "species of interest" for all BVs in the BIS. Although terrestrial invertebrates were mentioned during engagement, the cultural importance of species cannot be ascertained by Zoetica™ at this time, as this task requires further coordination with other disciplines studying the potential impacts of the Project. A review of engagement conducted to date that is of relevance to the BIS is presented in Appendix B of the BPPA Report (Zoetica 2021). The scope of species of interest for BIS baseline reporting will be expanded in future years of the BIS baseline program to include culturally important and indicator species when more information is gathered through Tier 2 studies and engagement.

For the purposes of the BIS, terrestrial invertebrates are defined as species that are wholly or predominantly dependent on terrestrial environments. Semi-aquatic invertebrates (e.g., dragonflies, damselflies, crayfish) and aquatic invertebrates are discussed in Chapter 8 of the 2023 BIS Baseline Report. Digger crayfish and Great Plains mudbug are both terrestrial crayfish; as such, they are addressed in Chapter 8. Detections of terrestrial invertebrates that are forest pests, including spongy moth, beech scale, European elm bark beetle, and emerald ash borer (EAB), are addressed in Chapter 9.

1.1.1 Objectives

The objectives of terrestrial invertebrate studies for the BIS are to:

[1] Please see Chapter 1 for limitations of and planned updates to the TISG Template.

1. Determine the presence, distribution, and abundance of relevant Significant Wildlife Habitat (SWH) and other important habitat for select BVs, with an emphasis on:
    a. Species of conservation concern, including SAR,
    b. Species of interest and potential importance to local stakeholders and rights-holders,
    c. Indicator species
2. Determine the potential presence and distribution of species of interest, including the select BVs listed in (1) and invasive species; and,
3. Provide additional baseline data to inform the Project's biodiversity IA and mitigation measures, and to assist in the potential development of monitoring program(s) to address environmental, regulatory, and stakeholder/rights-holder concerns.

The current Chapter 6 (Terrestrial Invertebrates) begins to fulfill the requirements of the TISG Template required for terrestrial invertebrates and their habitat (see Appendix C in the BPPA Report (Zoetica 2021)).

1.2 Methods

1.2.1 Study Areas

The BIS study areas for terrestrial invertebrates include the Area of Interest (AOI) and terrestrial local study area (LSA_{TER}). See Section 3.0 in Chapter 1 of the 2023 BIS Baseline Report and Section 5.2.9.4 of Zoetica's BPPA Report (Zoetica 2021) for more details on study area descriptions and rationale.

1.2.2 Collation of Species Observations and Habitat Data

Desk-based investigations of terrestrial invertebrates began with identification of species of interest that could potentially occur within the BIS study areas. Refer to Appendix D and Section 3.1 in the BPPA Report (Zoetica 2021) for a comprehensive list of SAR, including at-risk terrestrial invertebrate species, and the methods used to compile this list. Provincially rare species are indicated by their subnational rank (SRANK; S1, S2, S3, SH) and tracked by the Ontario Natural Heritage Information Centre (NHIC)[2]. Zoetica also compiled a list of regulated and non-regulated invasive terrestrial invertebrate species in Ontario to help direct the BIS program (see **Table A-3**).

Zoetica collated existing data from government, citizen science, and other biodiversity databases. For this 2023 BIS Baseline Report, data sources for verified species and habitat records included the NHIC; Ontario Ministry of Natural Resources and Forestry (MNRF), Global Biodiversity Information Facility (GBIF), and Early Detection and Distribution Mapping System (EDDMapS) Ontario. As these datasets periodically pull observations from other biodiversity-related projects and programs (e.g., iNaturalist, Bumble Bees of North America), Zoetica deemed them a good starting point to investigate terrestrial invertebrate species of interest and biodiversity that are found or are likely to be found in the BIS study areas. In addition, Zoetica investigated findings from the previous environmental studies conducted for the Project in the Saugeen Ojibway Nation (SON)-South Bruce siting area (Tulloch Environmental 2020, 2021). **Table 1-1**

[2] For the purposes of the 2023 BIS Baseline Report, conservation statuses described in text for at-risk species refer to their Species at Risk in Ontario (SARO) listings unless otherwise indicated. Conservation statuses are from the NHIC's Ontario species list, current to March 1, 2023, and updated for any discrepancies with provincial and federal SAR listings up to August 15, 2023. As such, species and status listings may differ from those presented in Zoetica's 2021 BPPA Report (Zoetica 2021).

summarizes the datasets, data layers, and reports investigated and analyzed for terrestrial invertebrate species observations and habitat data for the 2023 BIS Baseline Report. Data reported on maps were limited to observations from 1970 onward as older observations were considered historic and not as reliable. See also Appendix A, Chapter 1 for data quality scoring.

Table 1-1. Spatial datasets and reports analyzed for terrestrial invertebrates for the 2023 BIS Baseline Report.

Data Source / Owner	**Dataset**	**Data Format**	**Date Accessed / Received**	**Contains relevant[1] data?**
Tulloch Environmental *Phase 2 preliminary environmental studies for APM Project*	July 2020 Site Reconnaissance (Tulloch Environmental 2020)	Report	10/2020	N
	October 2020 Natural Heritage Features (Tulloch Environmental 2021)	Report	04/2021	N
Ontario Natural Heritage Information Centre (NHIC)	Species Occurrences	Shapefile	12/2020	N
Ontario Ministry of Natural Resources and Forestry (MNRF)	Wildlife Activity Site	Shapefile	12/2020	N
	Wildlife Activity Area	Shapefile	12/2020	N
	Greenock Swamp ANSI Report (Johnson 1994a, 1994b)	Reports	10/2020	Y
Global Biodiversity Information Facility (GBIF)	Species Occurrences	CSV	09/2021	Y
Early Detection and Distribution Mapping System (EDDMapS) Ontario	Invasive Species Observations	Shapefile	01/2022	Y
Environment and Climate Change Canada (ECCC) and Ontario Ministry of the Environment, Conservation and Parks (MECP)[2]	Federal and Provincial SAR Recovery Strategies	Reports	Various	N

Notes:

1. Zoetica determined dataset relevance based on geographic and temporal relevance as well as relevance to terrestrial invertebrates. For example, data that were not within the relevant BIS study areas, data that were too old to be considered relevant, or data that did not include records of terrestrial invertebrate species were labelled “N” for not containing relevant data.
2. SAR recovery strategies are published by the ECCC and MECP but authors may differ. Refer to Appendix D of the BPPA Report (Zoetica 2021) for a full list of potentially occurring SAR that had provincial and/or federal recovery strategies available at the time of writing the BPPA Report (note: new documents are continually posted on the SARO website and *SARA* Public Registry). The most updated version of Recovery Strategies for relevant species were reviewed and cited in the 2023 BIS Baseline Report.

A full list of the species mentioned in this report, including common and scientific names, is available in **Table A-1** in Appendix A.

For this 2023 iteration of the BIS Baseline Report, Zoetica searched additional datasets for species of interest, including the Ontario Butterfly Atlas, Bumble Bee Watch, and the Canadian National Collection of Insects, Arachnids, and Nematodes (CNC). In August 2023, Zoetica searched the eight 10 km^2 tiles that overlapped with the LSA_{ECO} (local study area for ecosystem function and services) in the Ontario Butterfly Atlas and found three potential species of interest: monarch (Special Concern), and cabbage white and European skipper (both introduced). However, none of the individual records fell within the AOI or LSA_{TER}.

On September 11, 2023, Zoetica searched the Bumble Bee Watch for five potential SAR in the LSA_{ECO} area: rusty-patched (Endangered), Ashton cuckoo (Endangered), American (Special Concern), Suckley's cuckoo (Endangered), and yellow-banded (Special Concern) bumblebees. There were no observations of these at-risk species in the AOI or LSA_{TER}. Zoetica searched the CNC for records of monarch, rusty-patched bumblebee, Ashton cuckoo bumblebee, American bumblebee, Suckley's cuckoo bumblebee, yellow-banded bumblebee, emerald ash borer (EAB; invasive), spongy moth (previously called LDD moth; invasive), juniper seed moth (provincially rare), black-legged tick (mentioned in engagement), beech scale (invasive), cabbage white, and European skipper on August 8, 2023, and found no records of any species in the AOI or LSA_{TER}. Additional investigations in future years will continue to focus on species of interest, as described in Section 1.1.

1.2.3 Tier 1 Studies

Field work for Tier 1 studies began in the summer of 2022, and Zoetica has received data from this season of field work for incorporation into the 2023 BIS Baseline Report. Field studies conducted in 2022 focused on collecting Tier 1 foundational habitat data and species detections through eDNA metabarcoding studies and incidental observations. Detailed methods for the Tier 1 studies outlined below are available in the *Biodiversity Impact Studies – Southwestern Ontario Region: Baseline Program Design* (BPD) Report and associated Standard Operating Procedures (SOPs) (Zoetica 2022). Terrestrial and aquatic field studies will improve understanding of terrestrial invertebrates and their habitat in the BIS study areas, and incidental observations collected during these studies will help to describe biodiversity.

1.2.3.1 Terrestrial Ecosystem Mapping

Terrestrial Ecosystem Mapping (TEM) work completed to date is described in Appendix B, Chapter 1. The ecosite classification dataset resulting from TEM work was used for desk-based identification of candidate SWH. The ecosites and presence of SWH were updated or confirmed by field teams in 2022.

1.2.3.2 Identification of Candidate SWH

Upon investigation of the SWH Ecoregional Criterion Schedule for Ecoregion 6E (hereafter '6E ECS') (OMNRF 2015), there is one terrestrial invertebrate-related SWH types of potential relevance to the SON-South Bruce siting area: Special Concern and Rare Species. Further details about candidate SWH investigations conducted to date and rationale for inclusion (or exclusion) of SWH types listed in the 6E ECS are presented in Appendix C, Chapter 1.

1.2.3.3 Aquatic Habitat Mapping

Aquatic Habitat Mapping (AHM) completed to date is described in Appendix D, Chapter 1. AHM studies focus on the characterization of watercourses, waterbodies (ponds, lakes), and wetlands in the relevant aquatic study areas. While not targeting terrestrial invertebrates, field contractors may incidentally observe and record the presence of terrestrial invertebrates.

1.2.3.4 Environmental DNA

Environmental DNA (eDNA) studies completed to date are described in Appendix E, Chapter 1. One set of primers used for eDNA studies was intended to capture invertebrate species.

1.2.4 Mapping Considerations

Incidental observations were recorded during various Tier 1 baseline field programs and were noted on different data forms (Incidental Observation Form or noted in TEM, AHM, or eDNA survey forms).

Incidental observations varied in method of observation (audio, visual, etc.) and life history stage of organisms, and may have been recorded in transit to a site and thus not associated with habitat data. As well, expertise in species identification may have varied among field contractors working on different field programs. Thus, not all pertinent information may have been available (e.g., observation type, activity, demographics) or collected in a directly comparable manner (e.g., quantity). Additionally, field-based observations of provincially tracked species (at-risk and/or rare) are represented by a 1 km grid, rather than a point, on maps to align with the NHIC's Sensitive Data Location Standards (NHIC n.d.). Data associated with mapped incidentals are included in Appendix B.

1.3 Results

1.3.1 Presence, Distribution, and Abundance of Important Habitat

1.3.1.1 General Habitat Associations

This section will be included in future BIS Baseline Reports after Tier 2 and Tier 3 studies have been completed.

1.3.1.2 Significant Wildlife Habitat

Field surveys detected candidate SWH for one Special Concern and Rare Wildlife Species, monarch, within the AOI. Monarchs were observed 17 times at 15 different locations in the AOI (**Figure B-1**), including egg, larva, and adult life history stages, and feeding, travelling, and resting behaviours. To be considered SWH for monarchs, there need to be enduring migration aggregations with enough individuals. Thus, further discussions with NHIC and/or targeted field surveys are planned for Tier 2 Studies (if SON-South Bruce is selected and the project interacts with these habitats) to confirm this candidate SWH. A more detailed discussion of candidate SWH within the LSA_{TER} is available in Appendix C, Chapter 1.

1.3.2 Presence and Distribution of Species of Interest

1.3.2.1 Species of Conservation Concern

eDNA metabarcoding detected juniper seed moth (S3) at two sites in the northeastern AOI in the fall (see Figure I-1 in Appendix E, Chapter 1).

Incidental observations during 2022 field surveys included monarch within the AOI (at four grid cells that are encompassed fully within the AOI; **Figure B-1**). See **Table B-2** for information on incidental observations (count, observation type, and Tier 1 survey source). Incidental observations of monarch were mostly concentrated in five grid cells in the southwestern region of the AOI / LSA_{TER}, with additional observations in two grid cells the northeastern AOI / LSA_{TER} (**Figure B-1**). As monarch caterpillars rely heavily on milkweed plants for feeding, Zoetica cross-checked the 2022 TEM vegetation survey data for presence of milkweed within the AOI and LSA_{TER}. Field contractors recorded milkweed species at four plots in the AOI: three with common milkweed and one with both common and swamp milkweeds. Two of the plots in the southwestern AOI were within grid cells that contained incidental observations of monarch, and another was just outside two grid cells containing monarch (**Figure B-1**).

1.3.2.2 Species of Interest to Stakeholders and Rights-Holders, and Species of Potential Socio-economic Importance

Emerald ash borer and Dutch elm disease (caused by fungi carried by elm bark beetles) were mentioned as environmental concerns for forest health and diversity in the SON-South Bruce siting area during engagement conducted for the Project (see Appendix B of the BPPA Report (Zoetica 2021)). However, these species will be addressed in Chapter 9 (Ecosystem Function and Services). Human health concerns regarding ticks in the SON-South Bruce siting area were also mentioned during engagement. The socio-economic or socio-ecological importance of additional terrestrial invertebrate species to local communities and/or Indigenous communities will be sought through future engagement.

Of these species mentioned by stakeholders and/or rights-holders, EAB was recorded in incidental observations from 2022 field surveys. A more detailed discussion about forest pests like EAB is presented in Section 1.3.2.3 below and Section 1.3.3.1 in Chapter 9.

1.3.2.3 Indicator Species

Based on forest health monitoring results collected between 2017 and 2022 for the MNRF Midhurst District (NDMNRF 2022, MNRF 2023), where the AOI and LSA_{TER} are located, forests in the BIS study areas may have potential infestation issues with several terrestrial invertebrates: spongy moth, cedar and basswood leafminers, forest tent caterpillar, beech scale, spruce gall adelgids, and fall webworm. Spongy moth and beech scale are invasive species. The other forest pests are native to Ontario and could be used as indicators of forest and ecosystem health for the purposes of the BIS. eDNA metabarcoding detected another terrestrial invertebrate forest pest in the AOI, spruce budworm (*Choristoneura fumiferana*), but this species has not caused moderate to severe defoliation in the Midhurst district for at least the past ten seasons (MNRF 2018, 2023). A more detailed discussion of these insects and other forest disturbances is presented in Section 1.3.3.1 in Chapter 9.

1.3.2.4 Invasive Species

Invasive terrestrial invertebrates were identified through eDNA metabarcoding and TEM forest health surveys, and incidentally while in the field for various surveys. eDNA surveys detected the following invasive terrestrial invertebrates that are not considered forest pests: common earthworm at four sites in the northeastern AOI in the fall, and red earthworm at four sites in the northern AOI and five sites in the LSA_{AQU} in summer and fall (see Figure I-2 in Appendix E, Chapter 1).

1.3.3 Additional Baseline Data to Inform the IA

1.3.3.1 Community Characterization

Tier 1 eDNA metabarcoding studies conducted in 2022 provided some insight into terrestrial, semi-aquatic, and aquatic invertebrate communities within the AOI and aquatic LSA (LSA_{AQU}) (see Appendix E, Chapter 1). There were 80 invertebrate species detected in the AOI and 168 in the LSA_{AQU}. Detections included species of conservation concern, interest to stakeholders and rightsholders, and introduced or invasive species, as discussed in Section 1.3.2.

The Greenock Swamp Area of Natural and Scientific Interest (ANSI) Life Science Inventory report may provide some insight into butterfly diversity in the SON-South Bruce siting area, as the ANSI overlaps with the LSA_{AQU} and northern parts of the LSA_{TER} (see Section 1.3.1.2, Chapter 9). Twelve species and three genera of butterflies, including the at-risk monarch, were identified within the ANSI; however, the author notes that "no doubt many more are present" (Johnson 1994a). A list of butterflies recorded in the Greenock Swamp ANSI is provided in **Table A-2**.

If the SON-South Bruce siting area is selected for additional baseline investigations for the Project, Tier 2 studies will aim to characterize terrestrial invertebrate communities more thoroughly within the BIS study areas.

1.4 Discussion

The current Chapter 6 of the 2023 BIS Baseline Report focused on analyzing desk-based data and one season of field data on terrestrial invertebrate-related SWH and species of interest observations. Complete results from additional years of Tier 1 terrestrial habitat assessments and incidental observations, along with the results of any Tier 2 studies that may be conducted, will be reported in future iterations of the BIS Baseline Report.

Candidate SWH in the BIS study areas for Special Concern and Rare Wildlife Species included the monarch. Field teams observed monarchs in various life stages and exhibiting several behaviours in agricultural fields and meadow marshes in the AOI in 2022. Additional years of data are required to determine whether these observations persist as "enduring migration aggregations" which would confirm the presence of monarch SWH. Monarch caterpillars predominantly feed on milkweed plants, and swamp milkweed and common milkweed were both detected in the herb layer of TEM plots within the AOI (see Table D-4 in Appendix B, Chapter 1; **Figure B-1**).

Of the six invasive terrestrial invertebrates detected in desk- and field-based data thus far, four are addressed in Chapter 9. Common earthworm and red earthworm, both detected via eDNA surveys in 2022, can alter forests by consuming the leaf-litter layer and exposing mineral soils, thereby threatening the health of forests (Ontario Invading Species Awareness Program 2021).

Future Tier 2 field studies for terrestrial invertebrates are to be determined if the SON-South Bruce siting area is selected. Study methods may include: 1) general community composition surveys using traditional sampling techniques and soil eDNA metabarcoding, and 2) targeted surveys for species of interest pending the complete results of Tier 1 studies. Further discussions with local people, Indigenous community members, the regulator, and other provincial and federal agencies are needed to inform the preferred study approach(es) for Tier 2 and/or Tier 3 studies. Refer to Section 5.2.9 of the BPPA Report (Zoetica 2021) for more information.

A more complete discussion of terrestrial invertebrates will be included in future iterations of the BIS Baseline Report after Tier 1 field data collection has been completed and analyzed. Tier 2 studies will be completed if the SON-South Bruce siting area is selected for additional baseline investigations for the Project.

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APPENDIX A – SUPPORTING INFORMATION FOR TERRESTRIAL INVERTEBRATES

Table A-1. Common and scientific names for species mentioned in this report. Species names follow the NHIC's Ontario species lists (current to March 1, 2023) or NatureServe Explorer if the species does not exist in the NHIC dataset.

Common Name (Species)	Scientific Name	Notes
TERRESTRIAL INVERTEBRATES		
Spruce gall adelgids	*Adelges* spp.	
Emerald ash borer	*Agrilus planipennis*	
Juniper seed moth	*Argyresthia alternatella*	
Basswood leafminer	*Baliosus nervosus*	
Rusty-patched bumblebee	*Bombus affinis*	
Ashton cuckoo bumblebee	*Bombus bohemicus*	
American bumblebee	*Bombus pensylvanicus*	
Suckley's cuckoo bumblebee	*Bombus suckleyi*	
Yellow-banded bumblebee	*Bombus terricola*	
Spruce budworm	*Choristoneura fumiferana*	
Beech scale	*Cryptococcus fagisuga*	
Monarch	*Danaus plexippus*	
Rusty crayfish	*Faxonius rusticus*	
Fall webworm	*Hyphantria cunea*	
Red earthworm	*Lumbricus rubellus*	
Common earthworm	*Lumbricus terrestris*	
Spongy moth	*Lymantria dispar dispar*	Previously called LDD moth / gypsy moth
Forest tent caterpillar	*Malacosoma disstria*	
Dutch elm disease	*Ophiostoma ulmi*	
Cabbage white	*Pieris rapae*	
European skipper	*Thymelicus lineola*	
-	*Argyresthia aureoargentella*	Cedar leafminers
-	*Argyresthia canadensis*	
Arborvitae leafminer moth	*Argyresthia thuiella*	
Brown Cedar leafminer moth	*Coleotechnites thujaella*	
Native elm bark beetle	*Hylurgopinus rufipes*	Elm bark beetles
European elm bark beetle	*Scolytus multistriatus*	
Digger crayfish	*Creaserinus fodiens*	Terrestrial crayfish
Great Plains mudbug	*Lacunicambarus nebrascensis*	
American dog tick / Wood tick	*Dermacentor variabilis*	Ticks reported in Grey Bruce & Huron Perth public health units that readily bite humans (Public Health Ontario 2023)
Black-legged tick / Deer tick	*Ixodes scapularis*	
Brown dog tick	*Rhipicephalus sanguineus*	
OTHER SPECIES		
Spruce trees	*Picea* spp.	
Elm trees	*Ulmus* spp.	
Common milkweed	*Asclepias syriaca*	
Swamp milkweed	*Asclepias incarnata*	

Table A-2. Butterflies recorded in the Greenock Swamp ANSI (Johnson 1994a).

Common Name	Scientific Name
Lesser Fritillary	*Boloria* sp.
Common Wood-Nymph	*Cercyonis pegala*
Monarch	*Danaus plexippus*
Viceroy	*Limenitis archippus*
Mourning Cloak	*Nymphalis antiopa*
Eastern Tiger Swallowtail	*Papilio glaucus*
Black Swallowtail	*Papilio polyxenes*
Pearl Crescent	*Phyciodes tharos*
Mustard White	*Pieris oleracea*
Cabbage White	*Pieris rapae*
Long Dash Skipper	*Polites mystic*
Angle Wing	*Polygonia* sp.
Greater Fritillary	*Speyeria* sp.
European Skipper	*Thymelicus lineola*
Red Admiral	*Vanessa atalanta*

Table A-3. List of regulated and non-regulated invasive terrestrial invertebrate species of concern in Ontario. This list does not imply potential occurrence in the SON-South Bruce siting area, as several invasive species "on the radar" have not yet been found in Ontario or even Canada; however, these species are known to have significant ecological, social, health, and/or economic impacts in other areas of North America and worldwide, where they have been introduced.

Common Name	Scientific Name	Ont. ISAP[1]	ISC[2]
European Fire Ant	*Myrmica rubra*		X
Jumping worm spp.	(Family Megascolecidae)	X	X
Jumping worm spp.	*Amynthas* spp.		X
Jumping worm spp.	*Metaphire* spp.		X
Jumping worm spp.	*Pheretima* spp.		X
baldfaced hornet	*Dolichovespula maculata*		
European hornet	*Vespa crabro*		
Box Tree Moth	*Cydalima perspectalis*		X
Northern Giant Hornet	*Vespa mandarinia*		X
European Hornet	*Vespa crabro germana*		

Notes:
1. Ontario's Invading Species Awareness Program (ISAP) is a partnership between the MNRF and the Ontario Federation of Anglers and Hunters. The webpages for Invasive Invertebrates and Invasive Forest Pests and Pathogens were accessed on September 25, 2023: http://www.invadingspecies.com/invaders/
2. The Invasive Species Centre (ISC) is a resource for Ontario and the rest of Canada. Based in Sault Ste. Marie, Ontario, the Board of Directors Organizations include the Great Lakes Fishery Commission, Grand Council Treaty #3, City of Ottawa, International Joint Commission, Wildlife Habitat Canada, University of Waterloo, BioForest, Nature Conservancy of Canada, Natural Resources Canada, Fisheries and Oceans Canada, and the CFIA. The webpage for Invasive Insects was accessed on September 25, 2023: https://www.invasivespeciescentre.ca/invasive-species/

APPENDIX B – INCIDENTAL OBSERVATIONS IN THE FIELD

Table B-1. Incidental observations of terrestrial invertebrates during TEM, AHM, and eDNA field surveys in the AOI or LSA_{TER} in 2022.

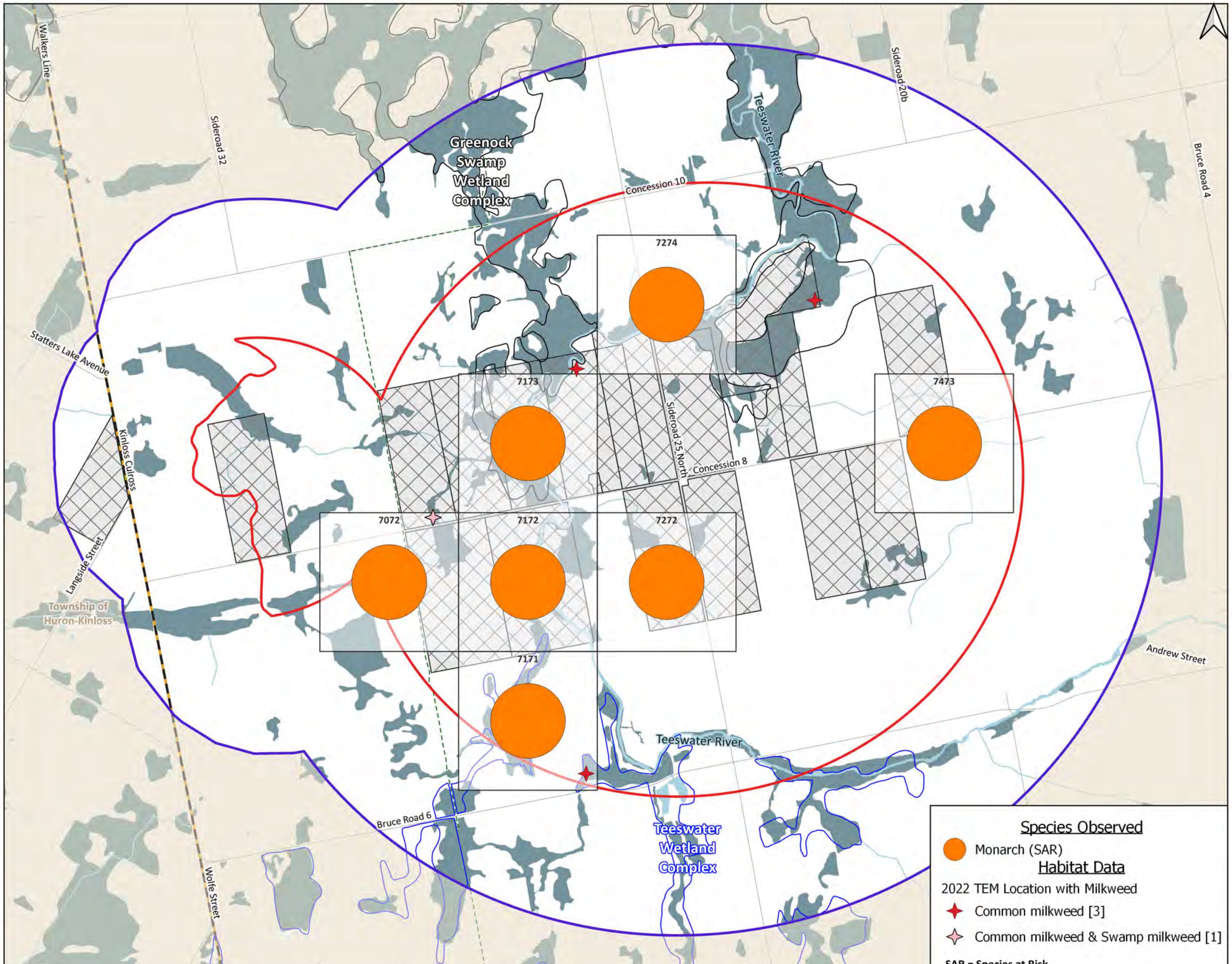
Common Name	Scientific Name	SAR	Rare	Invasive	Notes
Emerald ash borer (EAB)	*Agrilus planipennis*	N	N	Y	Addressed in Chapter 9
Giant swallowtail	*Heraclides cresphontes*	N	N	N	
Monarch	*Danaus plexippus*	Y	Y	N	SC in Ontario, END in Canada, S2N/S4B
Spongy moth	*Lymantria dispar dispar*	N	N	Y	Addressed in Chapter 9

<u>Notes:</u>
END = Endangered; SC = Special Concern
NHIC SRANKs: N = non-breeding population, B = breeding population.

Table B-2. Supplemental information for 2022 field-based incidental observations of terrestrial invertebrate species of interest in the BIS study areas.

Grid	Species	Observation Type	Count	Source Type	AOI	LSA_{TER}
7072	Monarch	Visual (juv)	1	Incidental	1	1
7072	Monarch	Visual	1	Incidental	1	1
7072	Monarch	Visual	7	Incidental	1	1
7072	Monarch	Visual	1	Incidental	1	1
7072	Monarch	Visual	1	Incidental	1	1
7171	Monarch	Visual	5	Incidental	1	1
7172	Monarch	Visual	1	Incidental	1	1
7172	Monarch	Visual	1	Incidental	1	1
7172	Monarch	Visual	2	Incidental	1	1
7172	Monarch	Visual	5	Incidental	1	1
7172	Monarch	Visual	1	Incidental	1	1
7173	Monarch	Visual	2	Incidental	1	1
7272	Monarch	Visual (juv)	1	Incidental	1	1
7272	Monarch	Visual (juv)	1	Incidental	1	1
7272	Monarch	Visual (juv)	1	Incidental	1	1
7274	Monarch	Visual	1	Incidental	1	1
7473	Monarch	Visual	1	AHM	1	1

Notes:
See **Figure B-1** for Grid locations of masked observations. Coordinates are not provided due to the sensitive nature of the at-risk monarch.
For the purposes of this table, the indicated study area includes overlap with other study area(s) that may be encompassed within its boundaries.



NWMO Biodiversity Impact Studies

Terrestrial Invertebrate Species of Interest Field Observations & Habitat Data

Figure B-1

- Area of Interest (AOI)
- Local Study Area (LSA_{TER})
- Lake
- Wetland
- Watercourse
- Highway
- Local Road
- South Bruce Boundary
- Municipal Boundary
- NWMO Purchased or Optioned Land

Of all wetlands shown, only Provincially Significant Wetlands (PSWs) are labelled. The colour of the outline surrounding PSWs matches the colour of the respective PSW label.

PSW boundaries may not match wetland boundaries due to changes in aquatic habitat coverage since their creation compared to 2022.

1:27,000
0 0.5 1 km

ZOETICA

Data received from:
Ontario GeoHub — OHN Waterbody (MNRF); OHN Watercourse (MNRF); MNRF Road Segments (MNRF); Municipal Boundary - Lower and Single Tier (MMAH); Wetlands (MNRF)
NWMO — AOI; NWMO Purchased or Optioned Land; 2022 SB TEM Ecosite Data Export V4 (Tulloch)
Wetlands and water features are mapped using ecosite data within the LSA_{ECO} and data available from Ontario GeoHub outside the LSA_{ECO}.

Project CRS: NAD83 / UTM zone 17N		
Author: AH	Reviewed by: CC	Approved by: HB
December 13, 2023	Map ID: NWMO_BIS_A115	

Report (R001)

BIODIVERSITY IMPACT STUDIES – SOUTHWESTERN ONTARIO REGION: 2023 BASELINE REPORT (CHAPTER 7: AVIFAUNA)

December 13, 2023

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GLOSSARY AND ABBREVIATIONS

AHM	Aquatic Habitat Mapping
ANSI	Area of Natural and Scientific Interest
AOI	Area of Interest
BCR	Bird Conservation Region
BIS	Biodiversity Impact Studies
BPD	Biodiversity Impact Studies – Southwestern Ontario Region: Baseline Program Design
BPPA	Biodiversity Impact Studies – Southwestern Ontario Region: Best Practices and Preferred Approach
BV	Biodiversity Value. The biotic environmental components that will be considered for study within the Project's Biodiversity Impact Studies. A subset of biodiversity values will ultimately be scoped into the Biodiversity Impact Assessment as Valued Components.
CA	Conservation Authority
CNSC	Canadian Nuclear Safety Commission
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
Critical habitat	Habitat that is necessary for the survival or recovery of a listed wildlife species and that is identified as the species' critical habitat in the recovery strategy or in an action plan for the species (*Species at Risk Act*, S.C. 2002, c. 29). Identification of critical habitat is not a required component of a recovery strategy under the Ontario *Endangered Species Act*. However, the approach used to identify critical habitat, in conjunction with the best scientific information available, is recommended when developing a habitat regulation. A habitat regulation is a legal instrument under the *ESA* that prescribes an area that will be protected as the habitat of the species.
ECCC	Environment and Climate Change Canada
Ecoregion	Second highest level of the ELC hierarchy (Crins et al. 2009). Large geographic areas primarily identified by sub-continental climatic regimes and bedrock geology.
Ecosite	Second lowest level of the ELC hierarchy (Crins et al. 2009). The land within an ecosite will generally contain similar substrate and vegetation.
Ecosite classification dataset	The dataset of ecosite classification created for the BIS using South Western Ontario Orthophotography Project (SWOOP) 2020 imagery.
ECS	Ecoregional Criterion Schedule
eDNA	Environmental DNA
ELC	Ecological Land Classification
Environmentally significant area	With respect to bird habitat, the TISG Template requires identification of environmentally significant areas, which include National Parks, Areas of Natural or Scientific Interest, Migratory Bird Sanctuaries or other priority areas or sanctuaries for birds, National Wildlife Areas or World Biosphere Reserves, offshore Marine Protected Areas and Ecologically and Biologically Significant Marine Areas (IAAC 2023).
EO	Element Occurrence. An EO is an area of land and/or water where a species or vegetation community is or was present. EOs represent areas important to the conservation of a species or vegetation community. In Ontario, the NHIC generates each EO from one or

	more observations, based on international standard EO specifications developed by NatureServe (NDMNRF 2021).
ESA	Ontario *Endangered Species Act*
FWCA	Ontario *Fish and Wildlife Conservation Act*
GBIF	Global Biodiversity Information Facility
GIS	Geographic Information System
GSWC	Greenock Swamp Wetland Complex
Habitat suitability / suitable habitat	The ability of the habitat, in its current condition, to provide the life requisites of a species.
IA	Impact Assessment
Landbird	Bird species that primarily use terrestrial habitats. This group includes a wide variety of tree-dwelling birds, perching birds or songbirds, raptors, and ground-feeding birds. For the purposes of the BIS, upland breeding birds include all landbirds except for raptors.
Lek	A communal area where animals congregate during the breeding season and males engage in competitive displays and courtship rituals to attract females. A variety of species use a lek mating system; grouse are amongst the most well-known examples.
LSA	Local Study Area LSA_{TER} = Terrestrial Local Study Area LSA_{AQU} = Aquatic Local Study Area LSA_{ECO} = Local Study Area for Ecosystem Function and Services
MBCA	Federal *Migratory Birds Convention Act, 1994*
MECP	Ontario Ministry of the Environment, Conservation and Parks
MNRF	Ontario Ministry of Natural Resources and Forestry
NHIC	Ontario Natural Heritage Information Centre
NWMO	Nuclear Waste Management Organization
OBBA	Ontario Breeding Bird Atlas
Rights-holders	First Nation and Métis communities who have asserted and or hold recognized treaty and/or Indigenous rights and whose traditional territories include the project location.
RSA	Regional Study Area RSA_{AVI} = Regional Study Area for Terrestrial Avifauna $RSA_{AVI-AQU}$ = Regional Study Area for Aquatic or Semi-aquatic Avifauna
SAR	Species at Risk. For the purposes of the BIS, SAR include species listed under Schedule 1 of the federal *Species at Risk Act* (*SARA*), species designated as Species at Risk in Ontario (SARO) and listed under the provincial *Endangered Species Act, 2007* (*ESA*), and species assessed as Extirpated, Endangered, Threatened, or Special Concern by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC).
SARA	Federal *Species at Risk Act*
SARO	Species at Risk in Ontario
SON	Saugeen Ojibway Nation
SON-South Bruce siting area	Used to describe the broader area surrounding the defined area within which the Project may be located. The SON-South Bruce siting area is the general area surrounding the

	Municipality of South Bruce and includes the traditional territory of Saugeen Ojibway Nation (SON) in southwestern Ontario.
SOP	Standard Operating Procedure
Species of conservation concern	Includes provincially and/or federally listed SAR (Extirpated, Endangered, Threatened, Special Concern) and provincially rare (SRANK S1, S2, S3, SH) species. Regionally rare species may also be scoped in if identified by stakeholders and/or rights-holders as VCs.
Species of interest	Includes species of conservation concern, culturally important species, indicator species, and invasive species (where applicable).
SRANK	Subnational Rank. SRANK is the conservation status of a species or vegetation community within a particular province, territory, or state. In Ontario, the NHIC assigns SRANKs using the best available information and considering factors such as abundance, distribution, population trends, and trends (NDMNRF 2021). Species assigned S1 (Critically Imperiled), S2 (Imperiled), S3 (Vulnerable), and SH (Possibly Extirpated) are considered provincially rare by the NHIC. See the NatureServe website for more information: https://www.natureserve.org/nsexplorer/about-the-data/statuses/conservation-status-categories
SWH	Significant Wildlife Habitat. Defined in the Ontario Provincial Policy Statement, 2020 as: *Wildlife habitat* – areas where plants, animals and other organisms live, and find adequate amounts of food, water, shelter and space needed to sustain their populations. Specific wildlife habitats of concern may include areas where species concentrate at a vulnerable point in their annual life cycle; and areas which are important to migratory and non-migratory species. *Significant* – in regard to wildlife habitat, ecologically important in terms of features, functions, representation or amount, and contributing to the quality and diversity of an identifiable geographic area or natural heritage system. Candidate SWH are areas that meet the ELC ecosite code(s) and/or habitat criteria outlined in the SWH ecoregional criterion schedule (ECS). Confirmed SWH are areas that meet the defining criteria outlined in the SWH ECS. Detailed field investigations are usually needed to confirm SWH.
TEM	Terrestrial Ecosystem Mapping
The Project	The Adaptive Phased Management Project is the Deep Geological Repository and other required infrastructure for the safe, long-term management of Canada's used nuclear fuel.
TISG	Tailored Impact Statement Guidelines. 'TISG Template' refers to the Tailored Impact Statement Guidelines Template (generic version) (IAAC 2023).
UBB	Upland Breeding Bird
UTM	Universal Transverse Mercator
VC	Valued Component. For impact assessments of designated projects under the *Impact Assessment Act*, the Agency's Glossary of Terms defines VCs as "environmental, health, social, economic or additional elements or conditions of the natural and human environment that may be impacted by a proposed project and are of concern or value to the public, Indigenous peoples, federal authorities and interested parties. Valued components may be identified as having scientific, biological, social, health, cultural, traditional, economic, historical, archaeological and/or aesthetic importance."

1.0 INTRODUCTION

Birds are important components of ecosystems, serving as pollinators, seed dispersers, insect controllers, and game for hunting. Birds provide a component of well-being for various community members, including spiritual connections for Indigenous peoples. Birds can also act as biological indicators of healthy ecosystems because methods for gathering information on diversity, abundance, and distribution of birds are well established, and data on many bird species can be gathered simultaneously using various protocols. In Canada, numbers of aerial insectivores, grassland birds, and shorebirds are generally declining; waterfowl and birds of prey are generally recovering; and a quarter of all bird species are not well monitored so population statuses and trends are unknown (NABCI-Canada 2019). For the purposes of the Adaptive Phased Management Project's (hereafter, 'the Project') Biodiversity Impact Studies (BIS), Zoetica™ has grouped the wide array of potential bird species into four functional groups, based on similar life-history attributes and survey methods for determining their presence and/or abundance. These groups will henceforth be referred to as: Upland Breeding Birds[1], Shorebirds, Waterbirds, and Raptors.

The importance of birds provincially, nationally, and internationally, is reflected in the many Acts and regulations put in place by the various levels of government, including the federal *Migratory Birds Convention Act, 1994* (*MBCA*) and *Species at Risk Act* (*SARA*), and the Ontario *Endangered Species Act* (*ESA*) and *Fish and Wildlife Conservation Act* (*FWCA*). Most migratory birds are protected under the *MBCA*, which protects individual birds, their eggs, and their nests from any form of hunting, trafficking, commercialization, or substance harm, unless holding a permit. All wild birds (that are not considered game birds) are protected under the *FWCA* from trapping or hunting. A full list of Acts, regulations, and other biodiversity considerations is available in Appendix E of the *Biodiversity Impact Studies – Southwestern Ontario Region: Best Practices and Preferred Approaches* (BPPA) Report (Zoetica 2021).

The Canadian Nuclear Safety Commission's (CNSC) *Guidance on Deep Geological Repository Site Characterization* includes wildlife, terrestrial habitat, and species at risk (SAR) as elements of terrestrial ecology that should be characterized in the Area of Interest (AOI) (CNSC 2018). In addition, the Tailored Impact Statement Guidelines Template (generic version) ('TISG Template')[2] identifies birds, migratory birds and their habitat, and SAR as elements of the biophysical environment that could be scoped into the Impact Assessment (IA) as Valued Components (VCs), which would require a detailed baseline description and project effects assessment in the impact statement (IAAC 2023).

The Saugeen Ojibway Nation (SON)-South Bruce siting area is located within Bird Conservation Region (BCR) 13: Lower Great Lakes/St. Lawrence Plain (EC 2014a). Environment and Climate Change Canada (ECCC) developed a series of bird conservation strategies in each of Canada's BCRs, including for the Ontario portion of BCR 13 (EC 2014a). These strategies form a basis for which specific implementation

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[1] Zoetica's *Biodiversity Impact Studies – Southwestern Ontario Region: Best Practices and Preferred Approaches* (BPPA) Report (Zoetica 2021) distinguished five functional groups of birds based on likeness of survey methods for determining their presence and/or abundance. For the 2023 BIS Baseline Report, Upland Breeding Birds and Game Birds are discussed together because of their similar habitat requirements. However, Zoetica recognizes that Game Birds and Waterfowl are important for hunting and traditional land use practices. If the Saugeen Ojibway Nation (SON)-South Bruce siting area is selected for the Project, future reporting of Tier 2 BIS baseline studies may present Game Birds and Waterfowl separately such that potential Project impacts on these species can be considered by the NWMO's social, economic, and health impact assessment team.

[2] Please see Chapter 1 for limitations of and planned updates to the TISG Template.

plans can be developed. Each plan includes a priority species assessment, habitats important to priority species, population objectives, threat assessment for priority species, conservation objectives, and recommended actions.

Priority species identified in the BCR 13 strategy include federal and provincial SAR and species of concern or stewardship[3] at both regional/subregional and national/continental scales. Priority species that are not at risk and not provincially rare (i.e., those without legal implications) may be selected as potential indicator species to carry forward to the IA (see Section 5.2.7 and Tables 5-17 and 5-18 of the BPPA Report (Zoetica 2021)). However, not all 97 priority species described in the BCR 13 strategy will apply to the SON-South Bruce siting area, as the BCR 13 region also includes Great Lakes shorelines and portions of southeastern Ontario (see Figure 1 in (EC 2014a), whereas the BIS study areas for birds include a smaller, inland location in southern Bruce County (see Section 3.0, Chapter 1).

Birds considered biodiversity values (BVs) for the BIS include: species that are indicators of ecosystem health, species of conservation concern (including SAR and rare species), and species of interest to stakeholders and rights-holders. Priority species identified in the BCR 13 strategy, along with culturally important and invasive species (where applicable)[4], are currently included as “species of interest” for the purposes of the BIS. For the current Chapter 7 (Avifauna) of the 2023 BIS Baseline Report, all priority species observations are discussed but mapping is limited to SAR and provincially rare species. Although some birds were mentioned during engagement, the cultural importance of species cannot be ascertained by Zoetica at this time, as this task requires further coordination with other disciplines studying the potential impacts of the Project. A review of engagement conducted to date that is of relevance to the BIS is presented in Appendix B of the BPPA Report (Zoetica 2021). The scope of species of interest for BIS baseline reporting will be expanded in future years of the BIS baseline program to include culturally important and other priority/indicator species when more information is gathered through Tier 2 studies and engagement.

1.1 General Objectives

The general objectives of bird studies for the BIS are to:

1. Determine the presence, distribution, and abundance of relevant Significant Wildlife Habitat (SWH) and other important habitat for select BVs, with an emphasis on:
    a. Species of conservation concern, including SAR,
    b. Species of interest and potential importance to local stakeholders and rights-holders,
    c. Indicator species;

[3] In addition to SAR and rare species, ECCC has identified other bird species of conservation concern if they “are vulnerable due to population size, distribution, population trend, abundance and threats” (EC 2014a). Stewardship species are widely distributed and abundant species that typify national and regional bird communities. Some species also have a large portion of their range and/or population within the BCR, warranting their inclusion as stewardship species (EC 2014a).

[4] There are currently no birds designated as invasive species in Ontario (i.e., listed under the Ontario *Invasive Species Act* or by Ontario’s Invading Species Awareness Program). While there are likely introduced/exotic bird species in the SON-South Bruce siting area, such as rock pigeon, European starling, and house sparrow, these are not typically considered invasive species. Introduced/exotic birds will not be included as species of interest for the purposes of the BIS unless management concerns are raised in the future through ongoing engagement with local stakeholders and/or rights-holders.

2. Determine the potential presence and distribution of species of interest, including the select BVs listed in (1); and,
3. Provide additional baseline data to help inform the Project's biodiversity IA and mitigation measures, and to assist in the potential development of monitoring program(s) to address environmental, regulatory, and stakeholder/rights-holder concerns.

The current Chapter 7 (Avifauna) begins to fulfill the requirements of the TISG Template required for birds, migratory birds, and their habitat (see Appendix C in the BPPA Report (Zoetica 2021)).

1.2 General Methods

ECCC has provided a framework for the scientific assessment of potential project impacts on birds (Hanson et al. 2009). This framework helps interweave BCR strategies, regulations, methods, and existing datasets into scientifically- based conclusions about potential project impacts on birds, ensuring that baseline data will adequately inform the IA. These concepts, sources, and guidelines helped shape the BIS baseline data collection for birds. If the SON-South Bruce siting area is selected for the Project, Zoetica will implement any additional guidance provided by ECCC regarding future planned baseline studies (i.e., Tiers 2 and 3) and the IA for migratory birds and SAR.

1.2.1 Study Areas

The BIS study areas for birds include the AOI, terrestrial local study area (LSA_{TER}), and two regional study areas (RSA_{AVI} and $RSA_{AVI\text{-}AQU}$). Different RSAs are used depending on the life history requirements of the species or species grouping (i.e., needing terrestrial habitat only or terrestrial and aquatic). The $RSA_{AVI\text{-}AQU}$ is comprised of the outer boundaries of the RSA_{AVI} and the aquatic LSA (LSA_{AQU}). See Section 3.0 in Chapter 1 and Section 5.2.7.5 of the BPPA Report (Zoetica 2021) for more details on study area descriptions and rationale.

For the Tier 1 baseline studies, desk-based ecosite classifications and subsequent field verifications were completed as part of Terrestrial Ecosystem Mapping (TEM) (see Appendix B, Chapter 1), and only covered the LSA for ecosystem functions and services (LSA_{ECO}). The LSA_{ECO} encompasses both the LSA_{TER} and portions of the RSA_{AVI} and $RSA_{AVI\text{-}AQU}$. Analyses involving ecosite data (e.g., to identify candidate SWH for birds) were thus limited to the LSA_{ECO}; however, mapping of species and important wildlife habitat from both desk- and field-based data extended into the RSAs.

1.2.2 Collation of Species Observations and Habitat Data

Zoetica began desk-based investigations of birds by identifying species of interest that could potentially occur within the BIS study areas. Refer to Appendix D and Section 3.1 in the BPPA Report (Zoetica 2021) for a comprehensive list of SAR, including at-risk bird species, and methods used to compile this list. Provincially rare species are indicated by their subnational rank (SRANK; S1, S2, S3, SH) and tracked by the Ontario Natural Heritage Information Centre (NHIC).[5]

[5] For the purposes of the 2023 BIS Baseline Report, conservation statuses described in text for at-risk species refer to their Species at Risk in Ontario (SARO) listings unless otherwise indicated. Conservation statuses are from the NHIC's Ontario species list, current to March 1, 2023, and updated for any discrepancies with provincial and federal SAR listings up to August 15, 2023. As such, species and status listings may differ from those presented in Zoetica's 2021 BPPA Report (Zoetica 2021).

Zoetica proceeded with desk-based research and mapping by collating existing data from government, citizen science, and other biodiversity databases. For this 2023 BIS Baseline Report, data sources for verified species and habitat records included the NHIC, Ontario Ministry of Natural Resources and Forestry (MNRF), and the Global Biodiversity Information Facility (GBIF). As these datasets periodically pull observations from other bird-related projects and programs (e.g., eBird, Ontario Bird Breeding Atlas [OBBA]), they were deemed to be a good starting point to describe the biodiversity of bird species and their habitats that are found or are likely to be found in the RSA_{AVI} and $RSA_{AVI\text{-}AQU}$.

In addition, Zoetica investigated findings from previous 2020 preliminary environmental studies conducted for the Project in the SON-South Bruce siting area (Tulloch Environmental 2020, 2021). Spatial data collected for these environmental studies were not incorporated into Zoetica's baseline maps; however, Tulloch Environmental's 2020 and 2021 reports and maps are available upon request from the NWMO. **Table 1-1** summarizes the datasets, data layers, and reports investigated and analyzed for bird species observations and habitat data for the 2023 BIS Baseline Report.

Table 1-1. Spatial datasets and reports analyzed for birds for the 2023 BIS Baseline Report.

Data Source / Owner	**Dataset**	**Data Format**	**Date Accessed / Received**	**Contains relevant[1] data?**
Tulloch Environmental *Preliminary environmental studies for the Project*	July 2020 Site Reconnaissance (Tulloch Environmental 2020)	Unpublished Report	10/2020	Y
	October 2020 Natural Heritage Features (Tulloch Environmental 2021)	Unpublished Report	04/2021	Y
Ontario Natural Heritage Information Centre (NHIC)	Species Occurrences	Shapefile	12/2020	Y
	Wildlife Concentration Area Observation	Shapefile	12/2020	Y
Ontario Ministry of Natural Resources and Forestry (MNRF)	Wildlife Activity Site	Shapefile	12/2020	N
	Wildlife Activity Area	Shapefile	12/2020	N
	Greenock Swamp ANSI Report (Johnson 1994a, 1994b)	Reports	10/2020	Y
Global Biodiversity Information Facility (GBIF)	Species Occurrences	Comma Separated Values	10/2021	Y
Environment and Climate Change Canada (ECCC) and Ontario Ministry of the Environment, Conservation and Parks (MECP)[2]	Federal and Provincial SAR Recovery Strategies	Reports	Various	Y

Notes:

1. Zoetica determined dataset relevance based on geographic and temporal relevance, as well as relevance to birds. For example, data that were not within the relevant BIS study areas, data that were too old to be considered relevant, or data that did not include records of bird species were labelled "N" for not containing relevant data.
2. SAR recovery strategies are published by the ECCC and MECP but authors may differ. Refer to Appendix D of the BPPA Report (Zoetica 2021) for a full list of potentially occurring SAR that had provincial and/or federal recovery strategies available at the time of writing the BPPA Report (note: new documents are continually posted on the SARO website and *SARA* Public Registry). The most updated versions of the recovery strategies for relevant species were reviewed and cited in this 2023 BIS Baseline Report.

A full list of the species mentioned in this report, including common and scientific names, is available in **Table A-1** in Appendix A. All map figures are presented in Appendix B.

Additional datasets will be investigated in future years of the BIS baseline program. For example, data collection is currently underway for the OBBA Atlas-3, a project conducted in partnership between Birds Canada, Canadian Wildlife Service (ECCC), MNRF, Ontario Field Ornithologists, and Ontario Nature. Data collected within atlas squares overlapping the RSA_{AVI} and $RSA_{AVI\text{-}AQU}$ will be sought in the future to complement the BIS baseline studies and to gather a larger regional picture of bird biodiversity.

1.2.3 Tier 1 Studies

Field studies conducted in 2022 focused on collecting Tier 1 foundational habitat data and species detections through environmental DNA (eDNA) metabarcoding studies. Each field team also collected incidental observations of biodiversity, including birds. Detailed methods for the Tier 1 studies are available in the *Biodiversity Impact Studies – Southwestern Ontario Region: Baseline Program Design* (BPD) Report and associated Standard Operating Procedures (SOPs) (Zoetica 2022). In addition to the utility of each Tier 1 study outlined below for understanding birds and bird habitat in the BIS study areas, incidental bird observations collected during the terrestrial and aquatic field studies may be informative in describing biodiversity.

1.2.3.1 Terrestrial Ecosystem Mapping

TEM work completed to date is described in Appendix B, Chapter 1. The ecosite classification dataset resulting from TEM work was used for desk-based identification of candidate SWH.

1.2.3.2 Identification of Candidate SWH

Desk- and field-based candidate SWH identification work completed to date is described in Appendix C, Chapter 1. SWH types of relevance to birds are outlined in Sections 2.0, 3.0, 4.0, and 5.0 of this report.

1.2.3.3 Aquatic Habitat Mapping

Aquatic Habitat Mapping (AHM) work completed to date is described in Appendix D, Chapter 1. The results of AHM may help identify important foraging habitats for piscivorous (fish-eating) bird species.

1.2.3.4 Environmental DNA Metabarcoding

eDNA metabarcoding studies completed to date are described in Appendix E, Chapter 1. The two vertebrate primers used for eDNA metabarcoding studies are primarily intended to capture aquatic and semi-aquatic species such as fish, amphibians, and turtles (see Section 2.4 of the BPD Report (Zoetica 2022)); however, the primers may also detect bird species.

1.2.4 Mapping Considerations

To protect sensitive species and ecosystems, NHIC spatial data and 2022 field data pertaining to provincially tracked (at-risk and rare) species and wildlife concentration areas (e.g., nest colonies) are represented by a 1 km grid, rather than a point or polygon, as per the NHIC's Sensitive Data Location Standards (NHIC n.d.). Descriptive reporting also follows sensitivity standards and is not detailed enough to allow for precise geolocation.

GBIF data were limited to observations from 1970 onward as older observations were considered historic and not as reliable. See also Appendix A, Chapter 1 for data quality scoring. When there were multiple entries with a count of one at the same location, Zoetica assumed the entries were all the same individual to avoid double-counting and erroneously reporting that multiple individuals were present.

Incidental observations were recorded during various Tier 1 baseline field programs and were noted on different data forms (Incidental Observation Form or noted in TEM, AHM, or eDNA survey forms). Incidental observations varied in method of observation (audio, visual, etc.) and life history stage of organisms, and may have been recorded in transit to a site and thus not associated with habitat data. As well, expertise in species identification may have varied among field contractors working on different field programs. Thus, not all pertinent information may have been available (e.g., observation type, activity, demographics) or collected in a directly comparable manner (e.g., quantity). For mapping and interpretation purposes, Zoetica defaulted to ‘unspecified’ observation type, count of one individual, and adult individuals unless otherwise indicated. Zoetica also assumed one individual when a singular observation (e.g., “barn swallow”) was recorded in the field notes, and more than one individual if plural observations (e.g., “barn swallows”) were recorded.

For both desk- and field-based species observation data, only the species and locations (masked for sensitive data, where needed) are presented on the maps in Appendix B. Additional information about count, observation type, and source type (i.e., which Tier 1 program the incidental observation came from) is presented in the supplemental table for each map in Appendix B.

2.0 UPLAND BREEDING BIRDS

2.1 Introduction

This section of the 2023 BIS Baseline Report focuses on upland breeding birds. This group refers to landbirds, aside from raptors (Section 5.0), and includes the following orders:

- Columbiformes – Pigeons and Doves
- Cuculiformes – Cuckoos
- Caprimulgiformes – Nightjars, Swifts, Hummingbirds, and Allies
- Coraciiformes – Kingfishers
- Piciformes – Woodpeckers
- Passeriformes – Flycatchers, Shrikes, Crows, Jays, Tits, Chickadees, Larks, Swallows, Warblers, Treecreepers, Wrens, Dippers, Thrushes, Waxwings, Old World Sparrows, Finches, Wagtails, Cardinals, and Allies
- Galliformes – Grouse, Pheasants, and Allies (‘Game Birds’ as discussed in the BPPA Report (Zoetica 2021))

A general introduction about the inclusion of birds for the BIS and background information about BCR 13 is included in Section 1.0. Out of 97 priority species identified in the BCR 13 strategy (EC 2014a), 39 are upland breeding birds. Most upland breeding birds are migratory species that are expected to be present in the BIS study areas only during the breeding season (Mitch Waite Group 2018). BCR 13 corresponds to nesting zone C2, where the regional nesting period is between early April to late August (ECCC 2018a). Baseline studies of upland breeding birds will, therefore, generally be conducted during this timeframe.

Several SWH types apply to upland breeding birds. Based on the SWH Ecoregional Criterion Schedule for Ecoregion 6E (hereafter ‘6E ECS’) (OMNRF 2015), there are 11 upland breeding bird-related SWH types of potential relevance to the SON-South Bruce siting area:

- Colonially-Nesting Bird Breeding Habitat (Bank and Cliff)
- Colonially-Nesting Bird Breeding Habitat (Tree/Shrubs) – *primarily of relevance to waterbirds but also indicated for chimney swift (Threatened)* (MNRF 2014)
- Colonially-Nesting Bird Breeding Habitat (Ground) – *primarily of relevance to waterbirds but also indicated for Brewer’s blackbird* (OMNRF 2015)
- Seeps and Springs
- Woodland Area-Sensitive Bird Breeding Habitat
- Marsh Bird Breeding Habitat – *primarily of relevance to waterbirds but also indicated for marsh wren and sedge wren* (OMNRF 2015)
- Open Country Bird Breeding Habitat
- Shrub/Early Successional Bird Breeding Habitat
- Alvar – *may support loggerhead shrike (Endangered)* (MNRF 2014)
- Tallgrass Prairie – *may support Henslow’s sparrow (Endangered)* (MNRF 2014)
- Special Concern and Rare Species

Further details about candidate SWH investigations conducted to date and rationale for inclusion (or exclusion) of SWH types listed in the 6E ECS are presented in Appendix C, Chapter 1.

2.1.1 Objectives

All general objectives listed in Section 1.1 apply to upland breeding birds.

2.2 Methods

2.2.1 Study Areas

The BIS study areas for upland breeding birds include the AOI, LSA_{TER}, and RSA_{AVI} (see figures and descriptions in Section 3.0, Chapter 1).

2.2.2 Presence, Distribution, and Abundance of Important Habitat

Collation of both existing and Tier 1 habitat data for upland breeding birds proceeded as described in Sections 1.2.2 and 1.2.3.

2.2.3 Presence and Distribution of Species of Interest

Collation of existing observations and Tier 1 incidental observations for upland breeding bird species of interest proceeded as described in Sections 1.2.2 and 1.2.3.

2.2.4 Additional Baseline Data to Inform the IA

Species lists were compiled from desk- and field-based studies (as per Section 1.2.2 and 1.2.3) as an initial investigation into the biodiversity of upland breeding birds in the BIS study areas.

2.3 Results

2.3.1 Presence, Distribution, and Abundance of Important Habitat

2.3.1.1 General Habitat Associations

Future Tier 2 studies aim to determine upland breeding bird-habitat associations within the BIS study areas. Discussion of general habitat associations will be included in future BIS Baseline Reports after Tier 2 studies have been completed (if the SON-South Bruce siting area is selected for the Project).

2.3.1.2 Significant and Other Important Wildlife Habitats

Two confirmed SWH types and various candidate SWH types of relevance to upland breeding birds have been found within the AOI, LSA_{TER}, and/or RSA_{AVI} based on ecosite matches, some or all habitat criteria being met, or records of species and/or habitat features. Of note, there is strong evidence from both TEM/SWH and AHM surveys to support confirmed SWH for Seeps and Springs, which are important feeding and drinking areas for a variety of wildlife species, including wild turkey and ruffed grouse. Barn swallow (Special Concern) nest sites should also be confirmed SWH; observations of barn swallow nesting are described further below in this Section 2.3.1.2. Of the 11 SWH types listed in Section 2.1, candidate SWH was identified for all except Tallgrass Prairie (which may support the Endangered Henslow's sparrow). There are no data to support candidate Tallgrass Prairie SWH within the BIS study areas for birds to date. A detailed discussion of confirmed and candidate SWH is available in Appendix C, Chapter 1.

In addition (or supplementary) to SWH, Zoetica investigated whether other important wildlife habitat data (e.g., nests, territories, snags/wildlife trees, important foraging/perching/roosting sites) were noted in existing datasets and reports (see **Table 1-1**) or found during the Tier 1 BIS baseline field programs. As part of previous preliminary environmental work for the Project, a reconnaissance for natural heritage features was conducted in July 2020 for borehole BH-01 (Tulloch Environmental 2020) and in October 2020 for borehole BH-02 (Tulloch Environmental 2021) within the AOI. At BH-01, the following breeding habitats for SAR were observed: nesting barn swallows within farmstead out-buildings on site, and suitable habitat for eastern meadowlark (Threatened) and bobolink (Threatened) within adjacent properties, but not at the BH-01 site. At BH-02, no active or recently active barn swallow nests were found, but suitable habitat exists within/around the buildings on site, and suitable habitat for eastern meadowlark and bobolink potentially exists on adjacent agricultural fields (depending on crop rotation). Suitable nesting habitat for migratory birds is available in treed/shrub/riparian habitats nearby; however, few birds were observed during the October 2020 survey, as would be expected (Tulloch Environmental 2021).

During 2022 field studies, upland breeding bird nesting activity was recorded within the AOI and/or LSA_{TER}: barn swallows were reported nesting in an old barn. Incidental observations of barn swallow and other species of conservation concern are further described in Section 2.3.2.1. Although nesting activity was rarely directly observed, field surveyors assessed TEM plots for their suitability as breeding habitat for a variety of upland breeding birds (i.e., candidate SWH), and recorded incidental observations of species of interest or their habitat whenever they were encountered. For example, field surveyors identified eroding banks that could be suitable breeding habitat for bank swallows (Threatened) along the Teeswater River within the AOI. These findings are also related to candidate SWH for Colonially-Nesting Bird Breeding Habitat (Bank and Cliff). Relevant incidental observations and field results showing which TEM plots were identified as candidate SWH are presented in Appendix C, Chapter 1.

2.3.1.3 Critical Habitat and Environmentally Significant Areas

As of September 2023, eight at-risk bird species have the potential to be found in the SON-South Bruce siting area (see Table 5-19 in the BPPA Report (Zoetica 2021)) with federal recovery strategies, where critical habitat (represented by 10 x 10 km squares) has been identified near BIS study areas for birds (**Table 2-1**). As shown in **Figure B-1**, there is a known critical habitat square for bobolink that overlaps with the AOI, LSA_{TER}, and RSA_{AVI}. Further discussions with ECCC and/or the Ontario Ministry of the Environment, Conservation and Parks (MECP) are needed to determine whether critical habitat for bobolink occurs within the BIS study areas. In addition, it is possible that new critical habitat will be identified by ECCC recovery practitioners during the timeline of the BIS baseline program and Project IA; should this occur, relevant critical habitat will be discussed in this section in future BIS baseline reports.

Table 2-1. Bird species at risk with critical habitat identified in or near the BIS study areas for birds.

Species	Overlaps RSA_{AVI} / $RSA_{AVI-AQU}$[1]	Distance from RSA (km)	Recovery Strategy Reference
Bobolink	Yes	-	(ECCC 2022a) – *proposed*
Bank Swallow	No	3.6	(ECCC 2022b)
Red-headed Woodpecker	No	6.8	(ECCC 2021)
Eastern Meadowlark	No	12.4	(ECCC 2022c) – *proposed*
Least Bittern[1]	No	23.8	(EC 2014b)
Eastern Whip-poor-will	No	31.0	(ECCC 2018b)
Chimney Swift	No	37.0	(ECCC 2023a)
Louisiana Waterthrush	No	67.6	(ECCC 2023b) – *proposed*

Notes:

1. The $RSA_{AVI-AQU}$ only applies to least bittern. This species is a waterbird and will be discussed in Section 4.0. However, for baseline reporting purposes, critical habitat and environmentally sensitive areas for all birds is discussed in Section 2.3.1.3.

Based on existing information, there are no National Parks, Migratory Bird Sanctuaries or other priority areas or sanctuaries for birds, National Wildlife Areas, or World Biosphere Reserves that may be impacted by the Project (see Section 1.3.1 in Chapter 9). However, the RSA_{AVI} (and $RSA_{AVI-AQU}$) and northern parts of the LSA_{TER} overlap with an Area of Natural and Scientific Interest (ANSI), Life Science – the Greenock Swamp (**Figure B-1**). The Greenock Swamp ANSI has been designated as provincially significant; the 1994 ANSI Life Science Inventory report states that between 90 and 100 bird species likely breed within the Greenock Swamp (Johnson 1994a). A full list of these breeding bird species, along with their current conservation statuses, is available in **Table C-1**. However, as more precise spatial information was not available in the Greenock Swamp ANSI Life Science Inventory report, these bird records could not be incorporated into Zoetica's baseline maps. In addition, the Turnberry Swamp ANSI, Life Science, overlaps a southern part of the $RSA_{AVI-AQU}$. The Turnberry Swamp ANSI is considered regionally significant; however, at the time of writing this 2023 BIS Baseline Report (September 2023), an ANSI Life Science Inventory report had not been made available to Zoetica.

2.3.2 Presence and Distribution of Species of Interest

2.3.2.1 Species of Conservation Concern

To date, 29 upland breeding bird species of conservation concern have been observed within the AOI, LSA_{TER}, and/or RSA_{AVI} (**Table 2-2**), including 14 SAR and two provincially rare species (**Figure B-2** and **Figure B-3**), and 13 other priority species identified by the BCR 13 strategy (EC 2014a). Thus, of the 26 upland breeding bird SAR identified by Zoetica as potentially occurring in the SON-South Bruce siting area (see Appendix D of the BPPA Report (Zoetica 2021)), approximately half (14) have now been confirmed within the BIS study areas.

Table 2-2. Summary list of upland breeding bird species of interest recorded within the AOI, LSA_{TER}, and RSA_{AVI}.

Common Name	Species of Interest[1]				Method of Detection			BIS Study Area[2]		
	SAR	Prov. Rare	BCR 13	Engage.	Desk-based	2020 Studies[3]	2022 Field[4]	AOI	LSA_{TER}	RSA_{AVI}
Baltimore Oriole	-	-	Y	-	Y	-	-	Y	Y	Y
Bank Swallow	Y	-	Y	-	Y	-	Y	Y	-	Y
Barn Swallow	Y	-	Y	-	Y	Y	Y	Y	Y	Y
Belted Kingfisher	-	-	Y	-	Y	-	-	Y	Y	Y
Black-billed Cuckoo	-	-	Y	-	Y	-	-	-	-	Y
Blue-winged Warbler	-	-	Y	-	Y	-	-	-	-	Y
Bobolink	Y	-	Y	-	Y	-	Y	Y	**Y**	Y
Brown Thrasher	-	-	Y	-	Y	-	-	-	Y	Y
Brown-headed Cowbird	-	-	-	Y	Y	-	-	Y	Y	Y
Canada Warbler	Y	-	Y	-	Y	-	-	-	-	Y
Common Nighthawk	Y	-	Y	Y	Y	-	-	-	-	Y
Eastern Kingbird	-	-	Y	-	Y	-	Y	Y	Y	Y
Eastern Meadowlark	Y	-	Y	-	Y	-	Y	Y	Y	Y
Eastern Towhee	-	-	Y	-	Y	-	-	Y	Y	Y
Eastern Whip-poor-will	Y	-	Y	-	Y	-	-	-	-	Y
Eastern Wood-pewee	Y	-	Y	-	Y	-	Y	**Y**	Y	Y
Evening Grosbeak	Y	-	-	-	Y	-	-	-	-	Y

Common Name	Species of Interest[1]				Method of Detection			BIS Study Area[2]		
	SAR	Prov. Rare	BCR 13	Engage.	Desk-based	2020 Studies[3]	2022 Field[4]	AOI	LSA_{TER}	RSA_{AVI}
Field Sparrow	-	-	Y	-	Y	-	-	Y	-	Y
Fox Sparrow	-	Y	-	-	Y	-	-	-	-	Y
Grasshopper Sparrow	Y	-	Y	-	Y	-	-	-	-	Y
Louisiana Waterthrush	Y	-	Y	-	Y	-	-	-	Y	-
Northern Flicker	-	-	Y	-	Y	-	Y	Y	Y	Y
Northern Rough-winged Swallow	-	-	Y	-	Y	-	-	Y	-	Y
Red-headed Woodpecker	Y	-	Y	-	Y	-	-	-	Y	-
Rose-breasted Grosbeak	-	-	Y	-	Y	-	-	Y	Y	Y
Rusty Blackbird	Y	-	-	-	Y	-	-	-	-	Y
Savannah Sparrow	-	-	Y	-	Y	Y	*	Y	Y	Y
Vesper Sparrow	-	-	Y	-	Y	-	-	-	Y	Y
White-crowned Sparrow	-	Y	-	-	Y	Y	-	Y	-	Y
Wood Thrush	Y	-	Y	-	Y	-	Y*	**Y**	Y	Y

Notes:

1. Species of conservation concern (at-risk and provincially rare), other priority species as identified by the BCR 13 strategy (EC 2014a), and species mentioned during engagement are noted, where applicable.
2. For the purposes of this table, the indicated study area excludes overlap with other study area(s) that may be encompassed within its boundaries. Cells shaded grey and with bold font indicate new detections in the study area based on 2022 field studies (i.e., not previously detected in the study area through desk-based research). For species of conservation concern, the study area(s) of field observations and NHIC records are based on overlap with the 1 km grid square, not the actual point or polygon location.
3. Data were collated from the previous preliminary environmental field studies conducted in July and October 2020 by Tulloch Environmental at boreholes 1 and 2 within the AOI (Tulloch Environmental 2020, 2021).
4. 2022 Field results include both incidental observations and eDNA metabarcoding analysis results. Species detected through eDNA metabarcoding analyses are indicated by an asterisk (*).

To date, six upland breeding bird SAR have been detected within the AOI (**Table 2-2**). Eastern wood-pewee (Special Concern) was the most observed bird species of interest in the field, with 43 records throughout the AOI, LSA_{TER}, and RSA_{AVI}, often in hardwood and mixedwood forests and swamps adjacent to agricultural fields (**Figure B-2**; **Table B-1**). Although no eastern wood-pewee nests or other indicators of confirmed or probable breeding were noted by surveyors, most observations were of birds vocalizing during the nesting season, sometimes in pairs, which may indicate important breeding habitat/territories in the area. Eastern wood-pewee had not been previously reported within the AOI, based on existing datasets. Field crews also observed barn swallows (Special Concern) at nine locations throughout the AOI and LSA_{TER}, often in groups of up to 25 individuals (**Figure B-2**; **Table B-1**). Based on the GBIF dataset, barn swallow is the most frequently and widely reported SAR, with 30 unique observations at 18 different locations within all three BIS study areas for upland breeding birds (**Figure B-3**; **Table B-2**). Additional SAR with only a few observations potentially within the AOI included bobolink (Threatened), eastern meadowlark (Threatened), bank swallow (Threatened), and wood thrush (Special Concern). Wood thrush was detected once as an incidental observation and once through eDNA metabarcoding analyses (see Section 4.1.4 in Appendix E, Chapter 1). Wood thrush had not been previously reported within the AOI;

however, there are records of the other three SAR from both fieldwork (**Figure B-2**) and existing datasets (**Figure B-3**). All GBIF records in the AOI are recent observations (between 2017-2020) made during the breeding season (May-June). Of the six SAR detected within the AOI, bobolink, eastern meadowlark, bank swallow, and barn swallow have provincial recovery strategies (McCracken et al. 2013, Heagy et al. 2014, Falconer et al. 2016) and government response statements available (MECP 2015, 2017, 2019). Three of these species also have federal recovery strategies and critical habitat squares identified near the SON-South Bruce siting area, as discussed in Section 2.3.1.3.

As shown in **Table 2-2**, five of the six upland breeding bird SAR observed within the AOI have also been found in the LSA_{TER}. To date, only one additional SAR has been detected within the LSA_{TER} (outside the AOI): there is a single GBIF record of Louisiana waterthrush (Threatened) from May 2008, which is also the only record of this species within the BIS study areas (**Figure B-3**). Except for one barn swallow observation from 2020, GBIF records in the LSA_{TER} (outside the AOI) are older observations (between 2001-2008), also made during the breeding season (May-June). In addition to 2022 fieldwork and GBIF data, there are NHIC 1 km grids (sensitive data obscured) for bobolink and eastern meadowlark that overlap with the LSA_{TER} and RSA_{AVI} (**Figure B-3**). These species observations of bobolink and eastern meadowlark were made between 2001-2004, with the element occurrence (EO) rankings made in 2011-2012 and designated by the NHIC as “Verified extant (viability not assessed)”. Furthermore, Zoetica’s previous investigations of NHIC observation (not occurrence) data for development of the BPPA Report (Zoetica 2021)[6] found that the red-headed woodpecker (Endangered) has been recorded within the LSA_{TER} (outside the AOI). This observation, designated as an EO Candidate by the NHIC, was from the OBBA Atlas-2 where a singing male or breeding calls were heard in suitable nesting habitat during the breeding season. Of the SAR detected within the LSA_{TER} (outside the AOI), only red-headed woodpecker has a recovery strategy available (ECCC 2021, MECP 2022). As discussed in Section 2.3.1.3, critical habitat squares for red-headed woodpecker have been identified near the SON-South Bruce siting area but not overlapping the BIS study areas.

All upland breeding bird SAR previously mentioned, except Louisiana waterthrush and red-headed woodpecker, have also been detected within the RSA_{AVI} (outside the AOI and LSA_{TER}) (**Table 2-2**). Eastern wood-pewee and eastern meadowlark were the only two upland breeding bird species of conservation concern observed within the RSA_{AVI} during 2022 field studies (**Figure B-2**; **Table B-1**). Six additional species have only been observed within the RSA_{AVI} but not the AOI or LSA_{TER}: eastern whip-poor-will (Threatened), Canada warbler (Special Concern), common nighthawk (Special Concern), evening grosbeak (Special Concern), grasshopper sparrow (Special Concern), and rusty blackbird (Special Concern) were all detected within the Teeswater Wetland Complex in the RSA_{AVI} (**Figure B-3**; **Table B-2**). Of note, rusty blackbirds were observed congregating in a flock of 100-300 individuals in April, with only 1-2 individuals detected in early May. This species is expected to be a migrant through southwestern Ontario (Cornell Lab of Ornithology 2019a). See Appendix D of the BPPA Report (Zoetica 2021) for a full list of potentially occurring SAR that had provincial and/or federal recovery strategies available at the time of writing the BPPA Report.

[6] At the time of writing the BPPA Report (Zoetica 2021), both NHIC observation and occurrence data were investigated. Zoetica has since received an updated version of the NHIC occurrence dataset for baseline reporting, and has requested but not yet received an updated NHIC observation dataset. Once received by Zoetica, NHIC observations will be included in future iterations of the BIS Baseline Report.

The two provincially rare species, fox sparrow and white-crowned sparrow, both have an SRANK of S3N, meaning that non-breeding populations are considered Vulnerable. Based on species range maps, both species are typically migrants through the SON-South Bruce siting area but could potentially winter in the area (Cornell Lab of Ornithology 2019b, 2019c). To date, fox sparrow has only been detected within the RSA_{AVI} (outside the AOI and LSA_{TER}) in early to mid-April. White-crowned sparrow was incidentally observed within the AOI by Tulloch Environmental during previous preliminary environmental studies in October 2020 (Tulloch Environmental 2021); there are also GBIF records of this species within the RSA_{AVI} (outside the AOI and LSA_{TER}) in early May (**Figure B-3**).

2.3.2.2 Species of Interest to Stakeholders and Rights-holders, and Species of Potential Socio-economic Importance

During engagement conducted with South Bruce residents and local Conservation Authorities (CAs) in August through November 2020, focused on identifying existing environmental concerns, birds were noted for their potential use as indicator species of ecosystem health. It was mentioned during engagement that there has been a noticeable decrease in the number of birds in the SON-South Bruce siting area and it is thought that pollution may be affecting bird habitat. In addition, an understanding of wildlife community complexity in general and of interior bird communities in particular was brought up during engagement. Effects of noise were also mentioned as a stressor to birds and other wildlife.

With respect to specific upland breeding birds, kettle lakes were noted as potentially important for supporting biodiversity, including nighthawks and black swift. Brown-headed cowbirds were noted as a ‘nuisance’ bird species that is increasing as the landscape becomes more fragmented. Upland breeding bird species mentioned during engagement and detected within the BIS study areas are included in **Table 2-2**; to date, only common nighthawk and brown-headed cowbird have been reported (from existing records). The socio-economic or socio-ecological importance of additional upland breeding bird species to local communities and/or Indigenous communities will be sought through future engagement. Zoetica’s proposed Tier 2 studies include community-level surveys that will detect a wide variety of upland breeding birds. Therefore, future data collection will enable retrospective analysis of newly identified species of interest, if needed.

2.3.2.3 Indicator Species

To date, 10 of the 12 upland breeding bird species used as stewardship species for BCR 13 or Great Lakes St. Lawrence forest indicators by the MNRF (all except Acadian flycatcher and hooded warbler; see Tables 5-17 and 5-18 in the BPPA Report (Zoetica 2021)) have been observed within the AOI, LSA_{TER}, and/or RSA_{AVI}. Some of the 13 other BCR 13 priority species detected within the BIS study areas (see Section 2.3.2.1 and **Table 2-2**) could also be considered indicator species after more baseline data are collected. Zoetica recommends that indicator species for the purposes of the BIS be determined after more information is gathered about potential project impacts and species-habitat associations (e.g., through Tier 2 community composition studies) within the BIS study areas for birds. See Sections 4.2 and 5.2.7.1 of the BPPA Report (Zoetica 2021) for further discussion of indicator species.

2.3.1 Additional Baseline Data to Inform the IA

2.3.1.1 Community Characterization

A total of 114 upland breeding bird species have been detected within the BIS study areas based on desk- and field-based investigations conducted to date (**Table D-1**). Of these, 58 species (50.9%) have been documented within the AOI. In 2022, field teams observed 32 upland breeding bird species in the AOI, nine of which had not been previously reported in the AOI based on existing datasets. The Greenock Swamp ANSI Life Science Inventory report identified additional upland breeding bird species in the SON-South Bruce siting area (see **Table C-1**), including chimney swift, marsh wren, cerulean warbler, and golden-winged warbler – all of which are SAR except for marsh wren. However, as there are no spatial data associated with the Greenock Swamp ANSI report to determine which species were observed within or outside the RSA_{AVI}, these additional species were not included in **Table 2-2** (which is limited to species detected within the BIS study areas).

2.4 Discussion

Section 2.0 of Chapter 7 (Avifauna) of the 2023 BIS Baseline Report focused on desk-based analyses of upland breeding bird habitat and species observations and preliminary results from Tier 1 terrestrial habitat assessments and incidental observations. To date, a total of 114 upland breeding bird species have been detected within the AOI, LSA_{TER}, or RSA_{AVI}, including 14 at-risk, two provincially rare, and 13 other priority species identified by the BCR 13 strategy (EC 2014a) (**Table D-1**). However, where a species has only been detected using desk-based data, caution should be taken as those data could be as old as 1970, and the conditions supporting the species' presence in the area may have changed. Of note, nine upland breeding bird species, including two SAR, had not been previously reported within the AOI but were observed in the AOI during 2022 field studies. In addition, the Greenock Swamp ANSI is known to provide breeding habitat for 76 upland breeding bird species (**Table C-1**); however, it is unclear if these observations occurred within the RSA_{AVI} portion of the ANSI.

Habitats for Endangered and Threatened species are protected under the Ontario *ESA*. The NHIC has mapped EOs for bobolink and eastern meadowlark that overlap with the LSA_{TER} and RSA_{AVI} (**Figure B-2**); critical habitat for bobolink (under the federal *SARA*) has also been identified overlapping the western portion of the BIS study areas (**Figure B-1**). The presence of suitable habitat for, or direct observations of, these two Threatened species within the BIS study areas is corroborated by recent fieldwork completed for the Project. During 2022 Tier 1 field studies, bobolink and eastern meadowlark were incidentally observed in agricultural fields within the AOI; and a bobolink was also heard west of the AOI in a heavily vegetated meadow within the LSA_{TER} (**Figure B-3**). During previous preliminary environmental studies in 2020, Tulloch Environmental identified potentially suitable habitat for bobolink and eastern meadowlark on agricultural lands adjacent to the NWMO's borehole sites (Tulloch Environmental 2020, 2021). Field surveyors in 2022 also identified two locations along the Teeswater River within the AOI with eroding banks that could be suitable breeding habitat for bank swallows. As habitats for upland breeding bird SAR are often applicable to other not-at-risk species, further discussion of suitable habitats (as candidate SWH) observed in the field is presented in Appendix C, Chapter 1. Finally, there are existing records of three Endangered or Threatened upland breeding bird species within the BIS study areas that have not yet been observed during field studies: red-headed woodpecker, Louisiana waterthrush, and eastern whip-poor-will (**Figure B-2**).

Habitats for Special Concern and Rare species are considered SWH and protected by the Ontario Provincial Policy Statement (MMAH 2020) under the *Planning Act*. The 2022 field crews identified nesting barn swallows and potential eastern wood-pewee breeding territories within the AOI (**Figure B-3**). Furthermore, although barn swallows were recently downlisted from Threatened to Special Concern under the Ontario *ESA* in January 2023, this species is currently still listed as Threatened under the federal

SARA (though it is under consideration for a status change). As a Threatened species, occupied barn swallow nests are protected under s.33 of the *SARA*, which prohibits damaging or destroying the residence of a listed Threatened, Endangered, or Extirpated species on federal lands (Government of Canada 2019). Furthermore, as a migratory species, active barn swallow nests are protected on non-federal lands under the *MBCA*. The attendant Migratory Birds Regulations, 2022, s.5, prohibits damaging destroying, disturbing, or removing migratory bird nests when they contain a live bird or viable egg.

Additional Special Concern and provincially rare upland breeding species have been collated from GBIF records and observed incidentally in the field (**Figure B-2**). However, details regarding habitat use and bird activity are lacking for these records; thus, it is unclear if the observations are associated with important habitats for these species. In addition to habitats for Special Concern and Rare species, candidate SWH has been identified within the AOI, LSA_{TER}, and RSA_{AVI} for Colonially-Nesting Bird Breeding Habitat (Bank and Cliff, Tree/Shrubs, and Ground); Seeps and Springs; Woodland Area-Sensitive, Marsh, Open Country, and Shrub/Early Successional Bird Breeding Habitats; and Alvar (which may support the Endangered loggerhead shrike). Of note, there are confirmed Seeps and Springs SWH within the BIS study areas. A detailed discussion of SWH is available In Appendix C, Chapter 1.

2.4.1 Next Steps

If the SON-South Bruce siting area is selected for the Project, Tier 2 studies will aim to characterize upland breeding bird communities more thoroughly within the BIS study areas. Refer to Section 5.2.7 of the BPPA Report (Zoetica 2021) for more information. Community-level studies will enable estimates of relative abundance and seasonal habitat use and provide insight into food webs and trophic linkages. Study methods for upland breeding birds may include point count surveys, the deployment of, and analysis of data from, autonomous song meters. Confirmation of candidate SWH (described in Appendix C, Chapter 1), including habitats for Special Concern and provincially rare species, and specific SAR surveys for the Threatened eastern meadowlark (OMNR 2013), bobolink (MNR 2011), and eastern whip-poor-will (OMNRF 2014) will focus on areas within the extent of direct and indirect project impacts (i.e., AOI and LSA_{TER}).[7] In addition, further discussions with knowledgeable stakeholders and rights-holders will help determine the locations of sensitive habitats for upland breeding birds. However, access limitations will continue to be a factor in determining which areas can be surveyed. The NWMO continues to engage with local landowners to gain permission to access their properties. Zoetica is providing input to the NWMO regarding priority locations within which they should seek access based on the baseline information collected to date.

[7] As described in Zoetica's BPPA Report (Zoetica 2021), the NWMO defined the AOI as the area within which the Project footprint will be located, and Zoetica designed the LSA_{TER} as a 1 km buffer around the AOI to capture potential indirect impacts of the Project on the terrestrial environment. The focal areas for Tier 2 studies may change depending on the Project Description (which is not yet available) and further information about potential project effects.

3.0 SHOREBIRDS

3.1 Introduction

This section of the 2023 BIS Baseline Report focuses on shorebirds. This group refers to sandpipers and allies of the Order Charadriiformes, and excludes gulls, terns, and allies, which are considered waterbirds (Section 4.0) for the purposes of the BIS.

A general introduction about the inclusion of birds for the BIS and background information about BCR 13 is included in Section 1.0. Out of 97 priority species identified in the BCR 13 strategy (EC 2014a), 11 are shorebirds. Most shorebirds are long-distance migratory species that breed in northern temperate, sub-Arctic, or Arctic regions, and are expected to only be present in the BIS study areas during spring and/or fall migration (Mitch Waite Group 2018). However, some shorebird species may breed in the area, such as American woodcock, killdeer, spotted sandpiper, upland sandpiper, and Wilson's snipe.

Several SWH types apply to shorebirds. Based on the 6E ECS (OMNRF 2015), there are five shorebird-related SWH types of potential relevance to the SON-South Bruce siting area:

- Shorebird Migratory Stopover Area
- Colonially-Nesting Bird Breeding Habitat (Ground) – *primarily of relevance to waterbirds but also indicated for Wilson's phalarope (provincially rare)* (MNRF 2014)
- Marsh Bird Breeding Habitat – *primarily of relevance to waterbirds but also indicated for Wilson's phalarope* (MNRF 2014)
- Open Country Bird Breeding Habitat – *primarily of relevance to upland breeding birds but also indicated for upland sandpiper* (OMNRF 2015)
- Special Concern and Rare Species

Further details about candidate SWH investigations conducted to date and rationale for inclusion (or exclusion) of SWH types listed in the 6E ECS are presented in Appendix C, Chapter 1.

3.1.1 Objectives

All general objectives listed in Section 1.1 apply to shorebirds.

3.2 Methods

3.2.1 Study Areas

The BIS study areas for shorebirds include the AOI, LSA_{TER}, and $RSA_{AVI\text{-}AQU}$ (see figures and descriptions in Section 3.0, Chapter 1).

3.2.2 Presence, Distribution, and Abundance of Important Habitat

Collation of both existing and Tier 1 habitat data for shorebirds proceeded as described in Sections 1.2.2 and 1.2.3.

3.2.3 Presence and Distribution of Species of Interest

Collation of existing observations and Tier 1 incidental observations for shorebird species of interest proceeded as described in Sections 1.2.2 and 1.2.3.

3.2.4 Additional Baseline Data to Inform the IA

Species lists were compiled from desk- and field-based studies (as per Section 1.2.2 and 1.2.3) as an initial investigation into the biodiversity of shorebirds in the BIS study areas.

3.3 Results

3.3.1 Presence, Distribution, and Abundance of Important Habitat

3.3.1.1 General Habitat Associations

Future Tier 2 studies aim to determine shorebird-habitat associations within the BIS study areas. Discussion of general habitat associations will be included in future BIS Baseline Reports after Tier 2 studies have been completed (if the SON-South Bruce siting area is selected for the Project).

3.3.1.2 Significant and Other Important Wildlife Habitats

Various candidate SWH of relevance to shorebirds have been found throughout the AOI, LSA_{TER}, and $RSA_{AVI-AQU}$ based on ecosite analyses, some or all habitat criteria being met, or records of species and/or habitat features. Of the five SWH types listed in Section 3.1, candidate SWH was identified for all except Colonially-Nesting Bird Breeding Habitat (Ground) for shorebirds. Ecosite matches and TEM plots identified as candidate Colonially-Nesting Bird Breeding Habitat (Ground) SWH in the field apply only to Brewer's blackbird, an upland breeding bird species. A detailed discussion of candidate SWH is available in Appendix C, Chapter 1. Special Concern and provincially rare shorebird species are also discussed in Section 3.3.2.1.

In addition (or supplementary) to SWH, Zoetica investigated whether other important wildlife habitat data (e.g., nests, territories, important foraging sites) were contained within the datasets analyzed (see **Table 1-1**) or found during the Tier 1 BIS baseline field programs. No further information was available for shorebirds.

3.3.2 Presence and Distribution of Species of Interest

3.3.2.1 Species of Conservation Concern

To date, seven shorebird species of conservation concern have been observed within the AOI, LSA_{TER}, and/or $RSA_{AVI-AQU}$ (**Table 3-1**), including one SAR and one provincially rare species (**Figure B-4**), and five other priority species identified by the BCR 13 strategy (EC 2014a). Only one shorebird species – killdeer, a BCR 13 priority species – was observed within the BIS study areas during 2022 field studies.

Table 3-1. Summary list of shorebird species of interest recorded within the AOI, LSA_{TER}, and $RSA_{AVI-AQU}$.

Common Name	Species of Interest[1]				Method of Detection			BIS Study Area[2]		
	SAR	Prov. Rare	BCR 13	Engage.	Desk-based	2020 Studies[3]	2022 Field	AOI	LSA_{TER}	$RSA_{AVI-AQU}$
Lesser Yellowlegs	Y	-	-	-	Y	-	-	Y	-	Y
Upland Sandpiper	-	Y	Y	-	Y	-	-	Y	-	Y
American Woodcock	-	-	Y	-	Y	-	-	-	Y	Y
Killdeer	-	-	Y	-	Y	-	Y	Y	Y	Y
Semipalmated Sandpiper	-	-	Y	-	Y	-	-	Y	-	Y
Spotted Sandpiper	-	-	Y	-	Y	-	-	Y	-	Y
Wilson's Snipe	-	-	Y	-	Y	-	-	-	-	Y

Notes:

1. Species of conservation concern (at-risk and provincially rare), other priority species as identified by the BCR 13 strategy (EC 2014a), and species mentioned during engagement are noted, where applicable.
2. For the purposes of this table, the indicated study area excludes overlap with other study area(s) that may be encompassed within its boundaries.
3. Data were collated from the previous preliminary environmental field studies conducted in July and October 2020 by Tulloch Environmental at boreholes 1 and 2 within the AOI (Tulloch Environmental 2020, 2021).

Lesser yellowlegs is not currently listed on *Species at Risk in Ontario* (SARO) but was assessed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as Threatened in November 2020 and is under consideration for a status change on Schedule 1 of *SARA*. This species is expected to be a migrant through southwestern Ontario (Cornell Lab of Ornithology 2019d); thus, there is no nesting calendar information for lesser yellowlegs in nesting zone C2 (where the SON-South Bruce siting area is located). From the GBIF dataset, lesser yellowlegs was observed within the AOI at the same pond off Concession Rd 8 in late May in 2018 and in early May in 2020 (**Figure B-4**; **Table B-3**). Within the $RSA_{AVI-AQU}$ (outside the AOI and LSA_{TER}), there are 15 records of lesser yellowlegs at eight different locations in late April to early May (spring migration) and late August to mid-September (fall migration) between 2012 and 2021.

Based on species range maps, upland sandpiper is expected to breed in southwestern Ontario (Cornell Lab of Ornithology 2019e) and is thus considered provincially rare (S2B). One GBIF observation of upland sandpiper was noted within the AOI at the same Concession Rd 8 pond as the lesser yellowlegs observations (**Figure B-4**), also in late May 2018. There were five additional observations of upland sandpiper within the $RSA_{AVI-AQU}$ (outside the AOI and LSA_{TER}) in June and July over a wide range of years (1983-2020). Further field studies are needed to determine whether there is important breeding habitat for this provincially rare shorebird species within the BIS study areas.

Although there are records of other shorebird species with SRANKs of S1B, S2B, or S3B (which apply to the breeding populations), such as pectoral sandpiper, semipalmated sandpiper, and stilt sandpiper, these species are only expected to migrate through southwestern Ontario, and they are not considered Critically Imperiled, Imperiled, or Vulnerable during migration. Further desk- and field-based studies will be conducted to determine whether large congregations of these species occur in the BIS study areas, which may suggest locally important migratory stopover areas for shorebirds (see discussion and maps of candidate SWH in Appendix C, Chapter 1).

3.3.2.2 Species of Interest to Stakeholders and Rights-holders, and Species of Potential Socio-economic Importance

See Section 2.3.2.2 for a general discussion about what Zoetica has heard from engagement regarding birds and bird communities. No specific shorebird species have been mentioned by stakeholders or rights-holders to date.

3.3.2.1 Indicator Species

Although there are no shorebird species used as forest indicators by the MNRF (see Table 5-18 in the BPPA Report (Zoetica 2021)), some of the five other BCR 13 priority species detected within the BIS study areas (see Section 3.3.2.1 and **Table 3-1**) could also be considered indicator species after more baseline data are collected. Zoetica recommends that indicator species for the purposes of the BIS be determined after more information is gathered about potential project impacts and species-habitat associations (e.g., through Tier 2 community composition studies) within the BIS study areas for birds. See Sections 4.2 and 5.2.7.1 of the BPPA Report (Zoetica 2021) for further discussion of indicator species.

3.3.3 Additional Baseline Data to Inform the IA

3.3.3.1 Community Characterization

A total of 14 shorebird species have been detected within the BIS study areas based on desk- and field-based investigations conducted to date (**Table D-2**). Of these, 10 species were documented within the AOI, including three of the five shorebird species whose breeding ranges overlap with the SON-South Bruce siting area: killdeer (the only shorebird species observed during 2022 field studies), spotted sandpiper, and upland sandpiper. In addition, the Greenock Swamp ANSI Life Science Inventory report includes confirmed and probable breeding records for American woodcock and Wilson's snipe, respectively (see **Table C-1**), within an area encompassed by the $RSA_{AVI-AQU}$ (see Section 2.3.1.3).

3.4 Discussion

Section 3.0 of Chapter 7 (Avifauna) of the 2023 BIS Baseline Report focused on desk-based analyses of shorebird habitat and species observations and preliminary results from Tier 1 terrestrial and aquatic habitat assessments and incidental observations. To date, 14 shorebird species have been detected within the AOI, LSA_{TER}, or $RSA_{AVI-AQU}$, including one at-risk, one provincially rare, and five other priority species as identified by the BCR 13 strategy (EC 2014a) (**Table D-2**). However, where a species has only been detected using desk-based data, caution should be taken as those data could be as old as 1970, and the conditions supporting the species' presence in the area may have changed.

Baseline data for shorebird species of conservation concern are currently limited to existing GBIF observations of lesser yellowlegs and upland sandpiper within the AOI and $RSA_{AVI-AQU}$ (**Figure B-4**). As these records do not contain additional information about habitat use or bird activity, it is unclear if the observations are associated with important habitats for these species. However, candidate SWH has been identified within the AOI, LSA_{TER}, and $RSA_{AVI-AQU}$ for Shorebird Migratory Stopover Area, Marsh Bird Breeding Habitat (relevant to solitary sandpiper), and Open Country Bird Breeding Habitat (relevant to upland sandpiper). A detailed discussion of SWH is available in Appendix C, Chapter 1. In addition, the Greenock Swamp ANSI overlaps with the $RSA_{AVI-AQU}$ and is known to provide breeding habitat for two shorebird species (**Table C-1**).

3.4.1 Next Steps

If the SON-South Bruce siting area is selected for the Project, Tier 2 studies will aim to characterize shorebird communities more thoroughly within the BIS study areas. Refer to Section 5.2.7 of the BPPA Report (Zoetica 2021) for more information. Community-level studies will enable estimates of relative abundance and seasonal habitat use and provide insight into food webs and trophic linkages. Study methods may include point count surveys during the breeding season and observation stations during spring migration, breeding period, and fall migration. Confirmation of candidate SWH (described in Appendix C, Chapter 1), including habitats for Special Concern and provincially rare species, will focus on areas within the extent of direct and indirect project impacts (i.e., AOI and LSA_{TER}).[7] In addition, further discussions with knowledgeable stakeholders and rights-holders will help determine the locations of sensitive habitats for shorebirds. However, access limitations will continue to be a factor in determining which areas can be surveyed. The NWMO continues to engage with local landowners to gain permission to access their properties. Zoetica is providing input to the NWMO regarding priority locations within which they should seek access based on the baseline information collected to date.

4.0 WATERBIRDS

4.1 Introduction

This section of the 2023 BIS Baseline Report focuses on waterbirds. This group refers to a wide variety of species that depend on aquatic environments, aside from shorebirds (Section 3.0), and includes the following orders:

- Anseriformes – Ducks, Geese, and Waterfowl
- Podicipediformes – Grebes
- Gruiformes – Rails, Limpkins, Cranes
- Charadriiformes – Gulls, Terns, and Allies
- Gaviiformes – Loons
- Suliformes – Cormorants and Allies
- Pelecaniformes – Pelicans, Herons, Bitterns, and Allies

A general introduction about the inclusion of birds for the BIS and background information about BCR 13 is included in Section 1.0. Out of 97 priority species identified in the BCR 13 strategy (EC 2014a), 40 are waterbirds. Both breeding and migrating populations of waterbirds are expected in the BIS study areas. These seasonal habitat uses are reflected in the seven waterbird-related SWH types outlined in the 6E ECS (OMNRF 2015) of potential relevance to the SON-South Bruce siting area:

- Waterfowl Stopover and Staging Area (Terrestrial)
- Waterfowl Stopover and Staging Area (Aquatic)
- Colonially-Nesting Bird Breeding Habitat (Tree/Shrubs)
- Colonially-Nesting Bird Breeding Habitat (Ground)
- Waterfowl Nesting Area
- Marsh Bird Breeding Habitat
- Special Concern and Rare Species

Further details about candidate SWH investigations conducted to date and rationale for inclusion (or exclusion) of SWH types listed in the 6E ECS are presented in Appendix C, Chapter 1.

4.1.1 Objectives

All general objectives listed in Section 1.1 apply to waterbirds.

4.2 Methods

4.2.1 Study Areas

The BIS study areas for waterbirds include the AOI, LSA_{TER}, and $RSA_{AVI-AQU}$ (see figures and descriptions in Section 3.0, Chapter 1).

4.2.2 Presence, Distribution, and Abundance of Important Habitat

Collation of both existing and Tier 1 habitat data for waterbirds proceeded as described in Sections 1.2.2 and 1.2.3.

4.2.3 Presence and Distribution of Species of Interest

Collation of existing observations and Tier 1 incidental observations for waterbird species of interest proceeded as described in Sections 1.2.2 and 1.2.3.

4.2.4 Additional Baseline Data to Inform the IA

Species lists were compiled from desk- and field-based studies (as per Section 1.2.2 and 1.2.3) as an initial investigation into the biodiversity of waterbirds in the BIS study areas.

4.3 Results

4.3.1 Presence, Distribution, and Abundance of Important Habitat

4.3.1.1 General Habitat Associations

Future Tier 2 studies aim to determine waterbird-habitat associations within the BIS study areas. Discussion of general habitat associations will be included in future BIS Baseline Reports after Tier 2 studies have been completed (if the SON-South Bruce siting area is selected for the Project).

4.3.1.2 Significant and Other Important Wildlife Habitats

Various candidate SWH of relevance to waterbirds have been found throughout the AOI, LSA_{TER}, and $RSA_{AVI-AQU}$ based on ecosite analyses, some or all habitat criteria being met, or records of species and/or habitat features. Of the seven SWH types listed in Section 4.1, only Colonially-Nesting Bird Breeding Habitat (Ground) for waterbirds does not have any supporting evidence to date. Ecosite matches and TEM plots identified as candidate SWH in the field apply only to Brewer's blackbird, an upland breeding bird species. While there are GBIF observations for gulls and terns, information about potential nesting was not available in these records. A detailed discussion of candidate SWH within the LSA_{TER} is available in Appendix C, Chapter 1. Special Concern and provincially rare waterbird species are also discussed in Section 4.3.2.1 below.

In addition (or supplementary) to SWH, Zoetica investigated whether other important wildlife habitat data (e.g., nests, territories, important foraging sites) were contained within the datasets analyzed (see **Table 1-1**) or found during the Tier 1 BIS baseline field programs. Based on the NHIC Wildlife Concentration Areas Observation dataset, there are two great blue heron nesting sites/colonies within or overlapping the BIS study areas (**Figure B-5**). One colony of 22 nests is located east of the AOI near the community of Teeswater; however, the colony nesting site has been considered "extinct" by the NHIC since 1991. The other colony in the northwestern portion of the Greenock Swamp Wetland Complex (GSWC) was noted as having been active for at least four years; however, it is unclear when this information was provided, and if the colony is still active. These NHIC data are described in more detail as candidate SWH for Colonially-Nesting Bird Breeding Habitat (Tree/Shrubs) in Appendix C, Chapter 1.

4.3.2 Presence and Distribution of Species of Interest

4.3.2.1 Species of Conservation Concern

To date, 33 waterbird species of conservation concern have been observed within the AOI, LSA_{TER}, and/or $RSA_{AVI-AQU}$, including three SAR and 10 provincially rare species, and 20 other priority species identified by the BCR 13 strategy (EC 2014a) (**Table 4-1**). Seven waterbird species, all of which are BCR 13 priority species but not at-risk or provincially rare, were observed within the BIS study areas during 2022 field studies.

Table 4-1. Summary list of waterbird species of interest recorded within the AOI, LSA_{TER}, and $RSA_{AVI-AQU}$.

Common Name	Species of Interest[1]				Method of Detection			BIS Study Area[2]		
	SAR	Prov. Rare	BCR 13	Engage.	Desk-based	2020 Studies[3]	2022 Field[4]	AOI	LSA_{TER}	$RSA_{AVI-AQU}$
American Bittern	-	-	Y	-	Y	-	-	-	-	Y
American Black Duck	-	-	Y	-	Y	-	-	-	Y	Y
American Coot	-	Y	Y	-	Y	-	-	-	-	Y
Black Tern	Y	-	Y	-	Y	-	-	-	-	Y
Blue-winged Teal	-	Y	Y	-	Y	-	-	-	-	Y
Bonaparte's Gull	-	-	Y	-	Y	-	-	-	-	Y
Canada Goose	-	-	Y	Y	Y	Y	Y	Y	Y	Y
Canvasback	-	Y	Y	-	Y	-	-	-	-	Y
Caspian Tern	-	Y	Y	-	Y	-	-	-	-	Y
Common Gallinule	-	Y	Y	-	Y	-	-	-	-	Y
Common Goldeneye	-	-	Y	-	Y	-	-	-	Y	Y
Common Loon	-	-	Y	-	Y	-	-	-	-	Y
Common Merganser	-	-	Y	-	Y	-	-	Y	Y	Y
Great Black-backed Gull	-	Y	Y	-	Y	-	-	-	-	Y
Great Blue Heron	-	-	Y	Y	Y	-	Y	Y	**Y**	Y
Great Egret	-	Y	Y	-	Y	-	-	-	-	Y
Greater White-fronted Goose	-	Y	-	-	Y	-	-	-	Y	Y
Green Heron	-	-	Y	-	Y	-	Y	**Y**	-	Y
Green-winged Teal	-	-	Y	-	Y	-	-	-	Y	Y
Horned Grebe	Y	-	Y	-	Y	-	-	-	-	Y
Least Bittern	Y	-	Y	-	Y	-	-	-	-	Y
Lesser Scaup	-	-	Y	-	Y	-	-	-	-	Y
Long-tailed Duck	-	-	Y	-	Y	-	-	-	-	Y
Mallard	-	-	Y	-	Y	-	Y*	Y	Y	Y
Mute Swan	-	-	Y	-	Y	-	-	-	-	Y
Pied-billed Grebe	-	-	Y	-	Y	-	-	-	-	Y
Red-necked Grebe	-	Y	Y	-	Y	-	-	-	-	Y
Ring-necked Duck	-	-	Y	-	Y	-	-	-	Y	Y
Sandhill Crane	-	-	Y	Y	Y	-	Y	Y	-	Y
Sora	-	-	Y	-	Y	-	-	-	-	Y
Tundra Swan	-	Y	Y	Y	Y	-	-	-	Y	Y
Virginia Rail	-	-	Y	-	Y	-	Y*	-	-	Y
Wood Duck	-	-	Y	-	Y	-	Y*	**Y**	-	Y

Notes:
1. Species of conservation concern (at-risk and provincially rare), other priority species as identified by the BCR 13 strategy (EC 2014a), and species mentioned during engagement are noted, where applicable.
2. For the purposes of this table, the indicated study area excludes overlap with other study area(s) that may be encompassed within its boundaries. Cells shaded grey and with bold font indicate new detections in the study area based on 2022 field studies (i.e., not previously detected in the study area through desk-based research).

3. Data were collated from the previous preliminary environmental field studies conducted in July and October 2020 by Tulloch Environmental at boreholes 1 and 2 within the AOI (Tulloch Environmental 2020, 2021).
4. 2022 Field results include both incidental observations and eDNA metabarcoding analysis results. Species detected through eDNA metabarcoding analyses are indicated by an asterisk (*).

Based on existing datasets, there have been no observations of at-risk or provincially rare waterbird species within the AOI. Of the waterbird SAR detected outside the AOI, least bittern (Threatened) and black tern (Special Concern) were both observed in the general vicinity of Clam Lake in the $RSA_{AVI\text{-}AQU}$ (**Figure B-5**; **Table B-4**). The least bittern record has been designated as a "Historical" EO by the NHIC; the last observation of this species was in 1980. The black tern is a more recent observation during the breeding season (July) in 2019. Horned grebe (Special Concern) has been recorded in two locations within the GSWC in the northern portion of the $RSA_{AVI\text{-}AQU}$, including a recent observation (2016) in a relatively remote, central area of the swamp, and an older observation (1978) at Schmidt Lake (**Figure B-5**). Horned grebe is expected to be a migrant throughout most of Ontario, including the southwestern region (Cornell Lab of Ornithology 2019f). Both GBIF records of horned grebe occurred during spring migration in mid-April; in nesting zone C2 (where the SON-South Bruce siting area is located), this species is expected to nest in mid-May (Rousseu and Drolet 2015).

Of the provincially rare waterbird species detected, tundra swan (S2B,S4N,S3M)[8] has been recorded throughout the BIS study areas, often in large numbers, during spring migration. The two GBIF records within the LSA_{TER} (outside the AOI) included counts of 30 and 45 tundra swans; records within the $RSA_{AVI\text{-}AQU}$ (outside the AOI and LSA_{TER}) ranged from two to 250 individuals (**Table B-4**). Other rare waterbird observations appear to be more localized (**Figure B-5**). Of note, greater white-fronted goose (S3M) has only been recorded within the western portion of the LSA_{TER} adjacent to the AOI boundary and within the $RSA_{AVI\text{-}AQU}$ north of the LSA_{TER}. Both GBIF records were made during spring migration in March 2018, with 11 and 15 individuals observed, respectively (**Table B-4**). Further field studies will be needed to determine whether areas potentially impacted by the Project may have local importance as a staging area for greater white-fronted goose. Two provincially rare waterbirds – American coot (S3B,S4N) and common gallinule (S3B) – were only recorded during the Greenock Swamp ANSI Life Science Inventory (Johnson 1994a). Spatial data were not available from this report; however, Zoetica assumed these species were observed within the extent of the BIS study areas for waterbirds (i.e., $RSA_{AVI\text{-}AQU}$).

4.3.2.2 Species of Interest to Stakeholders and Rights-holders, and Species of Potential Socio-economic Importance

See Section 2.3.2.2 for a general discussion about what Zoetica has heard from engagement regarding birds and bird communities. With respect to specific waterbirds, the Teeswater River system was mentioned as a potentially important migratory staging and overwintering area for waterfowl, including tundra swans, great blue herons, and Canada geese, as this system was noted to retain open water areas when surrounding waterbodies are frozen. Kettle lakes, typically identified as Provincially Significant Wetlands, were also noted as potentially important for supporting biodiversity with mention of various

[8] Tundra swan is expected to be a migrant through the SON-South Bruce siting area in southwestern Ontario (Cornell Lab of Ornithology 2019j). Thus, among the species' SRANK breeding status modifiers, the S3M (Vulnerable) ranking is relevant to the Project and tundra swan should be considered a provincially rare species.

species using these areas, including gulls. Observations from a member of the local community included sandhill cranes nesting on farmland.

Specific waterbird species mentioned during engagement and detected within the BIS study areas are included in **Table 4-1**. To date, tundra swan, sandhill crane, Canada goose, and great blue heron have been reported (from existing records); of these four species, all but tundra swan were also observed during 2022 field studies. Of note, three sandhill cranes were incidentally observed flying overhead at a tributary of Alps Creek south of the AOI. The field crew noted the wetland as a possible sandhill crane nesting area. The socio-economic or socio-ecological importance of additional waterbird species to local communities and/or Indigenous communities will be sought through future engagement. Zoetica's proposed Tier 2 studies include community-level surveys that will detect a wide variety of waterbirds. Therefore, future data collection will enable retrospective analysis of newly identified species of interest, if needed.

4.3.2.3 Indicator Species

Wood duck has been observed within the $RSA_{AVI-AQU}$ (outside the AOI and LSA_{TER}) and is the only waterbird species used as a forest indicator by MNRF (see Table 5-18 in the BPPA Report (Zoetica 2021)). Some of the 20 other BCR 13 priority species detected within the BIS study areas (see Section 4.3.2.1 and **Table 4-1**) could also be considered indicator species after more baseline data are collected. Zoetica recommends that indicator species for the purposes of the BIS be determined after more information is gathered about potential project impacts and species-habitat associations (e.g., through Tier 2 community composition studies) within the BIS study areas for birds. See Sections 4.2 and 5.2.7.1 of the BPPA Report (Zoetica 2021) for further discussion of indicator species.

4.3.3 Additional Baseline Data to Inform the IA

4.3.3.1 Community Characterization

A total of 46 waterbird species have been detected within the BIS study areas based on desk- and field-based investigations conducted to date (**Table D-3**). Of these, 10 species were documented within the AOI. In 2022, field teams observed five waterbird species in the AOI, two of which had not been previously reported in the AOI based on existing datasets. The Greenock Swamp ANSI Life Science Inventory report identified 14 waterbird species that likely breed within an area encompassed by the $RSA_{AVI-AQU}$ (see Section 2.3.1.3 and **Table C-1**).

4.4 Discussion

Section 4.0 of Chapter 7 (Avifauna) of the 2023 BIS Baseline Report focused on desk-based analyses of waterbird habitat and species observations and preliminary results from Tier 1 terrestrial and aquatic habitat assessments and incidental observations. To date, a total of 46 waterbird species have been detected within the AOI, LSA_{TER}, or $RSA_{AVI-AQU}$, including three at-risk, 10 provincially rare, and 20 other priority species as identified by the BCR 13 strategy (EC 2014a) (**Table D-3**). However, where a species has only been detected using desk-based data, caution should be taken as those data could be as old as 1970, and the conditions supporting the species' presence in the area may have changed.

Baseline data for waterbird species of conservation concern are currently limited to a historical NHIC EO for least bittern and existing GBIF observations of two SAR (black tern and horned grebe) and 10 provincially rare species (tundra swan, greater white-fronted goose, blue-winged teal, canvasback, red-necked grebe, common gallinule, American coot, Caspian tern, great black-backed gull, and great egret) (**Figure B-5**). Based on the timing of observations and individual counts, there may be important waterfowl migration habitat within the LSA_{TER} and $RSA_{AVI\text{-}AQU}$. Indeed, candidate SWH has been identified within the AOI, LSA_{TER}, and $RSA_{AVI\text{-}AQU}$ for Waterfowl Stopover and Staging Area (Terrestrial and Aquatic), as well as Colonially-Nesting Bird Breeding Habitat (Tree/Shrubs), Waterfowl Nesting Area, and Marsh Bird Breeding Habitat. In addition, the Greenock Swamp ANSI overlaps with the $RSA_{AVI\text{-}AQU}$ and is known to provide breeding habitat for 14 waterbirds, including three provincially rare species: American coot, common gallinule, and blue-winged teal (**Table C-1**). A detailed discussion of SWH is available in Appendix C, Chapter 1.

4.4.1 Next Steps

If the SON-South Bruce siting area is selected for the Project, Tier 2 studies will aim to characterize waterbird communities more thoroughly within the BIS study areas. Refer to Section 5.2.7 of the BPPA Report (Zoetica 2021) for more information. Community-level studies will enable estimates of relative abundance and seasonal habitat use and provide insight into food webs and trophic linkages. Study methods may include call playback surveys for secretive marsh birds during the breeding season, and observation stations during spring migration, breeding period, and fall migration. Confirmation of candidate SWH (described in Appendix C, Chapter 1), including habitats for Special Concern and provincially rare species and wildlife concentration areas (e.g., nesting colonies), will focus on areas within the extent of direct and indirect project impacts (i.e., AOI and LSA_{TER}).[7] In addition, further discussions with knowledgeable stakeholders and rights-holders will help determine the locations of sensitive habitats for waterbirds. However, access limitations will continue to be a factor in determining which areas can be surveyed. The NWMO continues to engage with local landowners to gain permission to access their properties. Zoetica is providing input to the NWMO regarding priority locations within which they should seek access based on the baseline information collected to date.

5.0 RAPTORS

5.1 Introduction

This section of the 2023 BIS Baseline Report focuses on raptors. This group refers to birds of prey from the following orders:

- Cathartiformes – New World Vultures
- Accipitriformes – Hawks, Eagles, Osprey
- Strigiformes – Owls
- Falconiformes – Falcons

A general introduction about the inclusion of birds for the BIS and background information about BCR 13 is included in Section 1.0. Among the 46 landbirds identified as priority species (out of 97 total species) in the BCR 13 strategy (EC 2014a), seven are raptors. Most raptors are expected to be present in the SON-South Bruce siting area year-round or during the breeding season (Mitch Waite Group 2018). However, a few raptor species may winter in the area (e.g., snowy owl, rough-legged hawk) or only pass through during migration (e.g., golden eagle).

Several SWH types apply to raptors. Based on the 6E ECS (OMNRF 2015), there are six raptor-related SWH types of potential relevance to the SON-South Bruce siting area:

- Raptor Wintering Area
- Bald Eagle and Osprey Nesting, Foraging, and Perching Habitat
- Woodland Raptor Nesting Habitat
- Open Country Bird Breeding Habitat
- Shrub/Early Successional Bird Breeding Habitat – *primarily of relevance to upland breeding birds but also indicated for eastern screech-owl* (MNRF 2014)
- Special Concern and Rare Species

Further details about candidate SWH investigations conducted to date and rationale for inclusion (or exclusion) of SWH types listed in the 6E ECS are presented in Appendix C, Chapter 1.

5.1.1 Objectives

All general objectives listed in Section 1.1 apply to raptors.

5.2 Methods

5.2.1 Study Areas

The BIS study areas for raptors include the AOI, LSA_{TER}, the RSA_{AVI} for terrestrial species, and the $RSA_{AVI-AQU}$ for species strongly associated with aquatic environments, such as bald eagle and osprey that feed primarily on fish (see figures and descriptions in Section 3.0, Chapter 1).

5.2.2 Presence, Distribution, and Abundance of Important Habitat

Collation of both existing and Tier 1 habitat data for raptors proceeded as described in Sections 1.2.2 and 1.2.3.

5.2.3 Presence and Distribution of Species of Interest

Collation of existing observations and Tier 1 incidental observations for raptor species of interest proceeded as described in Sections 1.2.2 and 1.2.3.

5.2.4 Additional Baseline Data to Inform the IA

Species lists were compiled from desk- and field-based studies (as per Section 1.2.2 and 1.2.3) as an initial investigation into the biodiversity of raptors in the BIS study areas.

5.3 Results

5.3.1 Presence, Distribution, and Abundance of Important Habitat

5.3.1.1 General Habitat Associations

Future Tier 2 studies aim to determine raptor-habitat associations within the BIS study areas. Discussion of general habitat associations will be included in future BIS Baseline Reports after Tier 2 studies have been completed (if the SON-South Bruce siting area is selected for the Project).

5.3.1.2 Significant and Other Important Wildlife Habitats

Various candidate SWH of relevance to raptors have been found throughout the AOI, LSA_{TER}, RSA_{AVI}, and $RSA_{AVI\text{-}AQU}$ based on ecosite analyses, some or all habitat criteria being met, or records of species and/or habitat features. There is supporting evidence for all six SWH types listed in Section 5.1. A detailed discussion of candidate SWH within the LSA_{TER} is available in Appendix C, Chapter 1. Special Concern and provincially rare raptor species are also discussed in Section 5.3.2.1 below.

In addition to SWH, Zoetica investigated whether other important wildlife habitat data (e.g., nests, territories, snags/wildlife trees, important foraging/perching/roosting sites) were contained within the datasets analyzed (see **Table 1-1**) or found during the Tier 1 BIS baseline field programs. No further information was available for raptors.

5.3.2 Presence and Distribution of Species of Interest

5.3.2.1 Species of Conservation Concern

To date, four raptor species of conservation concern have been observed within the AOI, LSA_{TER}, RSA_{AVI} and/or $RSA_{AVI\text{-}AQU}$ (**Table 5-1**), including two SAR and two other priority species as identified by the BCR 13 strategy (EC 2014a). Only two raptor (or functional raptor) species – bald eagle (Special Concern) and common raven – were observed within the BIS study areas during 2022 field studies.

Table 5-1. Summary list of raptor species of interest recorded within the AOI, LSA_{TER}, and RSA_{AVI} or $RSA_{AVI\text{-}AQU}$.

Common Name	Species of Interest[1]				Method of Detection			BIS Study Area[2]		
	SAR	Prov. Rare	BCR 13	Engage.	Desk-based	2020 Studies[3]	2022 Field	AOI	LSA_{TER}	RSA_{AVI} / $RSA_{AVI\text{-}AQU}$
Golden Eagle	Y	-	-	-	Y	-	-	-	-	Y
Bald Eagle	Y	-	Y	Y	Y	-	Y	Y	Y	Y
American Kestrel	-	-	Y	-	Y	-	-	-	-	Y
Northern Harrier	-	-	Y	-	Y	-	-	-	-	Y

Notes:
1. Species of conservation concern (at-risk and provincially rare), other priority species as identified by the BCR 13 strategy (EC 2014a), and species mentioned during engagement are noted, where applicable.

2. For the purposes of this table, the indicated study area <u>excludes</u> overlap with other study area(s) that may be encompassed within its boundaries.
3. Data were collated from the previous preliminary environmental field studies conducted in July and October 2020 by Tulloch Environmental at boreholes 1 and 2 within the AOI (Tulloch Environmental 2020, 2021).

Bald eagle has been widely observed throughout the $RSA_{AVI\text{-}AQU}$, as indicated by the GBIF dataset (**Figure B-6**; **Table B-5**). To date, there is only one GBIF record within the AOI – four individual bald eagles were observed in February 2018 along the Teeswater River close to the southern boundary of the AOI. Further field studies are needed to determine whether this location may have local importance as a raptor wintering area (see discussion and maps of candidate SWH in Appendix C, Chapter 1). Additionally, bald eagle was observed in the winter (January and February 2010) and in the spring (March 2018) at two locations within the LSA_{TER}. During Tier 1 field studies, bald eagles were incidentally observed once, in the northern portion of the GSWC in mid-October 2022 (data not mapped).

Golden eagle (Endangered) has a provincial recovery strategy (Wyshynski and Pulfer 2015) and a government response statement available (MECP 2016). There are two GBIF records of this species within the $RSA_{AVI\text{-}AQU}$ south and southwest of the LSA_{TER} (**Figure B-6**). Based on species range maps, golden eagle is expected to be a migrant through southwestern Ontario (Cornell Lab of Ornithology 2019g); however, these two observations were made in the winter (late December and January) of 2017 and 2019. It has been documented that small numbers of golden eagle overwinter in southern Ontario, often near large deer wintering areas where carcasses might be found (MECP 2021). Further investigation of the potential for golden eagle to be using the BIS study areas for overwintering is needed.

No provincially rare raptors have been observed within the BIS study areas (**Table 5-1**). Although rough-legged hawk and turkey vulture have SRANKS of S1 and S3 during the breeding and non-breeding periods, respectively, only wintering populations of rough-legged hawk and breeding populations of turkey vulture are expected in southwestern Ontario (Cornell Lab of Ornithology 2019h, 2019i). Therefore, these species are not of regulatory concern for the BIS.

5.3.2.1 <u>Species of Interest to Stakeholders and Rights-holders, and Species of Potential Socio-economic Importance</u>

See Section 2.3.2.2 for a general discussion about what Zoetica has heard from engagement regarding birds and bird communities. With respect to raptors, observations from a member of the local community included bald eagles nesting along the river west of Teeswater. While the community of Teeswater is located within the RSA_{AVI}, it is outside the LSA_{ECO} where 2022 field studies were conducted; therefore, no incidental observations of bald eagles or their nests were collected in this area. The socio-economic or socio-ecological importance of additional raptor species to local communities and/or Indigenous communities will be sought through future engagement. Zoetica's proposed Tier 2 studies include community-level surveys that will detect a variety of raptors. Therefore, future data collection will also enable retrospective analysis of newly identified species of interest, if needed.

5.3.2.1 <u>Indicator Species</u>

To date, only one of the three raptor species used as forest indicators by the MNRF (northern goshawk; see Table 5-18 in the BPPA Report (Zoetica 2021)) has been observed within the BIS study areas. The three other BCR 13 priority species detected within the BIS study areas (see Section 5.3.2.1 and **Table 5-1**) could also be considered as indicator species after more baseline data are collected. Zoetica recommends that indicator species for the purposes of the BIS be determined after more information is gathered about potential project impacts and species-habitat associations (e.g., through Tier 2 community composition studies) within the BIS study areas for birds. See Sections 4.2 and 5.2.7.1 of the BPPA Report (Zoetica 2021) for further discussion of indicator species.

5.3.3 Additional Baseline Data to Inform the IA

5.3.3.1 Community Characterization

A total of 17 raptor species have been detected within the BIS study areas based on desk- and field-based investigations conducted to date (**Table D-4**). Of these, six species were documented within the AOI in existing datasets; none were observed in the AOI during 2022 field studies. The Greenock Swamp ANSI Life Science Inventory report identified additional raptor species in the SON-South Bruce siting area (see **Table C-1**), including barred owl, long-eared owl, and red-shouldered hawk. However, as there are no spatial data associated with the Greenock Swamp ANSI report to determine which species were observed within or outside the RSA_{AVI}, these additional species were not included in **Table 5-1** (which is limited to raptor species detected within the BIS study areas).

5.4 Discussion

Section 5.0 of Chapter 7 (Avifauna) of the 2023 BIS Baseline Report focused on desk-based analyses of raptor habitat and species observations and preliminary results from Tier 1 terrestrial and aquatic habitat assessments and incidental observations. To date, 17 raptor species have been detected within the AOI, LSA_{TER}, RSA_{AVI}, or $RSA_{AVI-AQU}$, including two SAR and two other priority species as identified by the BCR 13 strategy (EC 2014a) (**Table D-4**). However, where a species has only been detected using desk-based data, caution should be taken as those data could be as old as 1970, and the conditions supporting the species' presence in the area may have changed.

Baseline spatial data for raptor species of conservation concern are currently limited to existing GBIF observations and one incidental field observation of bald eagle, and two GBIF observations of golden eagle (**Figure B-6**). Most observations occurred within the $RSA_{AVI-AQU}$ outside the AOI and LSA_{TER}. As these records do not contain additional information about habitat use or bird activity, it is unclear if the observations are associated with important habitats for these species. However, a local community member noted that bald eagles nest along the Teeswater River west of the community of Teeswater; this area falls within the BIS study areas and should be ground-truthed during future field studies if it occurs within the AOI or LSA_{TER}. If confirmed active, the bald eagle nest and surrounding habitat would constitute Bald Eagle and Osprey Nesting, Foraging and Perching Habitat SWH (OMNRF 2015).

Additional candidate SWH has been identified within the AOI, LSA_{TER}, RSA_{AVI}, and $RSA_{AVI-AQU}$ for Raptor Wintering Area, Woodland Raptor Nesting Habitat, Open Country Bird Breeding Habitat, and Shrub/Early Successional Bird Breeding Habitat. A detailed discussion of SWH is available in Appendix C, Chapter 1. In addition, the Greenock Swamp ANSI is known to provide breeding habitat for 11 raptor species (**Table C-1**); however, it is unclear if these observations occurred within the RSA_{AVI} portion of the ANSI.

5.4.1 Next Steps

If the SON-South Bruce siting area is selected for the Project, Tier 2 studies will aim to characterize raptor communities more thoroughly within the BIS study areas. Refer to Section 5.2.7 of the BPPA Report (Zoetica 2021) for more information. Community-level studies will enable estimates of relative abundance and seasonal habitat use and provide insight into food webs and trophic linkages. Study methods may include call playback surveys for woodland raptors, road transect surveys for open habitat raptors, and autonomous song meters to detect owls and other species. Based on these initial field studies, call playback for owls and ground nest searches may be conducted to identify breeding territories and/or nests. These targeted breeding/nest surveys and confirmation of candidate SWH (described in Appendix C, Chapter 1), including habitats for Special Concern and provincially rare species, will focus on areas within the extent of direct and indirect project impacts (i.e., AOI and LSA_{TER}).[7] In addition, further discussions with knowledgeable stakeholders and rights-holders will help determine the locations of sensitive habitats for raptors. However, access limitations will continue to be a factor in determining which areas can be surveyed. The NWMO continues to engage with local landowners to gain permission to access their properties. Zoetica is providing input to the NWMO regarding priority locations within which they should seek access based on the baseline information collected to date.

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APPENDIX A – SPECIES LIST

Table A-1. Common and scientific names for species mentioned in this report. Species names follow the NHIC's Ontario species lists, current to March 1, 2023.

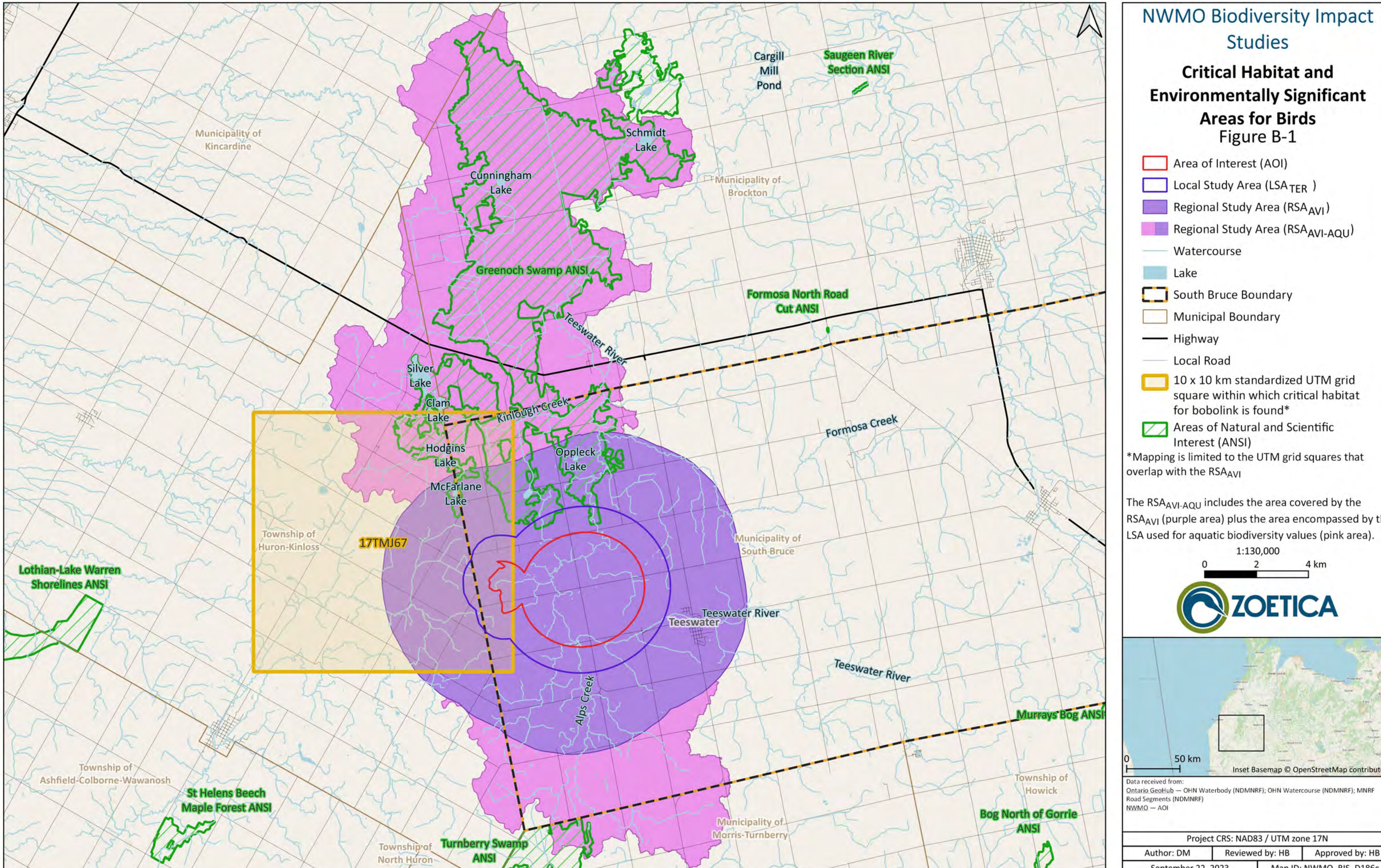
Common Name	Scientific Name
UPLAND BREEDING BIRDS	
Acadian Flycatcher	*Empidonax virescens*
Alder Flycatcher	*Empidonax alnorum*
American Crow	*Corvus brachyrhynchos*
American Goldfinch	*Spinus tristis*
American Redstart	*Setophaga ruticilla*
American Robin	*Turdus migratorius*
American Tree Sparrow	*Spizelloides arborea*
Baltimore Oriole	*Icterus galbula*
Bank Swallow	*Riparia riparia*
Barn Swallow	*Hirundo rustica*
Bay-breasted Warbler	*Setophaga castanea*
Belted Kingfisher	*Megaceryle alcyon*
Black Swift	*Cypseloides niger*
Black-and-white Warbler	*Mniotilta varia*
Black-billed Cuckoo	*Coccyzus erythropthalmus*
Blackburnian Warbler	*Setophaga fusca*
Black-capped Chickadee	*Poecile atricapillus*
Black-throated Blue Warbler	*Setophaga caerulescens*
Black-throated Green Warbler	*Setophaga virens*
Blue Jay	*Cyanocitta cristata*
Blue-gray Gnatcatcher	*Polioptila caerulea*
Blue-headed Vireo	*Vireo solitarius*
Blue-winged Warbler	*Vermivora cyanoptera*
Bobolink	*Dolichonyx oryzivorus*
Bohemian Waxwing	*Bombycilla garrulus*
Brewer's Blackbird	*Euphagus cyanocephalus*
Brown Creeper	*Certhia americana*
Brown Thrasher	*Toxostoma rufum*
Brown-headed Cowbird	*Molothrus ater*
Canada Warbler	*Cardellina canadensis*
Cape May Warbler	*Setophaga tigrina*
Cedar Waxwing	*Bombycilla cedrorum*
Cerulean Warbler	*Setophaga cerulea*
Chestnut-sided Warbler	*Setophaga pensylvanica*
Chimney Swift	*Chaetura pelagica*
Chipping Sparrow	*Spizella passerina*
Clay-colored Sparrow	*Spizella pallida*
Cliff Swallow	*Petrochelidon pyrrhonota*
Common Grackle	*Quiscalus quiscula*
Common Nighthawk	*Chordeiles minor*
Common Redpoll	*Acanthis flammea*
Common Yellowthroat	*Geothlypis trichas*
Dark-eyed Junco	*Junco hyemalis*
Downy Woodpecker	*Dryobates pubescens*
Eastern Bluebird	*Sialia sialis*
Eastern Kingbird	*Tyrannus tyrannus*
Eastern Meadowlark	*Sturnella magna*
Eastern Phoebe	*Sayornis phoebe*
Eastern Towhee	*Pipilo erythrophthalmus*
Eastern Whip-poor-will	*Antrostomus vociferus*

Common Name	Scientific Name
Eastern Wood-pewee	*Contopus virens*
European Starling	*Sturnus vulgaris*
Evening Grosbeak	*Coccothraustes vespertinus*
Field Sparrow	*Spizella pusilla*
Fox Sparrow	*Passerella iliaca*
Golden-crowned Kinglet	*Regulus satrapa*
Golden-winged Warbler	*Vermivora chrysoptera*
Grasshopper Sparrow	*Ammodramus savannarum*
Gray Catbird	*Dumetella carolinensis*
Great Crested Flycatcher	*Myiarchus crinitus*
Hairy Woodpecker	*Dryobates villosus*
Henslow's Sparrow	*Centronyx henslowii*
Hermit Thrush	*Catharus guttatus*
Hooded Warbler	*Setophaga citrina*
Horned Lark	*Eremophila alpestris*
House Finch	*Haemorhous mexicanus*
House Sparrow	*Passer domesticus*
House Wren	*Troglodytes aedon*
Indigo Bunting	*Passerina cyanea*
Least Flycatcher	*Empidonax minimus*
Loggerhead Shrike	*Lanius ludovicianus*
Louisiana Waterthrush	*Parkesia motacilla*
Magnolia Warbler	*Setophaga magnolia*
Marsh Wren	*Cistothorus palustris*
Mourning Dove	*Zenaida macroura*
Mourning Warbler	*Geothlypis philadelphia*
Nashville Warbler	*Leiothlypis ruficapilla*
Northern Cardinal	*Cardinalis cardinalis*
Northern Flicker	*Colaptes auratus*
Northern Parula	*Setophaga americana*
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*
Northern Shrike	*Lanius borealis*
Northern Waterthrush	*Parkesia noveboracensis*
Ovenbird	*Seiurus aurocapilla*
Palm Warbler	*Setophaga palmarum*
Pileated Woodpecker	*Dryocopus pileatus*
Pine Grosbeak	*Pinicola enucleator*
Pine Siskin	*Spinus pinus*
Pine Warbler	*Setophaga pinus*
Purple Finch	*Haemorhous purpureus*
Red-bellied Woodpecker	*Melanerpes carolinus*
Red-breasted Nuthatch	*Sitta canadensis*
Red-eyed Vireo	*Vireo olivaceus*
Red-headed Woodpecker	*Melanerpes erythrocephalus*
Red-winged Blackbird	*Agelaius phoeniceus*
Rock Pigeon	*Columba livia*
Rose-breasted Grosbeak	*Pheucticus ludovicianus*
Ruby-crowned Kinglet	*Corthylio calendula*
Ruby-throated Hummingbird	*Archilochus colubris*
Ruffed Grouse	*Bonasa umbellus*
Rusty Blackbird	*Euphagus carolinus*
Savannah Sparrow	*Passerculus sandwichensis*
Scarlet Tanager	*Piranga olivacea*
Sedge Wren	*Cistothorus stellaris*
Snow Bunting	*Plectrophenax nivalis*

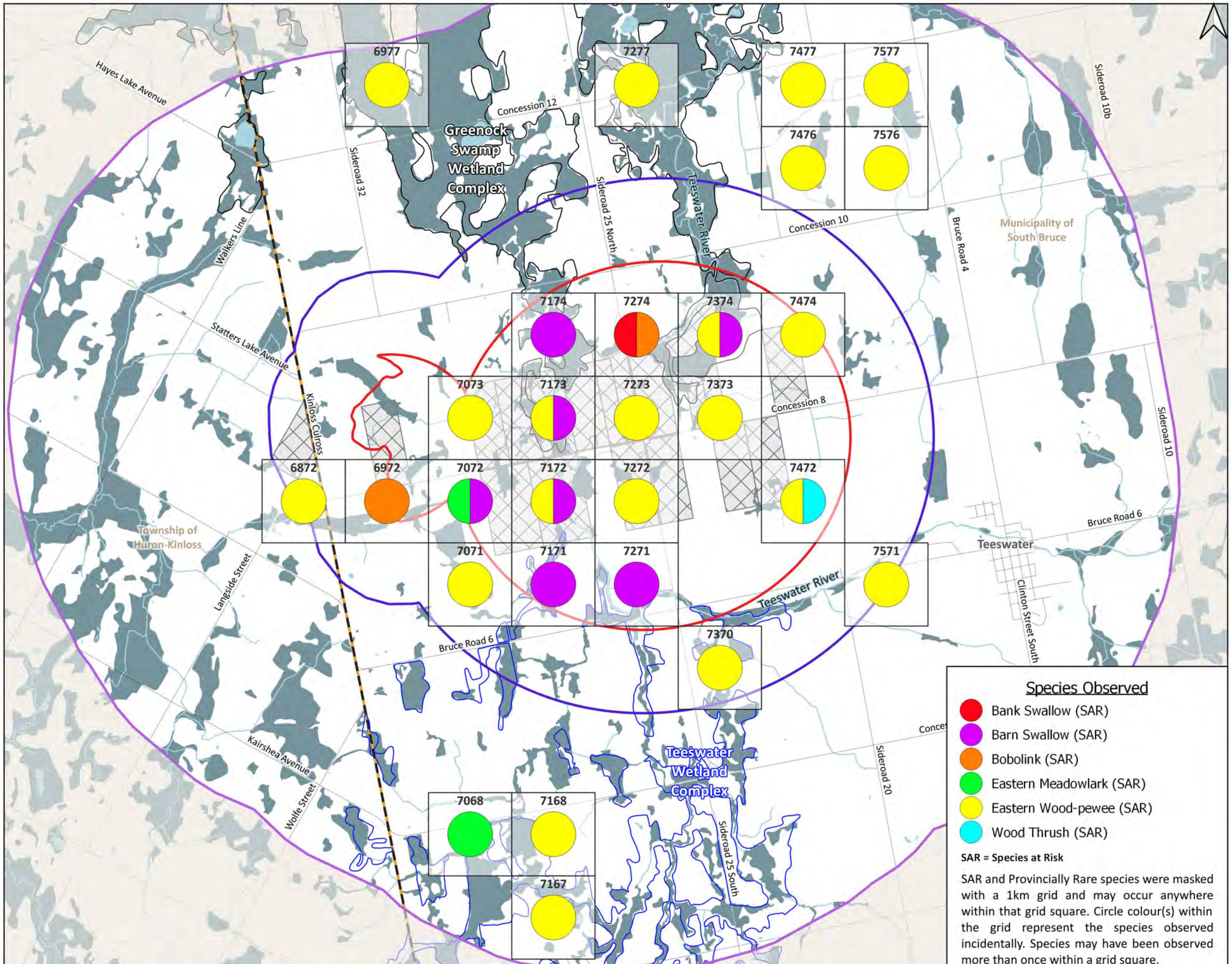
Common Name	Scientific Name
Song Sparrow	*Melospiza melodia*
Swainson's Thrush	*Catharus ustulatus*
Swamp Sparrow	*Melospiza georgiana*
Tree Swallow	*Tachycineta bicolor*
Veery	*Catharus fuscescens*
Vesper Sparrow	*Pooecetes gramineus*
Warbling Vireo	*Vireo gilvus*
White-breasted Nuthatch	*Sitta carolinensis*
White-crowned Sparrow	*Zonotrichia leucophrys*
White-throated Sparrow	*Zonotrichia albicollis*
Wild Turkey	*Meleagris gallopavo*
Willow Flycatcher	*Empidonax traillii*
Winter Wren	*Troglodytes hiemalis*
Wood Thrush	*Hylocichla mustelina*
Yellow Warbler	*Setophaga petechia*
Yellow-bellied Sapsucker	*Sphyrapicus varius*
Yellow-billed Cuckoo	*Coccyzus americanus*
Yellow-rumped Warbler	*Setophaga coronata*
Yellow-throated Vireo	*Vireo flavifrons*
SHOREBIRDS	
American Woodcock	*Scolopax minor*
Dunlin	*Calidris alpina*
Greater Yellowlegs	*Tringa melanoleuca*
Killdeer	*Charadrius vociferus*
Least Sandpiper	*Calidris minutilla*
Lesser Yellowlegs	*Tringa flavipes*
Pectoral Sandpiper	*Calidris melanotos*
Semipalmated Plover	*Charadrius semipalmatus*
Semipalmated Sandpiper	*Calidris pusilla*
Solitary Sandpiper	*Tringa solitaria*
Spotted Sandpiper	*Actitis macularius*
Stilt Sandpiper	*Calidris himantopus*
Upland Sandpiper	*Bartramia longicauda*
Wilson’s Phalarope	*Phalaropus tricolor*
Wilson's Snipe	*Gallinago delicata*
WATERBIRDS	
American Bittern	*Botaurus lentiginosus*
American Black Duck	*Anas rubripes*
American Coot	*Fulica americana*
American Wigeon	*Mareca americana*
Black Tern	*Chlidonias niger*
Blue-winged Teal	*Spatula discors*
Bonaparte's Gull	*Chroicocephalus philadelphia*
Bufflehead	*Bucephala albeola*
Cackling Goose	*Branta hutchinsii*
Canada Goose	*Branta canadensis*
Canvasback	*Aythya valisineria*
Caspian Tern	*Hydroprogne caspia*
Common Gallinule	*Gallinula galeata*
Common Goldeneye	*Bucephala clangula*
Common Loon	*Gavia immer*
Common Merganser	*Mergus merganser*
Double-crested Cormorant	*Nannopterum auritum*
Gadwall	*Mareca strepera*
Great Black-backed Gull	*Larus marinus*

Common Name	Scientific Name
Great Blue Heron	*Ardea herodias*
Great Egret	*Ardea alba*
Greater White-fronted Goose	*Anser albifrons*
Green Heron	*Butorides virescens*
Green-winged Teal	*Anas crecca*
Herring Gull	*Larus argentatus*
Hooded Merganser	*Lophodytes cucullatus*
Horned Grebe	*Podiceps auritus*
Least Bittern	*Ixobrychus exilis*
Lesser Scaup	*Aythya affinis*
Long-tailed Duck	*Clangula hyemalis*
Mallard	*Anas platyrhynchos*
Mute Swan	*Cygnus olor*
Northern Pintail	*Anas acuta*
Northern Shoveler	*Spatula clypeata*
Pied-billed Grebe	*Podilymbus podiceps*
Red-breasted Merganser	*Mergus serrator*
Red-necked Grebe	*Podiceps grisegena*
Ring-billed Gull	*Larus delawarensis*
Ring-necked Duck	*Aythya collaris*
Sandhill Crane	*Antigone canadensis*
Snow Goose	*Anser caerulescens*
Sora	*Porzana carolina*
Tundra Swan	*Cygnus columbianus*
Virginia Rail	*Rallus limicola*
White-winged Scoter	*Melanitta deglandi*
Wood Duck	*Aix sponsa*
RAPTORS	
American Kestrel	*Falco sparverius*
Bald Eagle	*Haliaeetus leucocephalus*
Barred Owl	*Strix varia*
Broad-winged Hawk	*Buteo platypterus*
Common Raven	*Corvus corax*
Cooper's Hawk	*Accipiter cooperii*
Eastern Screech-Owl	*Megascops asio*
Golden Eagle	*Aquila chrysaetos*
Great Horned Owl	*Bubo virginianus*
Long-eared Owl	*Asio otus*
Merlin	*Falco columbarius*
Northern Goshawk	*Accipiter gentilis*
Northern Harrier	*Circus hudsonius*
Osprey	*Pandion haliaetus*
Red-shouldered Hawk	*Buteo lineatus*
Red-tailed Hawk	*Buteo jamaicensis*
Rough-legged Hawk	*Buteo lagopus*
Sharp-shinned Hawk	*Accipiter striatus*
Snowy Owl	*Bubo scandiacus*
Turkey Vulture	*Cathartes aura*

APPENDIX B – MAP FIGURES AND SUPPLEMENTAL DATA



NWMO Biodiversity Impact Studies
Critical Habitat and Environmentally Significant Areas for Birds
Figure B-1
Area of Interest (AOI)
Local Study Area (LSA_{TER})
Regional Study Area (RSA_{AVI})
Regional Study Area ($RSA_{AVI-AQU}$)
Watercourse
Lake
South Bruce Boundary
Municipal Boundary
Highway
Local Road
10 x 10 km standardized UTM grid square within which critical habitat for bobolink is found*
Areas of Natural and Scientific Interest (ANSI)
*Mapping is limited to the UTM grid squares that overlap with the RSA_{AVI}
The $RSA_{AVI-AQU}$ includes the area covered by the RSA_{AVI} (purple area) plus the area encompassed by the LSA used for aquatic biodiversity values (pink area).
1:130,000
0
2
4 km
ZOETICA
0
50 km
Inset Basemap © OpenStreetMap contributors
Data received from:
Ontario GeoHub — OHN Waterbody (NDMNRF); OHN Watercourse (NDMNRF); MNRF Road Segments (NDMNRF)
NWMO — AOI
Project CRS: NAD83 / UTM zone 17N
Author: DM
Reviewed by: HB
Approved by: HB
September 22, 2023
Map ID: NWMO_BIS_D186c
Cargill Mill Pond
Saugeen River Section ANSI
Municipality of Kincardine
Schmidt Lake
Cunningham Lake
Municipality of Brockton
Greenoch Swamp ANSI
Formosa North Road Cut ANSI
Teeswater River
Silver Lake
Clam Lake
Kinlough Creek
Hodgins Lake
Formosa Creek
Oppleck Lake
McFarlane Lake
Township of Huron-Kinloss
17TMJ67
Municipality of South Bruce
Lothian-Lake Warren Shorelines ANSI
Teeswater River
Teeswater
Teeswater River
Alps Creek
Murrays Bog ANSI
Township of Ashfield-Colborne-Wawanosh
St Helens Beech Maple Forest ANSI
Township of Howick
Municipality of Morris-Turnberry
Bog North of Gorrie ANSI
Township of North Huron
Turnberry Swamp ANSI



NWMO Biodiversity Impact Studies

Species of Interest Field Observations: Upland Breeding Birds

Figure B-2

- Area of Interest (AOI)
- Local Study Area (LSA_{TER})
- Regional Study Area (RSA_{AVI})
- Lake
- Wetland
- Watercourse
- Highway
- Local Road
- South Bruce Boundary
- Municipal Boundary
- NWMO Purchased or Optioned Land

Of all wetlands shown, only Provincially Significant Wetlands (PSWs) are labelled. The colour of the outline surrounding PSWs matches the colour of the respective PSW label.

PSW boundaries may not match wetland boundaries due to changes in aquatic habitat coverage since their creation compared to 2022.

1:45,000

0 0.5 1 km

ZOETICA

Data received from:
Ontario GeoHub — OHN Waterbody (MNRF); OHN Watercourse (MNRF); MNRF Road Segments (MNRF); Municipal Boundary - Lower and Single Tier (MMAH); Wetlands (MNRF)
NWMO — AOI; NWMO Purchased or Optioned Land; 2022 SB TEM Ecosite Data Export V4 (Tulloch)
Wetlands and water features are mapped using ecosite data within the LSA_{ECO} and data available from Ontario GeoHub outside the LSA_{ECO}.

Project CRS: NAD83 / UTM zone 17N

Author: AH	Reviewed by: CC	Approved by: HB
December 11, 2023	Map ID: NWMO_BIS_A117	

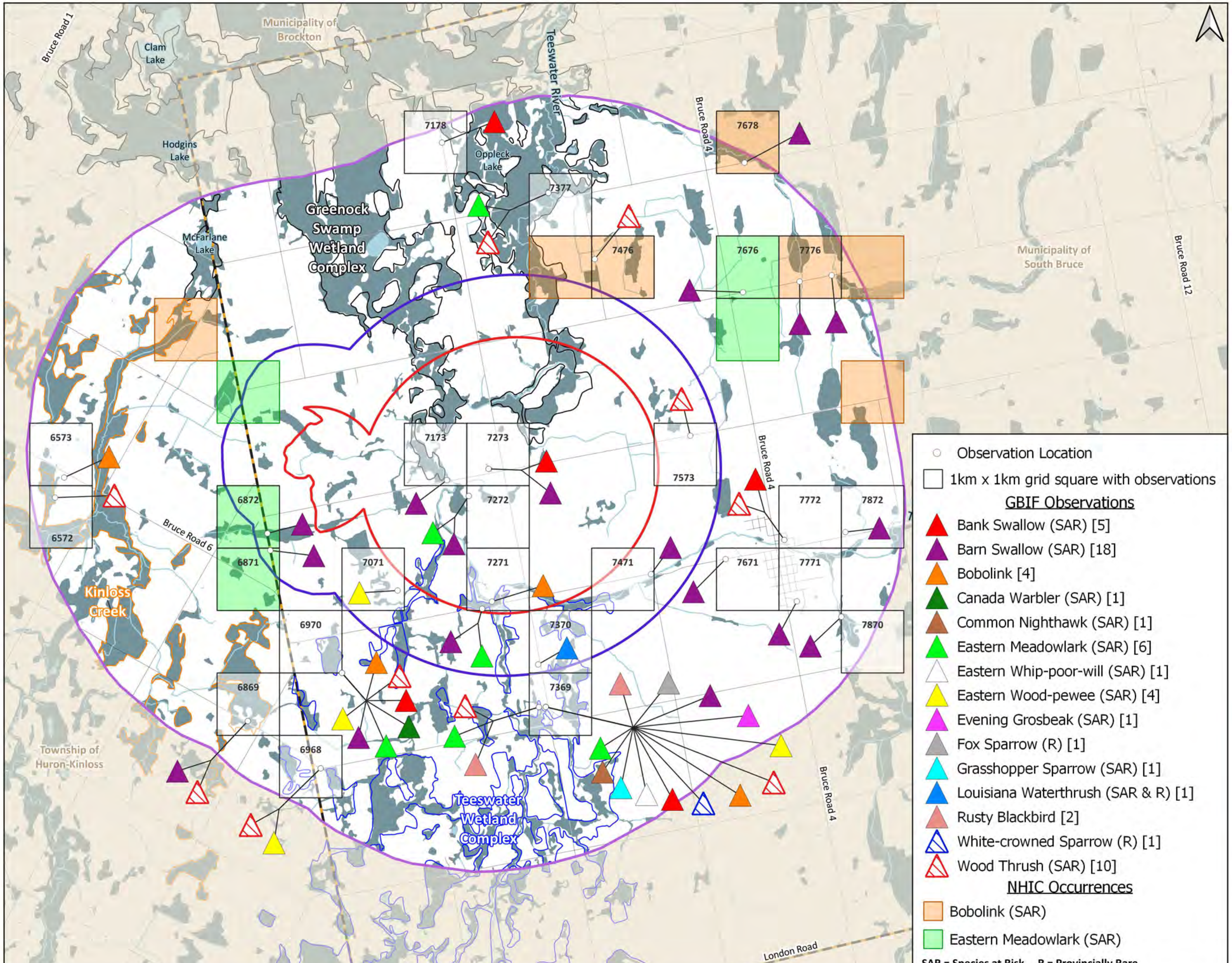
Table B-1. Supplemental data for 2022 field-based incidental observations of upland breeding bird species of interest within the BIS study areas.[1,2]

Grid	Species	Observation Type[3]	Count	Source Type[4]	AOI	LSA_{TER}	RSA_{AVI}
6872	Eastern Wood-pewee	Vocal	1	Incidental	0	1	1
6972	Bobolink	Vocal	1	Incidental	1	1	1
6977	Eastern Wood-pewee	Vocal	2	Incidental	0	0	1
6977	Eastern Wood-pewee	Vocal	1	Incidental	0	0	1
7068	Eastern Meadowlark	Visual	1	Incidental	0	0	1
7071	Eastern Wood-pewee	Vocal	2	Incidental	1	1	1
7072	Barn Swallow	Visual (ad, juv)	10	Incidental	1	1	1
7072	Eastern Meadowlark	Visual	1	Incidental	1	1	1
7073	Eastern Wood-pewee	Vocal	1	Incidental	1	1	1
7073	Eastern Wood-pewee	Vocal	1	SWH	1	1	1
7167	Eastern Wood-pewee	Vocal	2	Incidental	0	0	1
7168	Eastern Wood-pewee	Vocal	1	Incidental	0	0	1
7171	Barn Swallow	Nesting activity	>1	AHM	1	1	1
7171	Barn Swallow	Visual (ad, juv)	20	Incidental	1	1	1
7172	Barn Swallow	Visual	25	Incidental	1	1	1
7172	Barn Swallow	Visual	25	Incidental	1	1	1
7172	Eastern Wood-pewee	Vocal	1	Incidental	1	1	1
7172	Eastern Wood-pewee	Vocal	1	Incidental	1	1	1
7172	Eastern Wood-pewee	Vocal	2	Incidental	1	1	1
7173	Barn Swallow	Visual	1	AHM	1	1	1
7173	Eastern Wood-pewee	Vocal	1	Incidental	1	1	1
7173	Eastern Wood-pewee	Vocal	1	Incidental	1	1	1
7173	Eastern Wood-pewee	Vocal	1	Incidental	1	1	1
7173	Eastern Wood-pewee	Vocal	1	SWH	1	1	1
7173	Eastern Wood-pewee	Vocal	1	SWH	1	1	1
7173	Eastern Wood-pewee	Vocal	1	SWH	1	1	1
7173	Eastern Wood-pewee	Unspecified	1	SWH	1	1	1
7174	Barn Swallow	Vocal, Visual	3	Incidental	1	1	1
7174	Barn Swallow	Unspecified	>1	SWH	1	1	1
7271	Barn Swallow	Nesting activity	"many"	eDNA	1	1	1
7272	Eastern Wood-pewee	Vocal	1	Incidental	1	1	1
7272	Eastern Wood-pewee	Vocal	1	Incidental	1	1	1
7272	Eastern Wood-pewee	Vocal	1	Incidental	1	1	1
7272	Eastern Wood-pewee	Vocal	1	Incidental	1	1	1
7272	Eastern Wood-pewee	Vocal	1	eDNA	1	1	1
7273	Eastern Wood-pewee	Vocal	1	Incidental	1	1	1
7274	Bank Swallow	Visual	1	Incidental	1	1	1
7274	Bobolink	Vocal, Visual	1	Incidental	1	1	1
7277	Eastern Wood-pewee	Vocal	1	Incidental	0	0	1
7277	Eastern Wood-pewee	Vocal	1	Incidental	0	0	1

Grid	Species	Observation Type[3]	Count	Source Type[4]	AOI	LSA_{TER}	RSA_{AVI}
7277	Eastern Wood-pewee	Vocal	1	Incidental	0	0	1
7370	Eastern Wood-pewee	Vocal	2	Incidental	1	1	1
7370	Eastern Wood-pewee	Vocal	1	SWH	1	1	1
7370	Eastern Wood-pewee	Vocal	1	SWH	1	1	1
7373	Eastern Wood-pewee	Vocal	1	Incidental	1	1	1
7373	Eastern Wood-pewee	Vocal	1	Incidental	1	1	1
7374	Barn Swallow	Visual	1	Incidental	1	1	1
7374	Eastern Wood-pewee	Vocal	1	Incidental	1	1	1
7374	Eastern Wood-pewee	Vocal	1	Incidental	1	1	1
7374	Eastern Wood-pewee	Vocal	1	Incidental	1	1	1
7374	Eastern Wood-pewee	Vocal	1	Incidental	1	1	1
7472	Eastern Wood-pewee	Vocal	1	Incidental	1	1	1
7472	Eastern Wood-pewee	Vocal	1	Incidental	1	1	1
7472	Eastern Wood-pewee	Vocal	1	SWH	1	1	1
7472	Eastern Wood-pewee	Vocal	1	SWH	1	1	1
7472	Eastern Wood-pewee	Vocal	1	SWH	1	1	1
7472	Eastern Wood-pewee	Vocal	1	SWH	1	1	1
7472	Eastern Wood-pewee	Unspecified	1	AHM	1	1	1
7472	Wood Thrush	Unspecified	1	AHM	1	1	1
7474	Eastern Wood-pewee	Vocal	1	Incidental	1	1	1
7474	Eastern Wood-pewee	Vocal	1	Incidental	1	1	1
7474	Eastern Wood-pewee	Vocal	1	SWH	1	1	1
7474	Eastern Wood-pewee	Vocal	1	SWH	1	1	1
7476	Eastern Wood-pewee	Vocal	1	Incidental	0	1	1
7476	Eastern Wood-pewee	Vocal	3	Incidental	0	1	1
7477	Eastern Wood-pewee	Vocal, Visual	2	Incidental	0	0	1
7571	Eastern Wood-pewee	Vocal	1	Incidental	0	1	1
7571	Eastern Wood-pewee	Vocal	1	SWH	0	1	1
7571	Eastern Wood-pewee	Unspecified	1	SWH	0	1	1
7577	Eastern Wood-pewee	Vocal	1	Incidental	0	0	1

Notes:

1. Refer to Figure B-2 for the grid locations of masked observations. Coordinates are not provided due to the sensitive nature of SAR and provincially rare species. The indicated study area(s) is based on overlap with the 1 km grid square, not the actual point or polygon location.
2. For the purposes of this table, the indicated study area includes overlap with other study area(s) that may be encompassed within its boundaries. 1 = detected, 0 = not detected
3. Abbreviations for observation types: ad = adult, juv = juvenile
4. All 2022 field species observations are considered incidental; however, the source type is presented to allow interpretation of field effort and visited locations. “eDNA” refers to field observations and not the results of metabarcoding analyses.



NWMO Biodiversity Impact Studies

Species of Interest Desk-based Observations: Upland Breeding Birds

Figure B-3

- Area of Interest (AOI)
- Local Study Area (LSA_{TER})
- Regional Study Area (RSA_{AVI})
- Lake
- Wetland
- Watercourse
- Highway
- Local Road
- South Bruce Boundary
- Municipal Boundary

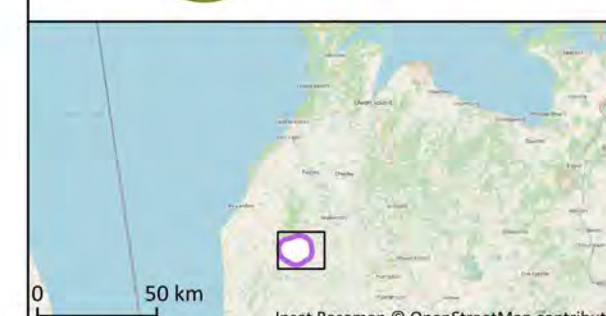
Of all wetlands shown, only Provincially Significant Wetlands (PSWs) are labelled. The colour of the outline surrounding PSWs matches the colour of the respective PSW label.

PSW boundaries may not match wetland boundaries due to changes in aquatic habitat coverage since their creation compared to 2022.

1:60,000

0 1 2 km

ZOETICA



Data received from:
Ontario GeoHub — OHN Waterbody (MNRF); OHN Watercourse (MNRF); MNRF Road Segments (MNRF); Municipal Boundary - Lower and Single Tier (MMAH); Wetlands (MNRF)
NWMO — AOI; NHIC Species Occurrences (MNRF)
GBIF.org — GBIF Occurrence Download - Accessed Oct., 2021
Wetlands and water features are mapped using ecosite data within the LSA_{ECO} and data available from Ontario GeoHub outside the LSA_{ECO}.

Project CRS: NAD83 / UTM zone 17N		
Author: AH	Reviewed by: CC	Approved by: HB
January 19, 2024	Map ID: NWMO_BIS_A067	

Table B-2. Supplemental data for desk-based observations of upland breeding bird species of interest within the BIS study areas.[1,2]

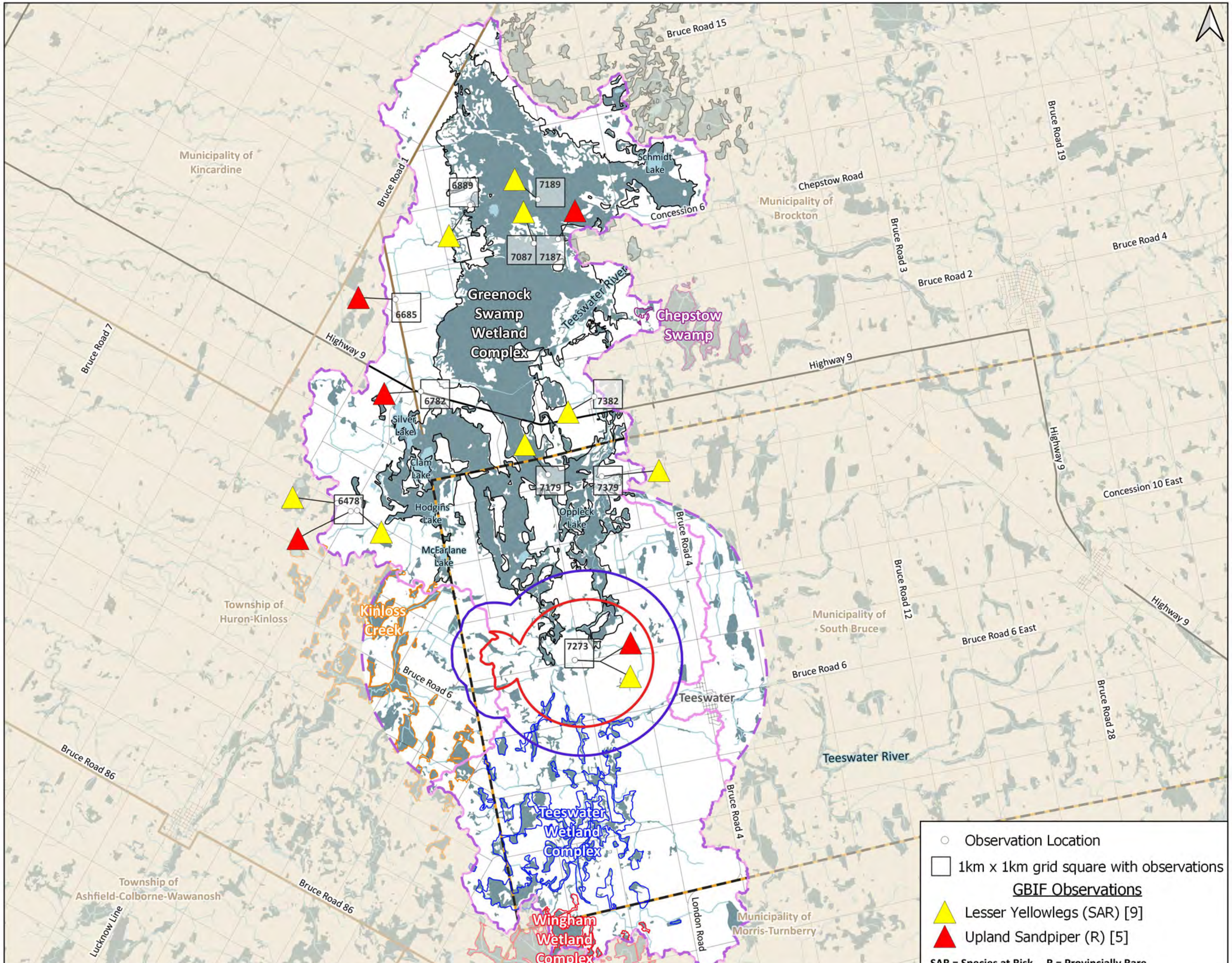
Grid	Source	Species	Count[3]	AOI	LSA_{TER}	RSA_{AVI}
6572	GBIF	Wood Thrush	2	0	0	1
6573	GBIF	Bobolink	1	0	0	1
6775	GBIF	Bobolink	2	0	0	1
6775	GBIF	Bobolink	2	0	0	1
6869	GBIF	Barn Swallow	3	0	0	1
6869	GBIF	Barn Swallow	3	0	0	1
6869	GBIF	Wood Thrush	1	0	0	1
6871	GBIF	Barn Swallow	8	0	1	1
6871	GBIF	Barn Swallow	8	0	1	1
6871	GBIF	Barn Swallow	8	0	1	1
6871	GBIF	Eastern Meadowlark	1	0	1	1
6871	GBIF	Eastern Meadowlark	1	0	1	1
6872	GBIF	Barn Swallow	5	0	1	1
6874	GBIF	Eastern Meadowlark	1	0	1	1
6874	GBIF	Eastern Meadowlark	1	0	1	1
6968	GBIF	Eastern Wood-pewee	1	0	0	1
6968	GBIF	Wood Thrush	1	0	0	1
6970	GBIF	Bank Swallow	U	0	0	1
6970	GBIF	Barn Swallow	U	0	0	1
6970	GBIF	Bobolink	U	0	0	1
6970	GBIF	Canada Warbler	U	0	0	1
6970	GBIF	Eastern Meadowlark	U	0	0	1
6970	GBIF	Eastern Wood-pewee	U	0	0	1
6970	GBIF	Wood Thrush	U	0	0	1
7071	GBIF	Eastern Wood-pewee	1	0	1	1
7173	GBIF	Barn Swallow	2	1	1	1
7178	GBIF	Bank Swallow	3	0	0	1
7271	GBIF	Barn Swallow	15	1	1	1
7271	GBIF	Bobolink	1	1	1	1
7271	GBIF	Eastern Meadowlark	1	1	1	1
7272	GBIF	Barn Swallow	6	1	1	1
7272	GBIF	Eastern Meadowlark	1	1	1	1
7273	GBIF	Bank Swallow	2	1	1	1
7273	GBIF	Barn Swallow	10	1	1	1
7273	GBIF	Barn Swallow	4	1	1	1
7273	GBIF	Barn Swallow	4	1	1	1
7369	GBIF	Bank Swallow	1	0	0	1
7369	GBIF	Barn Swallow	20	0	0	1
7369	GBIF	Barn Swallow	1	0	0	1
7369	GBIF	Barn Swallow	2	0	0	1

Grid	Source	Species	Count[3]	AOI	LSA_{TER}	RSA_{AVI}
7369	GBIF	Barn Swallow	4	0	0	1
7369	GBIF	Barn Swallow	1	0	0	1
7369	GBIF	Barn Swallow	1	0	0	1
7369	GBIF	Barn Swallow	8	0	0	1
7369	GBIF	Barn Swallow	5	0	0	1
7369	GBIF	Bobolink	1	0	0	1
7369	GBIF	Bobolink	1	0	0	1
7369	GBIF	Bobolink	1	0	0	1
7369	GBIF	Bobolink	4	0	0	1
7369	GBIF	Common Nighthawk	1	0	0	1
7369	GBIF	Eastern Meadowlark	2	0	0	1
7369	GBIF	Eastern Meadowlark	1	0	0	1
7369	GBIF	Eastern Whip-poor-will	1	0	0	1
7369	GBIF	Eastern Wood-pewee	2	0	0	1
7369	GBIF	Eastern Wood-pewee	1	0	0	1
7369	GBIF	Eastern Wood-pewee	1	0	0	1
7369	GBIF	Eastern Wood-pewee	2	0	0	1
7369	GBIF	Eastern Wood-pewee	1	0	0	1
7369	GBIF	Eastern Wood-pewee	2	0	0	1
7369	GBIF	Eastern Wood-pewee	1	0	0	1
7369	GBIF	Eastern Wood-pewee	3	0	0	1
7369	GBIF	Eastern Wood-pewee	1	0	0	1
7369	GBIF	Eastern Wood-pewee	1	0	0	1
7369	GBIF	Eastern Wood-pewee	1	0	0	1
7369	GBIF	Evening Grosbeak	20	0	0	1
7369	GBIF	Fox Sparrow	1	0	0	1
7369	GBIF	Fox Sparrow	5	0	0	1
7369	GBIF	Fox Sparrow	2	0	0	1
7369	GBIF	Fox Sparrow	1	0	0	1
7369	GBIF	Fox Sparrow	1	0	0	1
7369	GBIF	Fox Sparrow	1	0	0	1
7369	GBIF	Fox Sparrow	1	0	0	1
7369	GBIF	Grasshopper Sparrow	1	0	0	1
7369	GBIF	Rusty Blackbird	300	0	0	1
7369	GBIF	Rusty Blackbird	100	0	0	1
7369	GBIF	Rusty Blackbird	1	0	0	1
7369	GBIF	Rusty Blackbird	2	0	0	1
7369	GBIF	Rusty Blackbird	250	0	0	1
7369	GBIF	White-crowned Sparrow	1	0	0	1
7369	GBIF	White-crowned Sparrow	2	0	0	1
7369	GBIF	Wood Thrush	1	0	0	1
7369	GBIF	Wood Thrush	1	0	0	1

Grid	Source	Species	Count[3]	AOI	LSA_{TER}	RSA_{AVI}
7369	GBIF	Wood Thrush	1	0	0	1
7369	GBIF	Wood Thrush	3	0	0	1
7369	GBIF	Wood Thrush	1	0	0	1
7369	GBIF	Wood Thrush	1	0	0	1
7369	GBIF	Wood Thrush	2	0	0	1
7369	GBIF	Wood Thrush	1	0	0	1
7370	GBIF	Louisiana Waterthrush	1	0	1	1
7377	GBIF	Eastern Meadowlark	1	0	0	1
7377	GBIF	Wood Thrush	1	0	0	1
7471	GBIF	Barn Swallow	1	0	1	1
7476	GBIF	Wood Thrush	2	0	0	1
7573	GBIF	Wood Thrush	1	0	1	1
7671	GBIF	Barn Swallow	8	0	0	1
7676	GBIF	Barn Swallow	2	0	0	1
7678	GBIF	Barn Swallow	3	0	0	1
7771	GBIF	Barn Swallow	4	0	0	1
7772	GBIF	Bank Swallow	4	0	0	1
7772	GBIF	Wood Thrush	1	0	0	1
7776	GBIF	Barn Swallow	1	0	0	1
7776	GBIF	Barn Swallow	2	0	0	1
7870	GBIF	Barn Swallow	4	0	0	1
7872	GBIF	Barn Swallow	2	0	0	1

Notes:

1. Refer to Figure B-3 for the grid locations. Coordinates are not provided due to the sensitive nature of SAR and provincially rare species.
2. For the purposes of this table, the indicated study area includes overlap with other study area(s) that may be encompassed within its boundaries. 1 = detected, 0 = not detected
3. Count of “U” = unspecified.



NWMO Biodiversity Impact Studies

Species of Interest Desk-based Observations: Shorebirds

Figure B-4

- Area of Interest (AOI)
- Local Study Area (LSA_{TER})
- Local Study Area (LSA_{AQU})
- Regional Study Area ($RSA_{AVI-AQU}$)
- Lake
- Wetland
- Watercourse
- Highway
- Local Road
- South Bruce Boundary
- Municipal Boundary

Of all wetlands shown, only Provincially Significant Wetlands (PSWs) are labelled. The colour of the outline surrounding PSWs matches the colour of the respective PSW label.

PSW boundaries may not match wetland boundaries due to changes in aquatic habitat coverage since their creation compared to 2022.

1:130,000

0 2 4 km

ZOETICA

0 50 km

Inset Basemap © OpenStreetMap contributors

Data received from:
Ontario GeoHub — OHN Waterbody (MNRF); OHN Watercourse (MNRF); MNRF Road Segments (MNRF); Municipal Boundary - Lower and Single Tier (MMAH); Wetlands (MNRF)
NWMO — AOI
GBIF.org — GBIF Occurrence Download - Accessed Oct., 2021
Wetlands and water features are mapped using ecosite data within the LSA_{ECO} and data available from Ontario GeoHub outside the LSA_{ECO}.

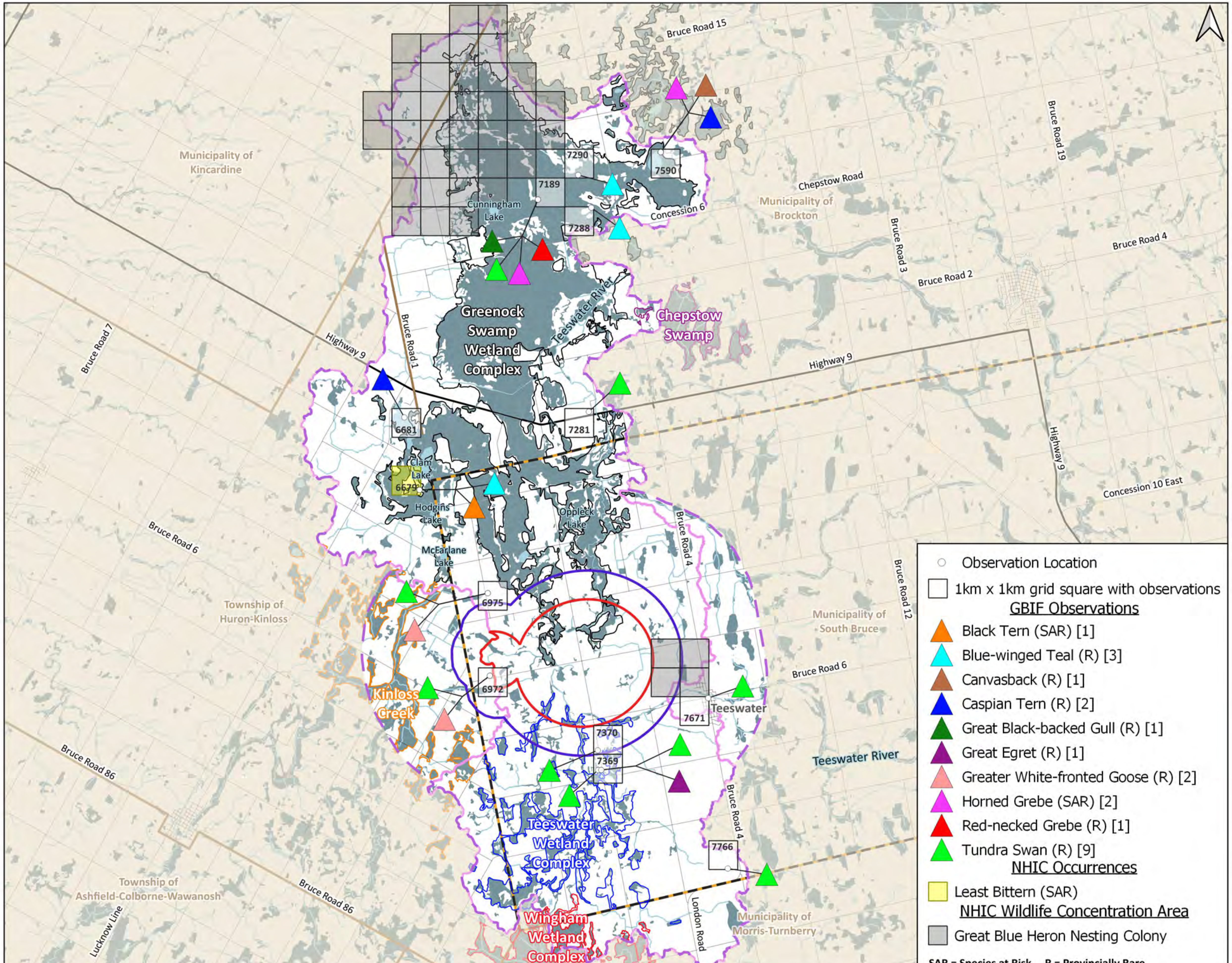
Project CRS: NAD83 / UTM zone 17N

Author: AH	Reviewed by: CC	Approved by: HB
December 18, 2023	Map ID: NWMO_BIS_A083	

Table B-3. Supplemental data for desk-based observations of shorebird species of interest within the BIS study areas.[1,2]

Grid	Source	Species	Count[3]	AOI	LSA_{TER}	$RSA_{AVI-AQU}$
6478	GBIF	Lesser Yellowlegs	5	0	0	1
6478	GBIF	Lesser Yellowlegs	3	0	0	1
6478	GBIF	Lesser Yellowlegs	1	0	0	1
6478	GBIF	Lesser Yellowlegs	5	0	0	1
6478	GBIF	Lesser Yellowlegs	1	0	0	1
6478	GBIF	Lesser Yellowlegs	5	0	0	1
6478	GBIF	Lesser Yellowlegs	3	0	0	1
6478	GBIF	Lesser Yellowlegs	3	0	0	1
6478	GBIF	Upland Sandpiper	U	0	0	1
6478	GBIF	Upland Sandpiper	U	0	0	1
6685	GBIF	Upland Sandpiper	2	0	0	1
6782	GBIF	Upland Sandpiper	1	0	0	1
6889	GBIF	Lesser Yellowlegs	U	0	0	1
7087	GBIF	Lesser Yellowlegs	U	0	0	1
7179	GBIF	Lesser Yellowlegs	U	0	0	1
7187	GBIF	Upland Sandpiper	1	0	0	1
7189	GBIF	Lesser Yellowlegs	1	0	0	1
7189	GBIF	Lesser Yellowlegs	2	0	0	1
7273	GBIF	Lesser Yellowlegs	3	1	1	1
7273	GBIF	Lesser Yellowlegs	3	1	1	1
7273	GBIF	Lesser Yellowlegs	3	1	1	1
7273	GBIF	Upland Sandpiper	1	1	1	1
7379	GBIF	Lesser Yellowlegs	4	0	0	1
7382	GBIF	Lesser Yellowlegs	5	0	0	1

Notes:
1. Refer to Figure B-4 for the grid locations. Coordinates are not provided due to the sensitive nature of SAR and provincially rare species.
2. For the purposes of this table, the indicated study area includes overlap with other study area(s) that may be encompassed within its boundaries. 1 = detected, 0 = not detected.
3. Count of "U" = unspecified.



NWMO Biodiversity Impact Studies

Species of Interest Desk-based Observations and Habitat Data: Waterbirds

Figure B-5

- Area of Interest (AOI)
- Local Study Area (LSA_{TER})
- Local Study Area (LSA_{AQU})
- Regional Study Area ($RSA_{AVI-AQU}$)
- Lake
- Wetland
- Watercourse
- Highway
- Local Road
- South Bruce Boundary
- Municipal Boundary

Of all wetlands shown, only Provincially Significant Wetlands (PSWs) are labelled. The colour of the outline surrounding PSWs matches the colour of the respective PSW label.

PSW boundaries may not match wetland boundaries due to changes in aquatic habitat coverage since their creation compared to 2022.

1:130,000

0 2 4 km

ZOETICA

Data received from:
Ontario GeoHub — OHN Waterbody (MNRF); OHN Watercourse (MNRF); MNRF Road Segments (MNRF); Municipal Boundary Lower and Single Tier (MMAH); Wetlands (MNRF)
NWMO — AOI; NHIC WCA Observations (MNRF); NHIC Species Occurrences (MNRF)
GBIF.org — GBIF Occurrence Download Accessed Oct., 2021
Wetlands and water features are mapped using ecosite data within the LSA_{ECO} and data available from Ontario GeoHub outside the LSA_{ECO}.

Project CRS: NAD83 / UTM zone 17N

Author: AH	Reviewed by: CC	Approved by: HB
December 12, 2023	Map ID: NWMO_BIS_A082	

Table B-4. Supplemental data for desk-based observations of waterbird species of interest within the BIS study areas.[1,2]

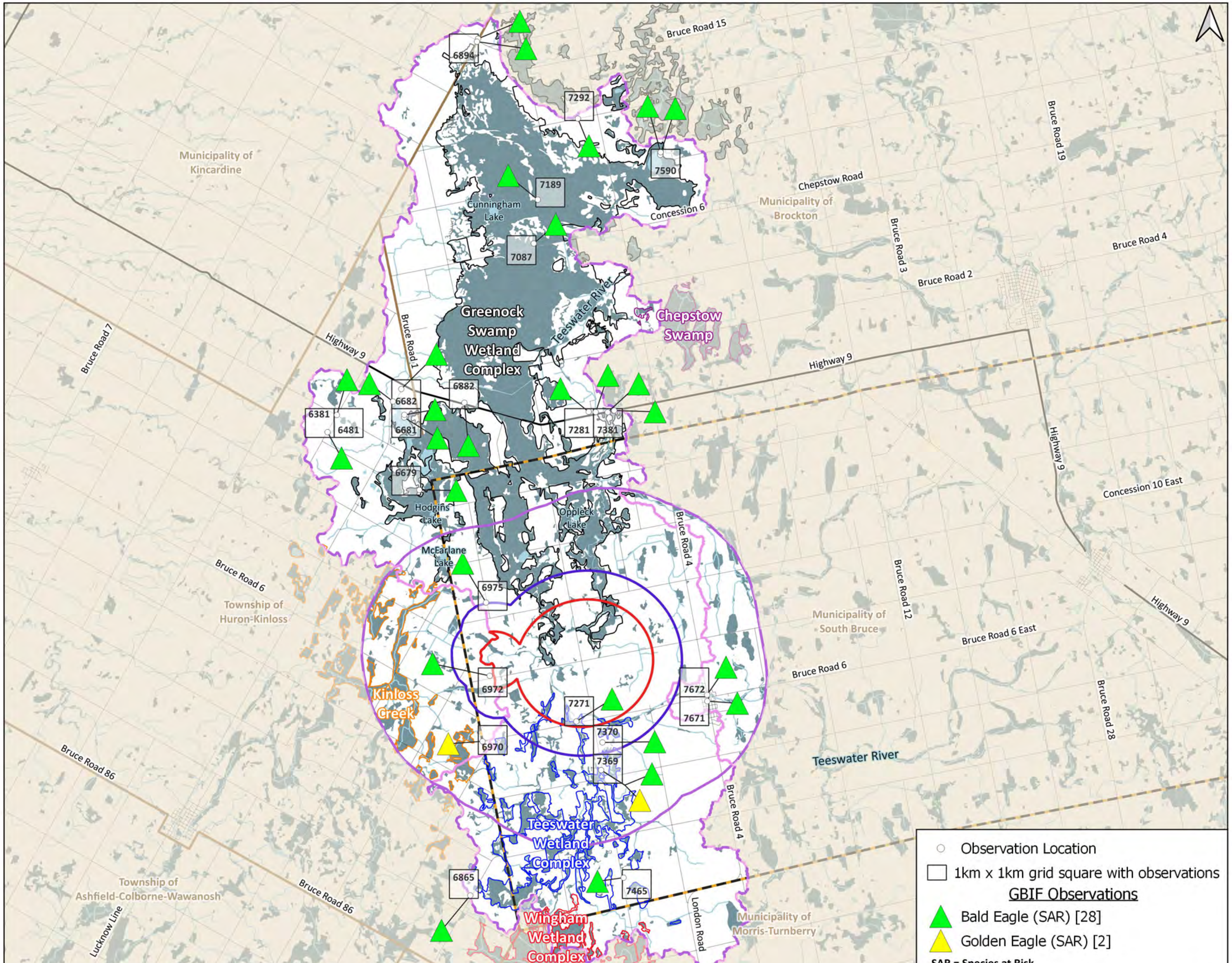
Grid	Source	Species	Count	AOI	LSA_{TER}	$RSA_{AVI-AQU}$
6679	GBIF	Black Tern	1	0	0	1
6679	GBIF	Blue-winged Teal	1	0	0	1
6679	GBIF	Blue-winged Teal	1	0	0	1
6681	GBIF	Caspian Tern	1	0	0	1
6681	GBIF	Caspian Tern	1	0	0	1
6972	GBIF	Greater White-fronted Goose	11	0	1	1
6972	GBIF	Tundra Swan	45	0	1	1
6975	GBIF	Greater White-fronted Goose	15	0	0	1
6975	GBIF	Tundra Swan	115	0	0	1
7189	GBIF	Great Black-backed Gull	1	0	0	1
7189	GBIF	Horned Grebe	3	0	0	1
7189	GBIF	Red-necked Grebe	1	0	0	1
7189	GBIF	Tundra Swan	2	0	0	1
7281	GBIF	Tundra Swan	60	0	0	1
7281	GBIF	Tundra Swan	60	0	0	1
7281	GBIF	Tundra Swan	60	0	0	1
7288	GBIF	Blue-winged Teal	10	0	0	1
7290	GBIF	Blue-winged Teal	15	0	0	1
7369	GBIF	Great Egret	1	0	0	1
7369	GBIF	Tundra Swan	50	0	0	1
7369	GBIF	Tundra Swan	2	0	0	1
7370	GBIF	Tundra Swan	30	0	1	1
7590	GBIF	Canvasback	3	0	0	1
7590	GBIF	Caspian Tern	1	0	0	1
7590	GBIF	Horned Grebe	2	0	0	1
7671	GBIF	Tundra Swan	50	0	0	1
7671	GBIF	Tundra Swan	25	0	0	1
7671	GBIF	Tundra Swan	35	0	0	1
7766	GBIF	Tundra Swan	250	0	0	1

Notes:
1. Refer to Figure B-5 for the grid locations. Coordinates are not provided due to the sensitive nature of SAR and provincially rare species.
2. For the purposes of this table, the indicated study area includes overlap with other study area(s) that may be encompassed within its boundaries. 1 = detected, 0 = not detected.

NWMO Biodiversity Impact Studies

Species of Interest Desk-based Observations: Raptors

Figure B-6



- Area of Interest (AOI)
- Local Study Area (LSA_{TER})
- Local Study Area (LSA_{AQU})
- Regional Study Area (RSA_{AVI})
- Regional Study Area ($RSA_{AVI-AQU}$)
- Lake
- Wetland
- Watercourse
- Highway
- Local Road
- South Bruce Boundary
- Municipal Boundary

Of all wetlands shown, only Provincially Significant Wetlands (PSWs) are labelled. The colour of the outline surrounding PSWs matches the colour of the respective PSW label.

PSW boundaries may not match wetland boundaries due to changes in aquatic habitat coverage since their creation compared to 2022.

1:130,000

0 2 4 km

ZOETICA

Data received from:
Ontario GeoHub — OHN Waterbody (MNRF); OHN Watercourse (MNRF); MNRF Road Segments (MNRF); Municipal Boundary - Lower and Single Tier (MMAH); Wetlands (MNRF)
NWMO — AOI
GBIF.org — GBIF Occurrence Download - Accessed Oct., 2021
Wetlands and water features are mapped using ecosite data within the LSA_{ECO} and data available from Ontario GeoHub outside the LSA_{ECO}.

Project CRS: NAD83 / UTM zone 17N

Author: AH	Reviewed by: CC	Approved by: HB
December 12, 2023	Map ID: NWMO_BIS_A059	

Table B-5. Supplemental data for desk-based observations of raptor species of interest within the BIS study areas.[1,2]

Grid	Source	Species	Count[3]	AOI	LSA_{TER}	RSA_{AVI} / $RSA_{AVI-AQU}$
6381	GBIF	Bald Eagle	1	0	0	1
6481	GBIF	Bald Eagle	1	0	0	1
6481	GBIF	Bald Eagle	1	0	0	1
6679	GBIF	Bald Eagle	1	0	0	1
6679	GBIF	Bald Eagle	1	0	0	1
6679	GBIF	Bald Eagle	1	0	0	1
6679	GBIF	Bald Eagle	1	0	0	1
6679	GBIF	Bald Eagle	1	0	0	1
6679	GBIF	Bald Eagle	1	0	0	1
6679	GBIF	Bald Eagle	1	0	0	1
6679	GBIF	Bald Eagle	1	0	0	1
6679	GBIF	Bald Eagle	1	0	0	1
6679	GBIF	Bald Eagle	1	0	0	1
6679	GBIF	Bald Eagle	1	0	0	1
6679	GBIF	Bald Eagle	1	0	0	1
6679	GBIF	Bald Eagle	1	0	0	1
6679	GBIF	Bald Eagle	1	0	0	1
6679	GBIF	Bald Eagle	1	0	0	1
6679	GBIF	Bald Eagle	1	0	0	1
6679	GBIF	Bald Eagle	2	0	0	1
6679	GBIF	Bald Eagle	1	0	0	1
6679	GBIF	Bald Eagle	1	0	0	1
6679	GBIF	Bald Eagle	1	0	0	1
6679	GBIF	Bald Eagle	2	0	0	1
6679	GBIF	Bald Eagle	1	0	0	1
6679	GBIF	Bald Eagle	1	0	0	1
6679	GBIF	Bald Eagle	1	0	0	1
6679	GBIF	Bald Eagle	1	0	0	1
6679	GBIF	Bald Eagle	1	0	0	1
6679	GBIF	Bald Eagle	1	0	0	1
6679	GBIF	Bald Eagle	1	0	0	1
6679	GBIF	Bald Eagle	1	0	0	1
6679	GBIF	Bald Eagle	1	0	0	1
6679	GBIF	Bald Eagle	1	0	0	1
6679	GBIF	Bald Eagle	1	0	0	1
6679	GBIF	Bald Eagle	1	0	0	1
6679	GBIF	Bald Eagle	1	0	0	1
6679	GBIF	Bald Eagle	1	0	0	1
6679	GBIF	Bald Eagle	1	0	0	1
6679	GBIF	Bald Eagle	1	0	0	1
6679	GBIF	Bald Eagle	1	0	0	1

Grid	Source	Species	Count[3]	AOI	LSA_{TER}	RSA_{AVI} / $RSA_{AVI-AQU}$
6681	GBIF	Bald Eagle	2	0	0	1
6681	GBIF	Bald Eagle	1	0	0	1
6681	GBIF	Bald Eagle	2	0	0	1
6682	GBIF	Bald Eagle	1	0	0	1
6682	GBIF	Bald Eagle	1	0	0	1
6865	GBIF	Bald Eagle	1	0	0	1
6882	GBIF	Bald Eagle	4	0	0	1
6894	GBIF	Bald Eagle	1	0	0	1
6894	GBIF	Bald Eagle	5	0	0	1
6894	GBIF	Bald Eagle	5	0	0	1
6894	GBIF	Bald Eagle	5	0	0	1
6970	GBIF	Golden Eagle	1	0	0	1
6972	GBIF	Bald Eagle	1	0	1	1
6975	GBIF	Bald Eagle	6	0	0	1
6975	GBIF	Bald Eagle	6	0	0	1
6975	GBIF	Bald Eagle	6	0	0	1
7087	GBIF	Bald Eagle	U	0	0	1
7189	GBIF	Bald Eagle	2	0	0	1
7189	GBIF	Bald Eagle	3	0	0	1
7271	GBIF	Bald Eagle	4	1	1	1
7281	GBIF	Bald Eagle	1	0	0	1
7281	GBIF	Bald Eagle	1	0	0	1
7281	GBIF	Bald Eagle	1	0	0	1
7281	GBIF	Bald Eagle	1	0	0	1
7281	GBIF	Bald Eagle	1	0	0	1
7281	GBIF	Bald Eagle	1	0	0	1
7292	GBIF	Bald Eagle	1	0	0	1
7369	GBIF	Bald Eagle	1	0	0	1
7369	GBIF	Bald Eagle	2	0	0	1
7369	GBIF	Bald Eagle	1	0	0	1
7369	GBIF	Golden Eagle	1	0	0	1
7369	GBIF	Bald Eagle	1	0	0	1
7369	GBIF	Bald Eagle	1	0	0	1
7369	GBIF	Bald Eagle	1	0	0	1
7369	GBIF	Bald Eagle	1	0	0	1
7369	GBIF	Bald Eagle	1	0	0	1
7369	GBIF	Bald Eagle	1	0	0	1
7369	GBIF	Bald Eagle	1	0	0	1
7369	GBIF	Bald Eagle	1	0	0	1
7369	GBIF	Bald Eagle	1	0	0	1
7370	GBIF	Bald Eagle	2	0	1	1

Grid	Source	Species	Count[3]	AOI	LSA_{TER}	RSA_{AVI} / $RSA_{AVI-AQU}$
7370	GBIF	Bald Eagle	1	0	1	1
7370	GBIF	Bald Eagle	1	0	1	1
7381	GBIF	Bald Eagle	1	0	0	1
7381	GBIF	Bald Eagle	2	0	0	1
7381	GBIF	Bald Eagle	2	0	0	1
7465	GBIF	Bald Eagle	3	0	0	1
7590	GBIF	Bald Eagle	1	0	0	1
7590	GBIF	Bald Eagle	3	0	0	1
7590	GBIF	Bald Eagle	1	0	0	1
7590	GBIF	Bald Eagle	3	0	0	1
7671	GBIF	Bald Eagle	1	0	0	1
7672	GBIF	Bald Eagle	2	0	0	1

Notes:
1. Refer to Figure B-6 for the grid locations. Coordinates are not provided due to the sensitive nature of SAR and provincially rare species.
2. For the purposes of this table, the indicated study area includes overlap with other study area(s) that may be encompassed within its boundaries. 1 = detected, 0 = not detected.
3. Count of "U" = unspecified.

APPENDIX C – LIST OF BIRDS FROM THE GREENOCK SWAMP ANSI REPORT

Table C-1. Breeding birds of the Greenock Swamp ANSI (Johnson 1994a). Conservation statuses come from the NHIC's Ontario species list, current to March 1, 2023. Species of Interest (SOI) for the purposes of the BIS are indicated: SAR = species at risk, Rare = provincially rare (S1-S3), BCR 13 = other BCR 13 priority species (EC 2014a), Engage. = species mentioned during engagement.

SOI?	Common Name	Scientific Name	SRANK	SARO	COSEWIC	*SARA*
UPLAND BREEDING BIRDS						
-	Alder Flycatcher	*Empidonax alnorum*	S5B	-	-	-
-	American Crow	*Corvus brachyrhynchos*	S5	-	-	-
-	American Goldfinch	*Spinus tristis*	S5	-	-	-
-	American Redstart	*Setophaga ruticilla*	S5B	-	-	-
-	American Robin	*Turdus migratorius*	S5	-	-	-
BCR 13	Baltimore Oriole[2]	*Icterus galbula*	S4B	-	-	-
SAR	Bank Swallow	*Riparia riparia*	S4B	THR	THR	THR
SAR	Barn Swallow	*Hirundo rustica*	S4B	SC	SC	THR
BCR 13	Belted Kingfisher	*Megaceryle alcyon*	S5B,S4N	-	-	-
-	Black-and-white Warbler	*Mniotilta varia*	S5B	-	-	-
BCR 13	Black-billed Cuckoo	*Coccyzus erythropthalmus*	S4S5B	-	-	-
-	Black-capped Chickadee	*Poecile atricapillus*	S5	-	-	-
-	Black-throated Green Warbler	*Setophaga virens*	S5B	-	-	-
-	Blue Jay	*Cyanocitta cristata*	S5	-	-	-
BCR 13	Blue-winged Warbler	*Vermivora cyanoptera*	S4B	-	-	-
-	Brown Creeper	*Certhia americana*	S5	-	-	-
BCR 13	Brown Thrasher	*Toxostoma rufum*	S4B	-	-	-
Engage.	Brown-headed Cowbird	*Molothrus ater*	S5	-	-	-
SAR	Canada Warbler	*Cardellina canadensis*	S5B	SC	SC	THR
-	Cedar Waxwing	*Bombycilla cedrorum*	S5	-	-	-
SAR	Cerulean Warbler	*Setophaga cerulea*	S2B	THR	END	END
-	Chestnut-sided Warbler	*Setophaga pensylvanica*	S5B	-	-	-
SAR	Chimney Swift	*Chaetura pelagica*	S3B	THR	THR	THR
-	Chipping Sparrow[1]	*Spizella passerina*	S5B,S3N	-	-	-
-	Common Grackle	*Quiscalus quiscula*	S5	-	-	-
-	Common Yellowthroat[1]	*Geothlypis trichas*	S5B,S3N	-	-	-
-	Downy Woodpecker	*Dryobates pubescens*	S5	-	-	-
-	Eastern Bluebird	*Sialia sialis*	S5B,S4N	NAR	NAR	-
BCR 13	Eastern Kingbird	*Tyrannus tyrannus*	S4B	-	-	-
BCR 13	Eastern Towhee[1,2]	*Pipilo erythrophthalmus*	S4B,S3N	-	-	-
SAR	Eastern Whip-poor-will	*Antrostomus vociferus*	S4B	THR	SC	THR
SAR	Eastern Wood-Pewee	*Contopus virens*	S4B	SC	SC	SC
-	European Starling	*Sturnus vulgaris*	SNA	-	-	-

BCR 13	Field Sparrow[1]	*Spizella pusilla*	S4B,S3N	-	-	-
-	Golden-crowned Kinglet	*Regulus satrapa*	S5	-	-	-
SAR	Golden-winged Warbler	*Vermivora chrysoptera*	S3B	SC	THR	THR
-	Gray Catbird[1]	*Dumetella carolinensis*	S5B,S3N	-	-	-
-	Great Crested Flycatcher	*Myiarchus crinitus*	S5B	-	-	-
-	Hairy Woodpecker	*Dryobates villosus*	S5	-	-	-
-	Hermit Thrush	*Catharus guttatus*	S5B,S4N	-	-	-
-	House Wren	*Troglodytes aedon*	S5B	-	-	-
-	Indigo Bunting	*Passerina cyanea*	S5B	-	-	-
-	Least Flycatcher	*Empidonax minimus*	S5B	-	-	-
-	Marsh Wren[1]	*Cistothorus palustris*	S4B,S3N	-	-	-
-	Mourning Dove	*Zenaida macroura*	S5	-	-	-
-	Mourning Warbler	*Geothlypis philadelphia*	S5B	-	-	-
-	Nashville Warbler	*Leiothlypis ruficapilla*	S5B	-	-	-
-	Northern Cardinal	*Cardinalis cardinalis*	S5	-	-	-
BCR 13	Northern Flicker	*Colaptes auratus*	S5	-	-	-
-	Northern Waterthrush	*Parkesia noveboracensis*	S5B	-	-	-
-	Ovenbird	*Seiurus aurocapilla*	S5B	-	-	-
-	Pileated Woodpecker	*Dryocopus pileatus*	S5	-	-	-
-	Purple Finch	*Haemorhous purpureus*	S5	-	-	-
-	Red-breasted Nuthatch	*Sitta canadensis*	S5	-	-	-
-	Red-eyed Vireo	*Vireo olivaceus*	S5B	-	-	-
SAR	Red-headed Woodpecker	*Melanerpes erythrocephalus*	S3	END	END	END
-	Red-winged Blackbird	*Agelaius phoeniceus*	S5	-	-	-
BCR 13	Rose-breasted Grosbeak	*Pheucticus ludovicianus*	S5B	-	-	-
-	Ruby-throated Hummingbird	*Archilochus colubris*	S5B	-	-	-
-	Ruffed Grouse	*Bonasa umbellus*	S5	-	-	-
-	Scarlet Tanager	*Piranga olivacea*	S5B	-	-	-
-	Sedge Wren	*Cistothorus stellaris*	S4B	NAR	NAR	-
-	Song Sparrow	*Melospiza melodia*	S5	-	-	-
-	Swainson's Thrush	*Catharus ustulatus*	S5B	-	-	-
-	Swamp Sparrow	*Melospiza georgiana*	S5B,S4N	-	-	-
-	Tree Swallow	*Tachycineta bicolor*	S4S5B	-	-	-
-	Veery	*Catharus fuscescens*	S5B	-	-	-
-	White-breasted Nuthatch	*Sitta carolinensis*	S5	-	-	-
-	White-throated Sparrow	*Zonotrichia albicollis*	S5	-	-	-
-	Winter Wren	*Troglodytes hiemalis*	S5B,S4N	-	-	-
SAR	Wood Thrush	*Hylocichla mustelina*	S4B	SC	THR	THR
-	Yellow Warbler	*Setophaga petechia*	S5B	-	-	-
-	Yellow-bellied Sapsucker[1]	*Sphyrapicus varius*	S5B,S3N	-	-	-

-	Yellow-billed Cuckoo	*Coccyzus americanus*	S4B	-	-	-
-	Yellow-rumped Warbler	*Setophaga coronata*	S5B,S4N	-	-	-
-	Yellow-throated Vireo	*Vireo flavifrons*	S4B	-	-	-
SHOREBIRDS						
BCR 13	American Woodcock	*Scolopax minor*	S4B	-	-	-
BCR 13	Wilson's Snipe[2]	*Gallinago delicata*	S5B	-	-	-
WATERBIRDS						
BCR 13	American Bittern	*Botaurus lentiginosus*	S5B	-	-	-
Rare	American Coot	*Fulica americana*	S3B,S4N	NAR	NAR	-
Rare	Blue-winged Teal	*Spatula discors*	S3B,S4M	-	-	-
BCR 13, Engage.	Canada Goose	*Branta canadensis*	S5	-	-	-
Rare	Common Gallinule[2]	*Gallinula galeata*	S3B	-	-	-
BCR 13	Common Loon	*Gavia immer*	S5	NAR	NAR	-
BCR 13	Common Merganser	*Mergus merganser*	S5	-	-	-
BCR 13, Engage.	Great Blue Heron	*Ardea herodias*	S4	-	-	-
BCR 13	Green Heron[2]	*Butorides virescens*	S4B	-	-	-
BCR 13	Mallard	*Anas platyrhynchos*	S5	-	-	-
BCR 13	Pied-billed Grebe[1]	*Podilymbus podiceps*	S4B,S2N	-	-	-
BCR 13	Sora	*Porzana carolina*	S5B	-	-	-
BCR 13	Virginia Rail	*Rallus limicola*	S4S5B	-	-	-
BCR 13	Wood Duck[1]	*Aix sponsa*	S5B,S3N	-	-	-
RAPTORS						
BCR 13	American Kestrel	*Falco sparverius*	S4	-	-	-
-	Barred Owl	*Strix varia*	S5	-	-	-
-	Broad-winged Hawk	*Buteo platypterus*	S5B	-	-	-
-	Cooper's Hawk	*Accipiter cooperii*	S4	NAR	NAR	-
-	Eastern Screech-Owl	*Megascops asio*	S4	NAR	NAR	-
-	Great Horned Owl	*Bubo virginianus*	S4	-	-	-
-	Long-eared Owl	*Asio otus*	S4	-	-	-
BCR 13	Northern Harrier	*Circus hudsonius*	S5B,S4N	NAR	NAR	-
BCR 13	Red-shouldered Hawk[1]	*Buteo lineatus*	S4B,S2N	NAR	NAR	-
-	Red-tailed Hawk	*Buteo jamaicensis*	S5	NAR	NAR	-
-	Turkey Vulture[1]	*Cathartes aura*	S5B,S3N	-	-	-

Notes:

Conservation status ranks: END = Endangered, THR = Threatened, SC = Special Concern, NAR = Not at Risk; S2 = Imperiled, S3 = Vulnerable, S4 = Apparently Secure, S5 = Secure, SNA = Not Applicable. B (Breeding), N (Non-breeding), and M (migrant) are breeding status modifiers.

1. Non-breeding populations of these species are ranked as Imperiled (S2N) or Vulnerable (S3N). However, only breeding populations are expected in the SON-South Bruce siting area based on known species ranges. Thus, these species are not considered provincially rare for the purposes of the BIS.
2. Common names for these species have been updated from those listed in the Greenock Swamp ANSI Life Science Inventory report to reflect taxonomic changes and follow the NHIC's Ontario species list.

APPENDIX D – BIRDS DETECTED IN THE BIS STUDY AREAS

The following tables present the bird species (by BV) detected within the applicable BIS study areas. Explanatory notes and common abbreviations are provided below:

- The first column of each table denotes the Species of Interest (SOI) for the purposes of the BIS; specifically, whether the species is Endangered, Threatened, or Special Concern ("SAR"); provincially rare ("Rare"); another priority species as identified in the BCR 13 strategy (EC 2014a) ("BCR 13"); and/or mentioned during engagement ("Engage.").

- The method(s) of detection are presented for each species, including desktop studies of existing biodiversity databases (e.g., GBIF, NHIC), previous preliminary environmental studies conducted in July and October 2020 by Tulloch Environmental at boreholes 1 and 2 within the AOI (Tulloch Environmental 2020, 2021), and 2022 Tier 1 BIS field studies (including incidental observations from all programs and eDNA metabarcoding analysis results). Species detected through eDNA metabarcoding analyses are indicated by an asterisk (*).

- For the purposes of these tables, the indicated study area (i.e., AOI, LSA_{TER}, RSA_{AVI} or $RSA_{AVI-AQU}$) excludes overlap with other study area(s) that may be encompassed within its boundaries. Cells shaded grey and with **bold** font indicate new detections in the study area based on 2022 field studies (i.e., not previously detected in the study area through desk-based research). For species of conservation concern, the study area(s) of field observations and NHIC records are based on overlap with the 1 km grid square, not the actual point or polygon location.

- Additional details about the species' subnational rank (SRANK), provincial (SARO) and federal (COSEWIC and SARA) SAR listings, and other BCR 13 priority (R/S = Regional/Subregional Concern or Stewardship; N/C = National/Continental Concern or Stewardship) are presented in the eight columns on the right.

- Conservation status ranks: END = Endangered, THR = Threatened, SC = Special Concern, NAR = Not at Risk; S1 = Critically Imperiled, S2 = Imperiled, S3 = Vulnerable, S4 = Apparently Secure, S5 = Secure, SNA = Not Applicable, SU = Unrankable. B (Breeding), N (Non-breeding), and M (migrant) are breeding status modifiers.

D.1 Upland Breeding Birds

Table D-1. List of upland breeding bird species recorded within the AOI, LSA_{TER}, and RSA_{AVI}. See definitions and other explanatory notes on page D-1.

SOI?	Common Name	Desk-based	2020 Studies	2022 Field	AOI	LSA_{TER}	RSA_{AVI}	SRANK	SARO	COSEWIC	SARA	R/S Concern	R/S Steward.	N/C Concern	N/C Steward.
-	Alder Flycatcher	Y	-	-	-	-	Y	S5B	-	-	-	-	-	-	-
-	American Crow	Y	Y	Y	Y	Y	Y	S5	-	-	-	-	-	-	-
-	American Goldfinch	Y	-	Y	Y	Y	Y	S5	-	-	-	-	-	-	-
-	American Redstart	Y	-	-	-	-	Y	S5B	-	-	-	-	-	-	-
-	American Robin	Y	-	Y	Y	Y	Y	S5	-	-	-	-	-	-	-
-	American Tree Sparrow	Y	-	-	-	Y	Y	S5	-	-	-	-	-	-	-
BCR 13	Baltimore Oriole	Y	-	-	Y	Y	Y	S4B	-	-	-	Y	-	-	-
SAR	Bank Swallow	Y	-	Y	Y	-	Y	S4B	THR	THR	THR	-	Y	-	-
SAR	Barn Swallow	Y	Y	Y	Y	Y	Y	S4B	SC	SC	THR	Y	-	-	-
-	Bay-breasted Warbler	Y	-	-	-	-	Y	S5B	-	-	-	-	-	-	-
BCR 13	Belted Kingfisher	Y	-	-	Y	Y	Y	S5B,S4N	-	-	-	Y	-	-	-
-	Black-and-white Warbler	Y	-	-	-	Y	Y	S5B	-	-	-	-	-	-	-
BCR 13	Black-billed Cuckoo	Y	-	-	-	-	Y	S4S5B	-	-	-	Y	Y	-	-
-	Blackburnian Warbler	Y	-	-	-	-	Y	S5B	-	-	-	-	-	-	-
-	Black-capped Chickadee	Y	-	Y	Y	Y	Y	S5	-	-	-	-	-	-	-

SOI?	Common Name	Desk-based	2020 Studies	2022 Field	AOI	LSA_{TER}	RSA_{AVI}	SRANK	SARO	COSEWIC	SARA	R/S Concern	R/S Steward.	N/C Concern	N/C Steward.
-	Black-throated Blue Warbler	Y	-	-	-	-	Y	S5B	-	-	-	-	-	-	-
-	Black-throated Green Warbler	Y	-	-	-	-	Y	S5B	-	-	-	-	-	-	-
-	Blue Jay	Y	Y	Y	Y	Y	Y	S5	-	-	-	-	-	-	-
-	Blue-gray Gnatcatcher	Y	-	-	Y	-	Y	S4B	-	-	-	-	-	-	-
-	Blue-headed Vireo	Y	-	Y	-	**Y**	Y	S5B	-	-	-	-	-	-	-
BCR 13	Blue-winged Warbler	Y	-	-	-	-	Y	S4B	-	-	-	Y	-	Y	-
SAR	Bobolink	Y	-	Y	Y	**Y**	Y	S4B	THR	SC	THR	Y	Y	Y	-
-	Bohemian Waxwing	Y	-	-	-	-	Y	S4B,S5N	-	-	-	-	-	-	-
-	Brown Creeper	Y	-	Y*	-	Y	Y	S5	-	-	-	-	-	-	-
BCR 13	Brown Thrasher	Y	-	-	-	Y	Y	S4B	-	-	-	Y	-	-	Y
Engage.	Brown-headed Cowbird	Y	-	-	Y	Y	Y	S5	-	-	-	-	-	-	-
SAR	Canada Warbler	Y	-	-	-	-	Y	S5B	SC	SC	THR	Y	-	Y	-
-	Cape May Warbler	Y	-	-	-	-	Y	S5B	-	-	-	-	-	-	-
-	Cedar Waxwing	Y	Y	Y	Y	Y	Y	S5	-	-	-	-	-	-	-
-	Chestnut-sided Warbler	Y	-	-	-	Y	Y	S5B	-	-	-	-	-	-	-
-	Chipping Sparrow[1]	Y	Y	-	Y	Y	Y	S5B,S3N	-	-	-	-	-	-	-

SOI?	Common Name	Desk-based	2020 Studies	2022 Field	AOI	LSA_{TER}	RSA_{AVI}	SRANK	SARO	COSEWIC	SARA	R/S Concern	R/S Steward.	N/C Concern	N/C Steward.
-	Clay-colored Sparrow	Y	-	-	-	-	Y	S4B	-	-	-	-	-	-	-
-	Cliff Swallow	Y	-	-	Y	-	Y	S4S5B	-	-	-	-	-	-	-
-	Common Grackle	Y	-	-	Y	Y	Y	S5	-	-	-	-	-	-	-
SAR, Engage.	Common Nighthawk	Y	-	-	-	-	Y	S4B	SC	SC	THR	Y	-	Y	-
-	Common Redpoll	Y	-	-	-	-	Y	S5	-	-	-	-	-	-	-
-	Common Yellowthroat[1]	Y	-	-	Y	Y	Y	S5B,S3N	-	-	-	-	-	-	-
-	Dark-eyed Junco	Y	-	-	-	Y	Y	S5	-	-	-	-	-	-	-
-	Downy Woodpecker	Y	Y	Y	Y	Y	Y	S5	-	-	-	-	-	-	-
-	Eastern Bluebird	Y	-	-	-	Y	Y	S5B,S4N	NAR	NAR	-	-	-	-	-
BCR 13	Eastern Kingbird	Y	-	Y	Y	Y	Y	S4B	-	-	-	Y	-	-	-
SAR	Eastern Meadowlark	Y	-	Y	Y	Y	Y	S4B,S3N	THR	THR	THR	Y	-	-	-
-	Eastern Phoebe	Y	Y	-	Y	Y	Y	S5B	-	-	-	-	-	-	-
BCR 13	Eastern Towhee[1]	Y	-	-	Y	Y	Y	S4B,S3N	-	-	-	Y	-	Y	Y
SAR	Eastern Whip-poor-will	Y	-	-	-	-	Y	S4B	THR	SC	THR	Y	-	Y	-
SAR	Eastern Wood-pewee	Y	-	Y	**Y**	Y	Y	S4B	SC	SC	SC	Y	-	-	-
-	European Starling	Y	Y	-	Y	Y	Y	SNA	-	-	-	-	-	-	-

SOI?	Common Name	Desk-based	2020 Studies	2022 Field	AOI	LSA_{TER}	RSA_{AVI}	SRANK	SARO	COSEWIC	SARA	R/S Concern	R/S Steward.	N/C Concern	N/C Steward.
SAR	Evening Grosbeak	Y	-	-	-	-	Y	S4	SC	SC	SC	-	-	-	-
BCR 13	Field Sparrow[1]	Y	-	-	Y	-	Y	S4B,S3N	-	-	-	Y	-	-	-
Rare	Fox Sparrow	Y	-	-	-	-	Y	S5B,S3N	-	-	-	-	-	-	-
-	Golden-crowned Kinglet	Y	-	Y	**Y**	Y	Y	S5	-	-	-	-	-	-	-
SAR	Grasshopper Sparrow	Y	-	-	-	-	Y	S4B	SC	SC	-	Y	-	Y	Y
-	Gray Catbird[1]	Y	-	Y	Y	Y	Y	S5B,S3N	-	-	-	-	-	-	-
-	Great Crested Flycatcher	Y	-	Y	Y	Y	Y	S5B	-	-	-	-	-	-	-
-	Hairy Woodpecker	Y	-	Y	Y	Y	Y	S5	-	-	-	-	-	-	-
-	Hermit Thrush	Y	-	-	-	-	Y	S5B,S4N	-	-	-	-	-	-	-
-	Horned Lark	Y	-	-	Y	Y	Y	S4	-	-	-	-	-	-	-
-	House Finch	Y	-	-	-	Y	-	SNA	-	-	-	-	-	-	-
-	House Sparrow	Y	Y	-	Y	Y	Y	SNA	-	-	-	-	-	-	-
-	House Wren	Y	-	Y	Y	**Y**	Y	S5B	-	-	-	-	-	-	-
-	Indigo Bunting	Y	-	-	Y	Y	Y	S5B	-	-	-	-	-	-	-
-	Least Flycatcher	Y	-	-	-	Y	Y	S5B	-	-	-	-	-	-	-
SAR	Louisiana Waterthrush	Y	-	-	-	Y	-	S2B	THR	THR	THR	Y	-	Y	Y

SOI?	Common Name	Desk-based	2020 Studies	2022 Field	AOI	LSA_{TER}	RSA_{AVI}	SRANK	SARO	COSEWIC	SARA	R/S Concern	R/S Steward.	N/C Concern	N/C Steward.
-	Magnolia Warbler	Y	-	-	-	-	Y	S5B	-	-	-	-	-	-	-
-	Mourning Dove	Y	-	-	Y	Y	Y	S5	-	-	-	-	-	-	-
-	Mourning Warbler	Y	-	Y	**Y**	-	Y	S5B	-	-	-	-	-	-	-
-	Nashville Warbler	Y	-	-	-	-	Y	S5B	-	-	-	-	-	-	-
-	Northern Cardinal	Y	Y	Y	Y	Y	Y	S5	-	-	-	-	-	-	-
BCR 13	Northern Flicker	Y	-	Y	Y	Y	Y	S5	-	-	-	Y	-	-	-
-	Northern Parula	Y	-	-	-	-	Y	S5B	-	-	-	-	-	-	-
BCR 13	Northern Rough-winged Swallow	Y	-	-	Y	-	Y	S4B	-	-	-	Y	-	-	-
-	Northern Shrike	Y	-	-	-	Y	Y	S4B,S5N	-	-	-	-	-	-	-
-	Northern Waterthrush	Y	-	Y	**Y**	Y	Y	S5B	-	-	-	-	-	-	-
-	Ovenbird	Y	-	-	-	Y	Y	S5B	-	-	-	-	-	-	-
-	Palm Warbler	Y	-	-	Y	-	Y	S5B	-	-	-	-	-	-	-
-	Pileated Woodpecker	Y	-	Y	**Y**	Y	Y	S5	-	-	-	-	-	-	-
-	Pine Grosbeak	Y	-	-	-	-	Y	S4B,S5N	-	-	-	-	-	-	-
-	Pine Siskin	Y	-	-	-	Y	Y	S5	-	-	-	-	-	-	-
-	Pine Warbler[1]	Y	-	-	-	-	Y	S5B,S3N	-	-	-	-	-	-	-

SOI?	Common Name	Desk-based	2020 Studies	2022 Field	AOI	LSA_{TER}	RSA_{AVI}	SRANK	SARO	COSEWIC	SARA	R/S Concern	R/S Steward.	N/C Concern	N/C Steward.
-	Purple Finch	Y	-	-	-	Y	Y	S5	-	-	-	-	-	-	-
-	Red-bellied Woodpecker	Y	-	-	-	-	Y	S5	-	-	-	-	-	-	-
-	Red-breasted Nuthatch	Y	-	Y*	Y	-	Y	S5	-	-	-	-	-	-	-
-	Red-eyed Vireo	Y	-	Y	Y	Y	Y	S5B	-	-	-	-	-	-	-
SAR	Red-headed Woodpecker	Y	-	-	-	Y	-	S3	END	END	END	Y	-	Y	-
-	Red-winged Blackbird	Y	Y	-	Y	Y	Y	S5	-	-	-	-	-	-	-
-	Rock Pigeon	Y	-	-	-	Y	Y	SNA	-	-	-	-	-	-	-
BCR 13	Rose-breasted Grosbeak	Y	-	-	Y	Y	Y	S5B	-	-	-	-	Y	-	-
-	Ruby-crowned Kinglet[1]	Y	-	-	-	-	Y	S5B,S3N	-	-	-	-	-	-	-
-	Ruby-throated Hummingbird	Y	-	-	-	-	Y	S5B	-	-	-	-	-	-	-
-	Ruffed Grouse	Y	-	-	-	Y	Y	S5	-	-	-	-	-	-	-
SAR	Rusty Blackbird	Y	-	-	-	-	Y	S4B,S3N	SC	SC	SC	-	-	-	-
BCR 13	Savannah Sparrow[1]	Y	Y	*	Y	Y	Y	S5B,S3N	-	-	-	Y	-	-	-
-	Scarlet Tanager	Y	-	-	-	-	Y	S5B	-	-	-	-	-	-	-
-	Sedge Wren	Y	-	-	-	-	Y	S4B	NAR	NAR	-	-	-	-	-
-	Snow Bunting	Y	-	-	-	Y	Y	S4N	-	-	-	-	-	-	-

SOI?	Common Name	Desk-based	2020 Studies	2022 Field	AOI	LSA_{TER}	RSA_{AVI}	SRANK	SARO	COSEWIC	SARA	R/S Concern	R/S Steward.	N/C Concern	N/C Steward.
-	Song Sparrow	Y	Y	Y	Y	Y	Y	S5	-	-	-	-	-	-	-
-	Swainson's Thrush	Y	-	-	-	-	Y	S5B	-	-	-	-	-	-	-
-	Swamp Sparrow	Y	-	-	-	-	Y	S5B,S4N	-	-	-	-	-	-	-
-	Tree Swallow	Y	Y	-	Y	Y	Y	S4S5B	-	-	-	-	-	-	-
-	Veery	Y	-	-	-	-	Y	S5B	-	-	-	-	-	-	-
BCR 13	Vesper Sparrow	Y	-	-	-	Y	Y	S4B	-	-	-	Y	-	-	-
-	Warbling Vireo	Y	-	-	Y	Y	Y	S5B	-	-	-	-	-	-	-
-	White-breasted Nuthatch	Y	-	Y	Y	Y	Y	S5	-	-	-	-	-	-	-
Rare	White-crowned Sparrow	Y	Y	-	Y	-	Y	S5B,S3N	-	-	-	-	-	-	-
-	White-throated Sparrow	Y	-	Y	**Y**	Y	Y	S5	-	-	-	-	-	-	-
-	Wild Turkey	Y	-	Y	**Y**	Y	Y	S5	-	-	-	-	-	-	-
-	Willow Flycatcher	Y	-	-	-	-	Y	S4B	-	-	-	-	-	-	-
-	Winter Wren	Y	-	Y	**Y**	-	Y	S5B,S4N	-	-	-	-	-	-	-
SAR	Wood Thrush	Y	-	Y*	**Y**	Y	Y	S4B	SC	THR	THR	Y	-	Y	-
-	Yellow Warbler	Y	-	-	Y	Y	Y	S5B	-	-	-	-	-	-	-
-	Yellow-bellied Sapsucker[1]	Y	-	Y	Y	-	Y	S5B,S3N	-	-	-	-	-	-	-

SOI?	Common Name	Desk-based	2020 Studies	2022 Field	AOI	LSA_{TER}	RSA_{AVI}	SRANK	SARO	COSEWIC	SARA	R/S Concern	R/S Steward.	N/C Concern	N/C Steward.
-	Yellow-billed Cuckoo	Y	-	-	-	-	Y	S4B	-	-	-	-	-	-	-
-	Yellow-rumped Warbler	Y	-	-	Y	-	Y	S5B,S4N	-	-	-	-	-	-	-
-	Yellow-throated Vireo	Y	-	-	-	-	Y	S4B	-	-	-	-	-	-	-

Notes:
1. Non-breeding populations of these species are ranked as Vulnerable (S3N). However, only breeding populations (and migration, in the case of ruby-crowned kinglets) are expected in the SON-South Bruce siting area based on known species ranges. Thus, these species are not considered provincially rare for the purposes of the BIS.

D.2 Shorebirds

Table D-2. List of shorebird species recorded within the AOI, LSA_{TER}, and $RSA_{AVI-AQU}$. See definitions and other explanatory notes on page D-1.

SOI?	Common Name	Desk-based	2020 Studies	2022 Field	AOI	LSA_{TER}	$RSA_{AVI-AQU}$	SRANK	SARO	COSEWIC	SARA	R/S Concern	R/S Steward.	N/C Concern	N/C Steward.
BCR 13	American Woodcock	Y	-	-	-	Y	Y	S4B	-	-	-	Y	-	Y	-
-	Dunlin	Y	-	-	Y	-	Y	S4B,S5M	-	-	-	-	-	-	-
-	Greater Yellowlegs	Y	-	-	-	-	Y	S4B,S5M	-	-	-	-	-	-	-
BCR 13	Killdeer	Y	-	Y	Y	Y	Y	S4B	-	-	-	Y	-	Y	-
-	Least Sandpiper	Y	-	-	Y	-	Y	S4B,S5M	-	-	-	-	-	-	-
SAR	Lesser Yellowlegs	Y	-	-	Y	-	Y	S3S4B,S5M	THR	THR	-	-	-	-	-
-	Pectoral Sandpiper[1]	Y	-	-	Y	-	Y	S1B,S4M	-	-	-	-	-	-	-
-	Semipalmated Plover	Y	-	-	Y	-	-	S4B,S5M	-	-	-	-	-	-	-
BCR 13	Semipalmated Sandpiper[1]	Y	-	-	Y	-	Y	S2B,S4M	-	-	-	Y	-	Y	-

SOI?	Common Name	Desk-based	2020 Studies	2022 Field	AOI	LSA_{TER}	$RSA_{AVI-AQU}$	SRANK	SARO	COSEWIC	SARA	R/S Concern	R/S Steward.	N/C Concern	N/C Steward.
-	Solitary Sandpiper	Y	-	-	-	-	Y	S4B,S5M	-	-	-	-	-	-	-
BCR 13	Spotted Sandpiper	Y	-	-	Y	-	Y	S5B	-	-	-	Y	-	Y	-
-	Stilt Sandpiper[1]	Y	-	-	Y	-	-	S3B,S4M	-	-	-	-	-	-	-
Rare	Upland Sandpiper	Y	-	-	Y	-	Y	S2B	-	-	-	Y	-	-	-
BCR 13	Wilson's Snipe	Y	-	-	-	-	Y	S5B	-	-	-	Y	-	-	-

Notes:
1. Breeding populations of these species are ranked as Critically Imperiled (S1B), Imperiled (S2B), or Vulnerable (S3B). However, only migrating populations are expected in the SON-South Bruce siting area based on known species ranges. Thus, these species are not considered provincially rare for the purposes of the BIS.

D.3 Waterbirds

Table D-3. List of waterbird species recorded within the AOI, LSA_{TER}, and $RSA_{AVI-AQU}$. See definitions and other explanatory notes on page D-1.

SOI?	Common Name	Desk-based	2020 Studies	2022 Field	AOI	LSA_{TER}	$RSA_{AVI-AQU}$	SRANK	SARO	COSEWIC	SARA	R/S Concern	R/S Steward.	N/C Concern	N/C Steward.
BCR 13	American Bittern	Y	-	-	-	-	Y	S5B	-	-	-	Y	-	Y	-
BCR 13	American Black Duck	Y	-	-	-	Y	Y	S4	-	-	-	Y	-	Y	-
Rare	American Coot	Y	-	-	-	-	Y	S3B,S4N	NAR	NAR	-	Y	-	-	-
-	American Wigeon	Y	-	-	-	Y	Y	S4B,S4N, S5M	-	-	-	-	-	-	-
SAR	Black Tern	Y	-	-	-	-	Y	S3B,S4M	SC	NAR	-	Y	-	Y	-
Rare	Blue-winged Teal	Y	-	-	-	-	Y	S3B,S4M	-	-	-	Y	-	Y	-
BCR 13	Bonaparte's Gull	Y	-	-	-	-	Y	S5	-	-	-	Y	-	Y	-

SOI?	Common Name	Desk-based	2020 Studies	2022 Field	AOI	LSA_{TER}	$RSA_{AVI-AQU}$	SRANK	SARO	COSEWIC	SARA	R/S Concern	R/S Steward.	N/C Concern	N/C Steward.
-	Bufflehead	Y	-	-	-	-	Y	S5	-	-	-	-	-	-	-
-	Cackling Goose	Y	-	-	-	-	Y	SUB,S4M	-	-	-	-	-	-	-
BCR 13, Engage.	Canada Goose	Y	Y	Y	Y	Y	Y	S5	-	-	-	Y	-	Y	-
Rare	Canvasback	Y	-	-	-	-	Y	S1B,S3N, S4M	-	-	-	Y	-	Y	-
Rare	Caspian Tern	Y	-	-	-	-	Y	S3B,S5M	NAR	NAR	-	Y	-	-	-
Rare	Common Gallinule	Y	-	-	-	-	Y	S3B	-	-	-	Y	-	-	-
BCR 13	Common Goldeneye	Y	-	-	-	Y	Y	S5	-	-	-	Y	-	Y	-
BCR 13	Common Loon	Y	-	-	-	-	Y	S5	NAR	NAR	-	Y	-	Y	-
BCR 13	Common Merganser	Y	-	-	Y	Y	Y	S5	-	-	-	Y	-	-	-
-	Double-crested Cormorant	Y	-	-	Y	-	Y	S5B,S4N	NAR	NAR	-	-	-	-	-
-	Gadwall	Y	-	-	-	-	Y	S4B,S4N, S5M	-	-	-	-	-	-	-
Rare	Great Black-backed Gull	Y	-	-	-	-	Y	S1B,S4N	-	-	-	Y	-	-	-
BCR 13, Engage.	Great Blue Heron	Y	-	Y	Y	**Y**	Y	S4	-	-	-	Y	-	-	-
Rare	Great Egret	Y	-	-	-	-	Y	S2B,S3M	-	-	-	Y	-	-	-
Rare	Greater White-fronted Goose	Y	-	-	-	Y	Y	S3M	-	-	-	-	-	-	-
BCR 13	Green Heron	Y	-	Y	**Y**	-	Y	S4B	-	-	-	Y	-	-	-

SOI?	Common Name	Desk-based	2020 Studies	2022 Field	AOI	LSA_{TER}	$RSA_{AVI-AQU}$	SRANK	SARO	COSEWIC	SARA	R/S Concern	R/S Steward.	N/C Concern	N/C Steward.
BCR 13	Green-winged Teal	Y	-	-	-	Y	Y	S4B,S4N, S5M	-	-	-	Y	-	-	-
-	Herring Gull	Y	-	-	-	Y	Y	S4B,S5N	-	-	-	-	-	-	-
-	Hooded Merganser	Y	-	Y*	Y	-	Y	S5	-	-	-	-	-	-	-
SAR	Horned Grebe[1]	Y	-	-	-	-	Y	S1B,S3N, S4M	SC	SC	-	Y	-	Y	-
SAR	Least Bittern	Y	-	-	-	-	Y	S4B	THR	THR	THR	Y	-	Y	-
BCR 13	Lesser Scaup	Y	-	-	-	-	Y	S4B,S4N, S5M	-	-	-	Y	-	Y	-
BCR 13	Long-tailed Duck[1]	Y	-	-	-	-	Y	S3B,S5N	-	-	-	Y	-	Y	-
BCR 13	Mallard	Y	-	Y*	Y	Y	Y	S5	-	-	-	Y	-	Y	-
BCR 13	Mute Swan	Y	-	-	-	-	Y	SNA	-	-	-	Y	-	-	-
-	Northern Pintail	Y	-	-	-	-	Y	S5B,S4N	-	-	-	-	-	-	-
-	Northern Shoveler	Y	-	-	-	-	Y	S4B,S4N, S5M	-	-	-	-	-	-	-
BCR 13	Pied-billed Grebe[2]	Y	-	-	-	-	Y	S4B,S2N	-	-	-	Y	-	-	-
-	Red-breasted Merganser	Y	-	-	-	-	Y	S5	-	-	-	-	-	-	-
Rare	Red-necked Grebe	Y	-	-	-	-	Y	S3	NAR	NAR	-	Y	-	-	-
-	Ring-billed Gull	Y	-	-	Y	Y	Y	S5	-	-	-	-	-	-	-
BCR 13	Ring-necked Duck	Y	-	-	-	Y	Y	S5B,S4N	-	-	-	Y	-	-	-

SOI?	Common Name	Desk-based	2020 Studies	2022 Field	AOI	LSA$_{TER}$	RSA$_{AVI-AQU}$	SRANK	SARO	COSEWIC	SARA	R/S Concern	R/S Steward.	N/C Concern	N/C Steward.
BCR 13, Engage.	Sandhill Crane[2]	Y	-	Y	Y	-	Y	S5B,S3N	-	-	-	Y	-	-	-
-	Snow Goose	Y	-	-	-	-	Y	S5B	-	-	-	-	-	-	-
BCR 13	Sora	Y	-	-	-	-	Y	S5B	-	-	-	Y	-	Y	-
Rare, Engage.	Tundra Swan	Y	-	-	-	Y	Y	S2B,S4N, S3M	-	-	-	Y	-	-	-
BCR 13	Virginia Rail	Y	-	Y*	-	-	Y	S4S5B	-	-	-	Y	-	Y	-
-	White-winged Scoter	Y	-	-	-	-	Y	S4B,S5N	-	-	-	-	-	-	-
BCR 13	Wood Duck[2]	Y	-	Y*	**Y**	-	Y	S5B,S3N	-	-	-	Y	-	-	-

Notes:

1. Breeding and non-breeding populations of horned grebe are ranked as Critically Imperiled (S1B) and Vulnerable (S3N), respectively, and breeding populations of long-tailed duck are ranked as Vulnerable (S3B). However, only migrating populations are expected in the SON-South Bruce siting area based on known species ranges. Thus, these species are not considered provincially rare for the purposes of the BIS.
2. Non-breeding populations of these species are ranked as Imperiled (S2N) or Vulnerable (S3N). However, only breeding populations are expected in the SON-South Bruce siting area based on known species ranges. Thus, these species are not considered provincially rare for the purposes of the BIS.

D.4 Raptors

Table D-4. List of raptor species recorded within the AOI, LSA$_{TER}$, and RSA$_{AVI}$ or RSA$_{AVI-AQU}$. See definitions and other explanatory notes on page D-1.

SOI?	Common Name	Desk-based	2020 Studies	2022 Field	AOI	LSA$_{TER}$	RSA$_{AVI}$ / RSA$_{AVI-AQU}$	SRANK	SARO	COSEWIC	SARA	R/S Concern	R/S Steward.	N/C Concern	N/C Steward.
BCR 13	American Kestrel	Y	-	-	-	-	Y	S4	-	-	-	Y	-	-	-
SAR, Engage.	Bald Eagle	Y	-	Y	Y	Y	Y	S4	SC	NAR	-	Y	-	-	Y
-	Broad-winged Hawk	Y	-	-	-	-	Y	S5B	-	-	-	-	-	-	-

SOI?	Common Name	Desk-based	2020 Studies	2022 Field	AOI	LSA_{TER}	RSA_{AVI} / $RSA_{AVI-AQU}$	SRANK	SARO	COSEWIC	SARA	R/S Concern	R/S Steward.	N/C Concern	N/C Steward.
-	Common Raven	Y	-	Y	Y	Y	Y	S5	-	-	-	-	-	-	-
-	Cooper's Hawk	Y	-	-	Y	Y	Y	S4	NAR	NAR	-	-	-	-	-
-	Eastern Screech-Owl	Y	-	-	-	Y	Y	S4	NAR	NAR	-	-	-	-	-
SAR	Golden Eagle	Y	-	-	-	-	Y	S1B,S4N	END	NAR	-	-	-	-	-
-	Great Horned Owl	Y	-	-	-	Y	Y	S4	-	-	-	-	-	-	-
-	Merlin	Y	-	-	-	-	Y	S5	NAR	NAR	-	-	-	-	-
-	Northern Goshawk	Y	-	-	-	-	Y	S4	NAR	NAR	-	-	-	-	-
BCR 13	Northern Harrier	Y	-	-	-	-	Y	S5B,S4N	NAR	NAR	-	Y	-	-	-
-	Osprey	Y	-	-	-	-	Y	S5B	-	-	-	-	-	-	-
-	Red-tailed Hawk	Y	-	-	Y	Y	Y	S5	NAR	NAR	-	-	-	-	-
-	Rough-legged Hawk	Y	-	-	Y	Y	Y	S1B,S4N	NAR	NAR	-	-	-	-	-
-	Sharp-shinned Hawk	Y	-	-	-	Y	Y	S5	NAR	NAR	-	-	-	-	-
-	Snowy Owl	Y	-	-	-	-	Y	S4N	NAR	-	-	-	-	-	-
-	Turkey Vulture	Y	-	-	Y	Y	Y	S5B,S3N	-	-	-	-	-	-	-

Report (R001)

BIODIVERSITY IMPACT STUDIES – SOUTHWESTERN ONTARIO REGION: 2023 BASELINE REPORT (CHAPTER 8: FISH AND FISH HABITAT)

December 13, 2023

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GLOSSARY AND ABBREVIATIONS

AHM	Aquatic Habitat Mapping
ALIS	Aquatic Landscape Inventory System; a system for delineating valley segments based on natural features.
ANSI	Area of Natural or Scientific Interest
AOI	Area of Interest
ARA	Aquatic Resource Area
Benthic	For fish, refer to bottom-dwelling fish
Benthopelagic	For fish, refer to species living and feeding near the bottom as well as in midwaters or near the surface
BIS	Biodiversity Impact Studies
BPD	Biodiversity Impact Studies – Southwestern Ontario Region: Baseline Program Design
BPPA	Biodiversity Impact Studies – Southwestern Ontario Region: Best Practices and Preferred Approach
BV	Biodiversity Value; the biotic environmental components that will be considered for study within the Project's Biodiversity Impact Studies. A subset of biodiversity values will ultimately be scoped into the Biodiversity Impact Assessment as Valued Components.
CABIN	Canadian Aquatic Biomonitoring Network
Carnivore	For fish, refer to species that survive based on a meat-based diet, including fish and other invertebrates
Chlorophyll	A green pigment, present in all green plants and cyanobacteria, responsible for the absorption of light to provide energy for photosynthesis.
CNSC	Canadian Nuclear Safety Commission
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
COSSARO	Committee on the Status of Species at Risk in Ontario
Critical habitat	Habitat that is necessary for the survival or recovery of a listed wildlife species and that is identified as the species' critical habitat in the recovery strategy or in an action plan for the species (*Species at Risk Act*, S.C. 2002, c. 29). Identification of critical habitat is not a required component of a recovery strategy under the Ontario *Endangered Species Act*. However, the approach used to identify critical habitat, in conjunction with the best scientific information available, is recommended when developing a habitat regulation. A habitat regulation is a legal instrument under the *ESA* that prescribes an area that will be protected as the habitat of the species.
Detritivore	An organism that eats dead or decaying plants or animals
EDDMapS	Early Detection and Distribution Mapping System
eDNA	Environmental DNA
EMBP	Environmental Media Baseline Program

ESA	Ontario *Endangered Species Act*
GBIF	Global Biodiversity Information Facility
GSWC	Greenock Swamp Wetland Complex
Herbivore	Organisms that are physiologically adapted to eating plant material, including foliage or algae for the main component of their diet.
IA	Impact Assessment
IK	Indigenous Knowledge
Invertivore	An organism that feeds primarily on invertebrates.
Lacustrine	For fish and fish habitat, refer to species that live in lakes for part of all of their life history requirements
LSA	Local Study Area LSA_{AQU} = Aquatic Local Study Area
Macrophyte	A large enough plant to be seen by the naked eye; often refers to aquatic plants.
MNRF	Ontario Ministry of Natural Resources and Forestry (formerly Ontario Ministry of Northern Development, Mines, and Natural Resources and Forestry [NDMNRF])
NHIC	Ontario Natural Heritage Information Centre
NHIC Observation and Elemental Occurrence	NHIC Observations are any record of a species sent to the NHIC and integrated into their dataset. NHIC Element Occurrences are generated from one or more observations following the Element Occurrence Specifications developed by NatureServe network. Occurrences represent areas of importance for the conservation of that species or vegetation community
NWMO	Nuclear Waste Management Organization
OBBN	Ontario Benthos Biomonitoring Network
Pelagic	For fish, refer to species living and feeding in the midwaters or near the surface
Periphyton	Freshwater organisms are composed of a complex mixture of algae, cyanobacteria, heterotrophic microbes, and detritus attached or clinging to plants and other objects projecting above the bottom sediments.
Phytoplankton	Plankton consisting of microscopic plants
Planktivore	For fish, refer to species that feed on planktonic food, including zooplankton and phytoplankton
Plankton	Microscopic organisms drifting or floating in the water column, consisting of diatoms, protozoans, small crustaceans, and the eggs and larval stages of larger animals.
Rights-holders	First Nation and Métis communities who have asserted and or hold recognized treaty and/or Indigenous rights and whose traditional territories include the project location.
RSA	Regional Study Area RSA_{AQU} = Aquatic Regional Study Area

SAR	Species at Risk
SARA	Federal *Species at Risk Act*
SARO	Species at Risk in Ontario
SON	Saugeen Ojibway Nation
SON-South Bruce siting area	Used to describe the broader area surrounding the defined area within which the Project may be located. The SON-South Bruce siting area is the general area surrounding the Municipality of South Bruce and includes the traditional territory of Saugeen Ojibway Nation (SON) in southwestern Ontario.
SOP	Standard Operating Procedure
SRANK	Subnational Rank; The conservation status of a species or vegetation community within a particular province, territory, or state. In Ontario, the NHIC assigns SRANKs using the best available information and considering factors such as abundance, distribution, population trends, and trends (NDMNRF 2021). Species assigned S1 (Critically Imperiled), S2 (Imperiled), S3 (Vulnerable), and SH (Possibly Extirpated) are considered provincially rare by the NHIC. See the NatureServe website for more information:
SWH	Significant Wildlife Habitat. Defined in the Ontario Provincial Policy Statement, 2020 as: *Wildlife habitat* – areas where plants, animals and other organisms live, and find adequate amounts of food, water, shelter and space needed to sustain their populations. Specific wildlife habitats of concern may include areas where species concentrate at a vulnerable point in their annual life cycle; and areas which are important to migratory and non-migratory species. *Significant* – in regard to wildlife habitat, ecologically important in terms of features, functions, representation or amount, and contributing to the quality and diversity of an identifiable geographic area or natural heritage system.
TEM	Terrestrial Ecosystem Mapping
The Project	The Adaptive Phased Management Project is the Deep Geological Repository and other required infrastructure for the safe, long-term management of Canada’s used nuclear fuel.
TISG	Tailored Impact Statement Guidelines for Designated Projects Subject to the *Impact Assessment Act and the Nuclear Safety and Control Act*
VC	Valued Component. For impact assessments of designated projects under the *Impact Assessment Act*, the Agency’s Glossary of Terms defines VCs as “environmental, health, social, economic or additional elements or conditions of the natural and human environment that may be impacted by a proposed project and are of concern or value to the public, Indigenous peoples, federal authorities and interested parties. Valued components may be identified as having scientific, biological, social, health, cultural, traditional, economic, historical, archaeological and aesthetic importance.”
Zooplankton	Plankton consisting of small animals and the immature stages of larger animals

1.0 INTRODUCTION

Fish are defined in the *Fisheries Act* as fish, shellfish, crustaceans, or any parts of these animals (e.g., eggs, sperm, spawn, larvae spat, and juvenile stages). Fish habitat, as defined under the *Fisheries Act,* includes any watercourse, waterbody, or wetland that fish use during their various life history stages (e.g., spawning, rearing, migrating). For the Biodiversity Impact studies (BIS), all biodiversity values (BVs) pertaining to fish and fish habitat as defined under the *Fisheries Act* are discussed in the current Chapter 8.

The Canadian Nuclear Safety Commission's (CNSC) *Guidance on Deep Geological Repository Site Characterization* includes the requirement that fish and fish habitat be characterized as aquatic ecosystem components in the area of interest (CNSC 2018). In addition, the Tailored Impact Statement Guidelines Template (generic version) (TISG Template[1]) includes guidance to characterize effects on fish and fish habitat in potentially affected waterbodies along with the characterization of life history and biotic interaction processes (e.g., food web and trophic levels, nutrient cycling), seasonal variability, ranges, and sensitive periods.

Fish and fish habitat play a vital role in the ecosystem and generate ecosystem services (see Chapter 9) based on ecosystem functions and human demands for fish (Holmlund and Hammer 1999). In addition to being critical components of aquatic and terrestrial food webs, fish are also central to human well-being, culture, and the economy. In the Saugeen Ojibway Nation (SON)-South Bruce siting area, fish and fish habitat are valued by recreational and commercial land users and Indigenous communities for social, recreational, commercial, domestic, and spiritual reasons (Environment Office SON 2021).

Several federal and provincial regulations in Canada restrict activities that could harm fish and their habitat. The *Fisheries Act*, updated in 2019, protects all commercial, recreational, or Aboriginal fisheries, provides clearer permitting requirements for development projects, uses traditional knowledge in habitat decisions, and provides provisions for habitat restoration and rebuilding fish stocks. Federal or provincially listed fish species and their habitat may be afforded even greater protections under the federal *Species at Risk Act* (*SARA*) or the provincial *Endangered Species Act* (*ESA*)[2]. A full list of regulatory requirements pertaining to biodiversity is available in Appendix E of the *Biodiversity Impact Studies – Southwestern Ontario Region: Best Practices and Preferred Approaches* (BPPA) Report (Zoetica 2021).

In addition to regulations to protect fish, the Ontario *Invasive Species Act* (*ISA*) sets out rules to prevent and control the spread of regulated invasive species. The federal Aquatic Invasive Species Regulations (SOR/2015-121) under the *Fisheries Act* includes prohibitions and controls for certain invasive species. Several other species are considered invasive in Ontario but are not regulated (see **Table A-1**).

Stakeholders and rights-holders noted the health of aquatic ecosystems during engagement as important and brought up concerns about pressures on fishing. In addition, stakeholders and rights-holders identified the importance of recognizing the connection between all aspects of ecology and nature. For example, the connection between water quality and the food web structure should be considered during study design and implementation.

[1] Please see Chapter 1 for limitations of and planned updates to the TISG Template.
[2] See Appendix D and Section 3.1 in Zoetica's BPPA Report (Zoetica 2021) for a comprehensive list of SAR, and methods used to compile this list.

For the BIS, fish and fish habitat are classified into two groups based on their ecological role: fish, and primary and secondary producers (including molluscs and crustaceans).

1.1 General Objectives

The general objectives of fish and fish habitat studies for the BIS are to:

1. Determine the presence, distribution, and abundance of important habitats for select BVs with an emphasis on the following:
    a. species of conservation concern, including species at-risk (SAR),
    b. species of interest and potential importance to local stakeholders and rights-holders,
    c. indicator species;
2. Determine the potential presence and distribution of species of interest, including the select BVs listed in (1); and,
3. Provide additional baseline data to help inform the Adaptive Phased Management Project's (hereafter, 'the Project') biodiversity Impact Assessment (IA), mitigation measures, and to assist in the potential development of monitoring program(s) to address environmental, regulatory, and stakeholder/rights-holder concerns.

The current Chapter 8 on Fish and Fish Habitat begins to fulfil the requirements of the TISG Template required for fish and fish habitat (see Appendix C, in the BPPA Report (Zoetica 2021)).

Zoetica™ recommends the consideration of indicator species as species of interest. However, Zoetica also recommends that indicator species be determined after more information is gathered about potential project impacts and species' distributions and habitat associations (e.g., through Tier 2 community composition studies) within the BIS study areas for fish and fish habitat. See Section 4.2 of the BPPA Report (Zoetica 2021) for further discussion of indicator species. Thus, no indicator species are discussed in the current Chapter 8 (Fish and Fish Habitat) of the 2023 BIS Baseline Report. If the SON-South Bruce site is selected and a project description is made available, Zoetica will examine information on potential project impacts to fish and fish habitat, and report on potential indicator fish and primary and secondary producer species in future iterations of the BIS Baseline Report.

1.2 General Methods

Studies conducted in 2021 and 2022 were focused on collecting desk- and field-based Tier 1 data. Field studies commenced in the summer of 2022. This 2023 BIS Baseline Report focusses on information collected to date. Additional Tier 1 studies are anticipated to continue at the SON-South Bruce site in 2024.

This section addresses methods common to each Fish and Fish Habitat BV group. If BIS studies for a specific fish and fish habitat BV group include additional methods, these are listed within the BV-specific sections, beginning with Section 2.0.

1.2.1 Study Areas

The BIS study areas for fish and fish habitat include an Area of Interest (AOI), an aquatic local study area (LSA_{AQU}), and an aquatic regional study area (RSA_{AQU}). See Section 3.0 in Chapter 1 of the 2023 BIS Baseline Report for further detail on study areas. The rationale for developing these study areas can be found in Section 5.2.10.4 of Zoetica's BPPA report (Zoetica 2021).

For the Tier 1 baseline studies, work completed to date has primarily been focused within the AOI and LSA_{AQU}, along with select areas of the RSA_{AQU} to act as potential control sites. Where relevant, Zoetica extended searches of existing data for SAR and important habitat beyond the RSA_{AQU} to potential control sites for lakes and wetlands within the Greenock Swamp Wetland Complex (GSWC), should a need for control sites arise.

1.2.2 Collation of Species Observations and Habitat Data

Zoetica began desk-based investigations of fish by identifying species of interest that could potentially occur within the BIS study areas. See Appendix D and Section 3.1 in Zoetica's BPPA Report (Zoetica 2021) for a comprehensive list of SAR including at-risk fish species, and methods used to compile this list. Additional at-risk species that have been listed since the publication of the BPPA report are discussed in the BV sections of this report (Chapters 2 – 9). Provincially rare species are indicated by their subnational rank (SRANK; S1, S2, S3, SH) and tracked by the Ontario Natural Heritage Information Centre (NHIC)[3].

Zoetica proceeded with desk-based research and mapping by collating existing data from government, citizen science, and other biodiversity databases. For this 2023 BIS Baseline Report, data sources for verified species and habitat records included the NHIC, Ontario Ministry of Natural Resources and Forestry (MNRF), and the Global Biodiversity Information Facility (GBIF). As these datasets periodically pull observations from other biodiversity-related projects and programs (e.g., iNaturalist), they were deemed a good starting point to describe the biodiversity of fish species and their habitats that are found or are likely to be found in the BIS study areas. **Table 1-1** summarizes the datasets, data layers, and reports investigated and analyzed for fish species observations and habitat data for the 2023 BIS Baseline Report. Also see Appendix A, Chapter 1 for data scoring of datasets used.

Table 1-1. Spatial datasets and reports analyzed for fish and fish habitat groups for the 2023 BIS Baseline Report.

Data Source / Owner	Dataset	Data Format	Date Accessed / Received	Contains Relevant Data?
Zoetica / Sumac Geomatics *BIS Tier 1 studies*	Ecosite Classification Dataset	Shapefile	03/2020	Y
Tulloch Environmental *Phase 2 preliminary environmental studies for the Project*	July 2020 Site Reconnaissance (Tulloch Environmental 2020)	Report	10/2020	Y
	October 2020 Natural Heritage Features (Tulloch Environmental 2021)	Report	04/2021	Y
Ontario Natural Heritage Information Centre (NHIC)	Provincially Tracked Species 1km grid	Shapefile	08/2021	Y
	Species Occurrences	Shapefile	12/2020	Y
Ontario Ministry of Natural Resources and Forestry (MNRF)	Aquatic Resource Area (ARA) Polygon Dataset	Geodatabase	09/2021	Y
	Fish ON-Line	Webmap	09/2021	Y
	Fish Activity Area Database (GeoHub)	Shapefile	10/2021	Y

[3] For the purposes of this BIS Baseline Report chapter, conservation statuses described in text for at-risk species refer to their Species at Risk in Ontario (SARO) listings unless otherwise indicated. Conservation statuses for species of conservation concern were pulled from the NHIC's Ontario species list, current to March 1, 2023, then updated for any discrepancies with provincial and federal SAR listings up to August 15, 2023. As such, species and status listings may differ from those presented in Zoetica's 2021 BPPA Report (Zoetica 2021).

Data Source / Owner	Dataset	Data Format	Date Accessed / Received	Contains Relevant Data?
	Provincial SAR Recovery Strategies[1]	Reports	Various	Y
Global Biodiversity Information Facility (GBIF)	Species Occurrences	CSV	10/2021	Y
Ontario Ministry of the Environment (MOE)	Ontario Benthos Biomonitoring Network (OBBN)	Database	10/2022	N[2]
Environment and Climate Change Canada (ECCC)	Canadian Aquatic Biomonitoring Network (CABIN)	Database	09/2022	N[2]
Early Detection & Distribution Mapping System (EDDMapS) Ontario	Invasive Species Observations	Shapefile	01/2022	Y
Fisheries and Oceans Canada (DFO)	Federal Recovery Strategies[1]	Report	Various	Y
Johnson (Johnson 1994)	A Life Science Inventory of the Greenock Swamp Area of Natural and Scientific Interest (ANSI), Par II: Inventory Report	Report	10/2020	Y
Private	Ontario Freshwater Fishes Life History Database	Website information copied into a database	10/2022	Y

Notes:

1. SAR recovery strategies are published by DFO and MNRF, but authors may differ. Refer to Appendix D of Zoetica's BPPA Report (Zoetica 2021) for a full list of potentially occurring SAR that had provincial and/or federal recovery strategies available at the time of writing the BPPA Report (June 2021; note: new documents are continually posted on the SARO website and SARA Public Registry). The most updated versions of the recovery strategies for relevant species were reviewed and cited in this Baseline Report.
2. Zoetica determined dataset relevance based on geographic and temporal relevance, as well as relevance to fish and fish habitat. For example, data that were not within the relevant BIS study areas, data that were too old to be considered relevant, or data that did not include records of fish and primary producer species were labelled "N" for not containing relevant data. The Ontario Benthos Biomonitoring Network (OBBN) and Canadian Aquatic Biomonitoring Network (CABIN) databases were searched for relevant information on benthic invertebrates; however, no data were available within the BIS study areas.

See also Appendix A, Chapter 1 for data quality scoring.

A full list of the fish species mentioned in this report, including common and scientific names, is available in Appendix A. A list of invertebrate species mentioned in this report is available in Appendix B. For the many invertebrate species that do not have common names, scientific names are included in the body of the report.

Additional datasets that may be investigated further are found in Appendix F in the BPPA Report (Zoetica 2021). If additional datasets that are relevant to fish species in the applicable study areas are identified, they will be investigated and incorporated into baseline reports in future years. For example, once updated versions of Species Observation data are received from NHIC, through the Nuclear Waste Management Organization (NWMO), relevant data will be incorporated into baseline data maps in future iterations of the BIS Baseline Report. Future projects that may overlap with the BIS study areas may also provide data or identify data sources that can be integrated into future iterations of baseline reports.

1.2.3 Tier 1 Studies

Tier 1 studies to date focussed on the collation of desk-based data from accessible existing data sources, desk-based aquatic habitat mapping (see Appendix D, Chapter 1), and preliminary field studies conducted in summer of 2022. Field studies focused on collecting Tier 1 foundational habitat data and species detections through environmental DNA (eDNA) metabarcoding studies. Each field team also collected incidental observations of biodiversity including fish and primary and secondary producers. Detailed methods for the Tier 1 studies are available in the *Biodiversity Impact Studies – Southwestern Ontario Region: Baseline Program Design* (BPD) Report and associated Standard Operating Procedures (SOPs) (Zoetica 2022). In addition to the utility of each Tier 1 study outlined below for understanding fish and fish habitat in the BIS study areas, incidental observations collected during the terrestrial and aquatic field studies may also be informative in describing biodiversity.

1.2.3.1 Terrestrial Ecosystem Mapping

Terrestrial Ecosystem Mapping (TEM) completed to date is described in Appendix B, Chapter 1. The ecosite classification dataset resulting from desk-based TEM work was used for delineating various types of wetlands used in planning Aquatic Habitat Mapping (AHM) surveys for collecting fish habitat information.

1.2.3.2 Identification of candidate Significant Wildlife Habitat

Desk- and field-based candidate Significant Wildlife Habitat (SWH) identification work completed to date is described in Appendix C, Chapter 1. No SWH were considered for fish because the *Fisheries Act* (2019) protects all fish and fish habitat in all internal waters of Canada and thus, would cover any SWH for fish. If the *Fisheries Act* were to become less protective, SWH for Special Concern and rare fish species would be considered at that time. SWH types of relevance to primary and secondary producers are outlined in Section 3.3.1.2 of this report.

1.2.3.3 Aquatic Habitat Mapping

AHM completed to date is described in Appendix D, Chapter 1. The 2023 BIS Baseline Report presents desk-based mapping results for the delineation of reaches on watercourses, waterbodies, and wetlands selected for survey in the relevant aquatic study areas and field-collected habitat data of relevance to fish and primary and secondary producers. These data may help identify important habitats for various species of interest.

1.2.3.4 Environmental DNA Metabarcoding Studies

Environmental DNA (eDNA) metabarcoding studies completed to date are described in Appendix E, Chapter 1. The two vertebrate primers used for eDNA studies are primarily intended to capture aquatic and semi-aquatic species such as fish, amphibians, and turtles. Invertebrate primers used for eDNA studies were primarily intended to capture aquatic and semi-aquatic invertebrate species (see Zoetica's BPD Report (Zoetica 2022)). These data are used to identify the potential presence of species of interest and the general distribution of fish and invertebrate communities within the BIS study areas.

1.2.4 Mapping Considerations

For 2023 baseline reporting, mapping was limited to species of interest. Due to the sensitivity of at-risk and rare species and nesting/denning habitat features, spatial data from NHIC are represented by a 1 km grid rather than a point, as per the NHIC's Sensitive Data Location Standards (NHIC, n.d.). Descriptive reporting will also follow sensitivity standards and will not be detailed enough to allow for precise geolocation. GBIF data reported on maps were limited to observations from 1970 onward as older observations were considered historic and not as reliable. See also Appendix A, Chapter 1 for data quality scoring.

For GBIF species observation data, when there were multiple entries with a count of one at the same location, Zoetica assumed the entries were all the same individual to avoid double-counting and erroneously reporting that multiple individuals were present. For simplicity, mapped species observations present the cumulative number of observations and counts and do not represent the number of individuals.

Incidental observations were recorded during various Tier 1 baseline field programs and were noted on different data forms. Incidental observations varied in life history stage of organisms and may have been recorded in transit to a site and thus not associated with habitat data. In addition, expertise in species identification may have varied among field contractors working on different field programs. Thus, not all pertinent information may have been available (e.g., observation type, activity, demographics) or collected in a directly comparable manner (e.g., quantity). Field-based observations of provincially-tracked species (at-risk and/or rare) are represented by a 1 km grid, rather than a point, on maps to align with the NHIC's Sensitive Data Location Standards. Data associated with mapped field observations are included in the appendices to this chapter.

2.0 FISH

2.1 Introduction

Fish are a vital component of biodiversity and are sustained by many aspects of functional aquatic and terrestrial environments. Fish and fish habitat are affected by other BVs (or sub-components) such as surface water quality and quantity, riparian vegetation (providing shading and water runoff filtration), primary and secondary aquatic producers (providing food), wildlife (e.g., beaver as ecosystem engineers), and humans (through fishing and land use and development). Conversely, any potential effects of the Project on fish and their habitats can impact other BVs that depend on them (e.g., fish-eating wildlife and humans). Due to their varied trophic positions in food webs, fish are often used as indicators of environmental impacts through different pathways (e.g., water quality, changes in benthic and plankton communities, sediment contamination, accumulation of toxins in tissues, overexploitation, habitat loss, and temperature changes).

Several species of conservation concern also have the potential to occur in the BIS aquatic study areas (see Appendix D in Zoetica's BPPA Report ((Zoetica 2021)). In addition, several fish species have been identified as prohibited invasive species in Ontario, and several other species are considered invasive in Ontario but are not regulated (see **Table A-1**). During engagement conducted with local stakeholders and rights-holders in the SON-South Bruce siting area, concerns were raised regarding changes in fish populations and the need for aquatic inventories in streams (see Appendix B in Zoetica's BPPA Report (Zoetica 2021)). Concerns voiced during engagement about changes in fish populations were in reference to contamination from agricultural runoff; however, the need for aquatic health studies, as a whole, was also mentioned (see Appendix B in Zoetica's BPPA Report (Zoetica 2021)). To date, no species of interest have been mentioned during engagement. However, whitefish are a species of interest to the SON people (Lowitt et al. 2017, Gobin and Lauzon 2019, 2020), and thus, observations of this species reported in the BIS aquatic study areas are discussed in the current Chapter 8 on fish and fish habitat. Future engagement may focus on species of interest to stakeholders and rights-holders in the SON-South Bruce siting area if species of interest are mentioned during future engagement.

2.1.1 Objectives

Several studies aim to collect baseline data to help inform the Project's biodiversity IA. General objectives for fish and fish habitat are listed in Section 1.1. Specific objectives of fish and fish habitat studies are to:

1. Achieve the general objectives listed in Section 1.1;
2. Assess the quality and quantity of fish habitat in watercourses and waterbodies within the aquatic study areas to meet the requirements of the TISG Template (IAAC 2023) including:
    a. Characterizing fish habitat features that demonstrate the presence of fish species in terms of appropriate habitats (e.g., spawning habitats, nursery habitats, rearing habitats, overwintering and migration routes);
3. Determine fish presence, community structure, and distribution within watercourses, waterbodies, and wetlands within the BIS aquatic study areas to meet the TISG Template requirements (IAAC 2023), including:
    a. Identifying the distribution and life history traits of species of importance (SAR, species of cultural importance and invasive species) within the AOI, LSA_{AQU}, RSA_{AQU}, and in reference areas outside of the RSA, where no suitable reference locations exist within the RSA;

b. Describing the biodiversity within the freshwater environment, including trophic state and interactions and relative significance of species within identified food chains and identification of biodiversity metrics and indicators used to characterize aquatic biodiversity; and
c. Identifying suitable indicator species (if a community approach is not possible).

Zoetica™ recognizes that there are additional requirements for fish and fish habitat to meet TISG requirements. These additional requirements include the description of physical watercourse and waterbody habitat characteristics and mesohabitats (e.g., pool, riffle, run) and the identification of natural obstacles or existing structures that can impede the movement of fish. Work done to date by Zoetica to fulfill these requirements are included in the objectives for Tier 1 AHM studies (Appendix D, Chapter 1). The current Chapter 8 begins to fulfill the TISG requirements for fish and fish habitat outlined in Appendix C of Zoetica's BPPA Report (Zoetica 2021).

2.2 Methods

To meet the general objectives listed in Section 1.1 and fish-specific data objectives outlined in Section 2.1.1, Zoetica considered the best practices outlined in the BPPA report (Zoetica 2021) when designing the surveys for fish studies. Study designs also considered areas and species of importance to local stakeholders and rights-holders, and the statistical and scientific rigour needed for future analyses to inform the biodiversity IA and potential future monitoring programs.

2.2.1 Study Areas

The BIS study areas for fish include the AOI, LSA_{AQU}, and RSA_{AQU} (see Figures and descriptions included in Section 3.0, Chapter 1). The rationale for study area delineation is included in Zoetica's BPPA Report (Zoetica 2021). Several aquatic habitats outside of the RSA_{AQU} were included in desk-based assessments of information (e.g., fish presence) during Tier 1 studies, to act as potential control sites for sites within the GSWC, should the Project impact aquatic habitats within the GSWC.

2.2.2 Presence Distribution and Abundance of Habitat

Collation of both existing and Tier 1 habitat data for fish proceeded as described in Sections 1.2.2 and 1.2.3. Additional habitat studies may be conducted in future years to fill data gaps and to conduct more detailed habitat assessments in key areas, once a site has been selected and more is known regarding infrastructure placement.

2.2.3 Presence and Distribution of Species of Interest

The collation of existing observations and Tier 1 eDNA and incidental observations for fish species of interest proceeded as described in Sections 1.2.2 and 1.2.3.

2.2.4 Additional Baseline Data Collection to Inform the Impact Assessment

2.2.4.1 Fish Community Characterization

As the 2021 and 2022 BIS baseline program focused on Tier 1 habitat studies (see Section 1.2.3), data collection for fish community characterization was limited to the collation of desk-based studies (as per Section 1.2.2), eDNA detection (see Appendix E, Chapter 1), and incidental observations of fish collected during all Tier 1 field studies. The 2023 BIS Baseline Report includes all Tier 1 data collected to date.

Methods for future Tier 2 field studies planned for fish and fish habitat, should the SON-South Bruce siting area be selected, include fish community assessments to determine community composition and demographics of fish populations within the LSA_{AQU} and select areas in the RSA_{AQU}. In addition, more detailed habitat assessments may be conducted in the AOI and LSA_{AQU} once more is understood about the siting of Project infrastructure and the potential for effects. See Zoetica's BPPA report (Zoetica 2021) for more information on best practices for fish community characterization studies.

2.3 Results

2.3.1 Presence, Distribution and Abundance of Important Habitat

2.3.1.1 Critical Habitat

Critical habitat for pugnose shiner exists on the Teeswater River downstream of the LSA_{AQU} at the Cargill Mill Ponds (see Figure 4-13 in Appendix D, Chapter 1). The federal recovery strategy for pugnose shiner describes critical habitat in the Teeswater River as the area extending from the dam in Cargill Mill Pond upstream to the end of the first Aquatic Landscape Inventory System (ALIS) segment, including all contiguous waters and wetlands within the Cargill Mill Ponds (DFO 2012). The section of the Teeswater River containing critical habitat is approximately 1.4 km long with an area of approximately 0.014 km^2 (DFO 2012).

2.3.1.2 Watercourse Habitat

2.3.1.2.1 Spawning

Spawning habitat preferences vary considerably among fish species in Ontario (DFO 2008). For example, trout species may spawn in smaller cold-water streams with high levels of oxygen; northern pike will migrate upstream in spring to spawn in flooded shallow areas that typically dry during summer months; walleye and white suckers prefer to lay eggs in oxygen-rich waters of riffles over cobbles and boulders (DFO 2008).

A search of the Ontario GeoHub Fish Activity dataset revealed one brook trout spawning area on Alps Creek in the southern part of the LSA_{AQU} (see **Figure A-1**). No additional fish spawning areas were documented within the Ontario GeoHub Fish Activity dataset in watercourses within the RSA_{AQU}. No additional potential spawning areas were documented during AHM field surveys; however, several reaches surveyed on the Teeswater River and in tributaries to the Teeswater within the AOI, including Alps Creek south of the AOI, contained riffle habitat (see Figure B-2 in Appendix D, Chapter 1) which can be used by various species of fish for spawning. Additionally, several groundwater seeps and springs were noted during 2022 AHM field surveys, including within the AOI and in Alps Creek in the LSA_{AQU} south of the AOI (see Figure E-1 in Appendix D, Chapter 1). These areas could also be used by various fish species for spawning.

2.3.1.2.2 Rearing

Rearing habitat in watercourses requires healthy shoreline habitat with food availability, and places for fish to hide from predators and wait for food. Watercourse edges that offer suitable riparian and shoreline cover (e.g., coarse woody debris, boulders, in-water vegetation) can provide good quality rearing habitat (DFO 2008). "In-water" habitat such as large grain sediments (e.g., boulders, cobbles), coarse woody debris, and aquatic vegetation can also provide protection from predators (DFO 2008).

During desk-based searches of available datasets (see **Table 1-1**), no rearing habitat was reported in watercourses within the BIS aquatic study areas. However, during 2022 AHM field surveys, field crews recorded riparian and shoreline cover and in-water vegetation in reaches surveyed in the BIS study areas (see Figure B-1 and B-4 in Appendix D, Chapter 1). Riparian habitat varied greatly depending on the study area. Within the AOI, riparian cover types were dominated by initial cover such as meadow and wetland and significant amounts of cropland cover. South of the AOI, predominant riparian cover types were mixed forest, deciduous forest, and meadow. Riparian habitat north of the AOI was dominated by deciduous forest (see Figure B-1 in Appendix D, Chapter 1). Shoreline cover also varied among study areas with less shoreline cover on reaches in the LSA_{AQU} south of the AOI and in the southern portion of the AOI relative to reaches surveyed in the northern portion of the AOI and in the LSA_{AQU} north of the AOI (see Figure B-4 in Appendix D, Chapter 1).

2.3.1.2.3 Overwintering

Deep pools in watercourses, such as those created from beaver dams, can be used by fish species (e.g., minnows) for overwintering (Davis 2016; Brown et al. 2011). A search of existing databases revealed no overwintering habitat within watercourses in the BIS aquatic study areas. During 2022 AHM field surveys, several pools were reported in watercourse reaches in the BIS study areas (see Figure B-2 in Appendix D, Chapter 1). Pool habitat was located primarily in tributaries to the Teeswater River in the AOI and the LSA_{AQU} south of the AOI, and one reach in the LSA_{AQU} north of the AOI on Kinlough Creek (see Figure B-2 in Appendix D, Chapter 1).

2.3.1.2.4 Migratory

Fish require the ability to move from one type of habitat to another, dictated by seasonal changes and life cycle requirements (DFO 2008). For example, many species of fish migrate upstream to spawn. Thus, fish require barrier-free access to spawning areas from overwintering areas. The detection of fish barriers (which prevent fish passage) and obstacles (which make fish passage more difficult) can help elucidate potential migratory limitations to fish. No migratory watercourse habitat for fish has been documented in available desk databases in the BIS aquatic study areas. However, as part of Tier 1 studies, desk- and field-based barrier identification was conducted (see Section 4.3 of Appendix D, Chapter 1). A search of the Ontario GeoHub Fish activity dataset and the OHN Hydrographic point dataset revealed 52 features (e.g., dams, rapids, rocks) that may serve as potential barriers to fish passage within the RSA_{AQU}, two features within the LSA_{AQU}, and none within the AOI. In the LSA_{AQU}, a dam exists on the Teeswater River at the eastern edge of the LSA_{AQU} upstream of the AOI. In addition, a potential barrier (rocks) exists in the south end of the LSA_{AQU} (See Figure F-1 in Appendix D, Chapter 1). Within the RSA_{AQU}, most potential barriers are rock features with the majority occurring on the Saugeen River near its confluence with Lake Huron. Several dams exist on the Teeswater River, both upstream and downstream of the LSA_{AQU}. Several sets of rapids exist on the Teeswater River upstream of the AOI and LSA_{AQU} and on Formosa Creek which flows into the Teeswater River downstream of the AOI. During AHM field surveys, field contractors identified several additional potential barriers and obstacles in the BIS study areas (see Figure F-1 in Appendix D, Chapter 1), including several human-made structures (dams, rock weirs, docks, cement structures, and culverts) as well as several naturally made barriers or obstacles (e.g., log jams, blockages due to overgrowth). Many of the human-made features were culverts found in surveyed reaches on tributaries to the Teeswater River in the AOI. Additionally, in one reach on the Teeswater River in the northern portion of the AOI, a road had been created by raising the creek bed (using cobbles and small boulders) so that vehicles could cross the Teeswater River (see Figure F-1 in Appendix D, Chapter 1).

In addition to potential barriers listed above, a total of 17 beaver dams were reported in the MNRF Beaver Dam dataset, of which eight occur in the LSA_{AQU}. An additional 20 beaver dams or lodges were detected during AHM field surveys. Beaver dams in the AOI were primarily reported on tributaries to the Teeswater River in the northwest portion of the AOI. Beaver dams in the LSA_{AQU} were primarily located on smaller streams south of the AOI and on tributaries to the Teeswater River within the GSWC (see Figure F-1 in Appendix D, Chapter 1). Beaver dams can act as barriers to fish passage if they do not allow enough flow through the structure and may still present as obstacles to fish passage if they have enough flow.

2.3.1.3 Lake and Pond Habitat

2.3.1.3.1 Spawning

Shallow shoreline waters often offer ideal habitat for lacustrine species such as lake trout and lake whitefish (DFO 2008). However, like fish that spawn in watercourses, lake-dwelling species are selective regarding spawning habitat, and ideal spawning habitat is often species-specific. Lake trout typically need rocky shoals for spawning, while lake whitefish use hard or stony bottom sediments (Eakins 2020). Other species, such as perch, prefer shallow lakes and spawn in areas with extensive aquatic vegetation (Eakins 2020). Some lake-dwelling species migrate from lakes to adjoining watercourses to spawn. Desk-based searches of existing datasets (**Table 1-1**) revealed no documented lacustrine spawning areas within the AOI or the LSA_{AQU}. However, a review of fish inventory information in the Greenock Swamp Area of Natural and Scientific Interest (ANSI) revealed that walleye were introduced into the Silver Lake – Otter Lake system in 1964 and limited spawning success has occurred since then (Johnson 1994).

Shoreline data was collected during 2022 AHM field surveys in several lakes within the AOI, LSA_{AQU}, as well as Cargill Mill Pond downstream of the LSA_{AQU}, and Robson and Hines Lakes outside of the RSA_{AQU}. Such shoreline data could reveal spawning habitats for species that spawn in the shallow waters of lakes. Surveys conducted on lakes in 2022 revealed that most lakes, except Silver and Hines Lakes, contain abundant nearshore aquatic vegetation (see Figures C-3 through C-10 in Appendix D, Chapter 1). However, the 2022 AHM studies did not include surveys of deeper zones of lakes for their potential as spawning habitat.

2.3.1.3.2 Rearing

Shallow areas of deep lakes often offer nursery and rearing habitat for fish (DFO 2008). Like watercourses, shorelines with adequate riparian habitat and cover (both shoreline and in-water) provide the best quality rearing habitat as they offer plenty of food and good hiding places for fish to hide from predators and wait for food. To date, no lacustrine-rearing habitat has been identified through desk-based searches of existing datasets listed in **Table 1-1**. During AHM field surveys, most surveyed lakes had abundant shoreline and nearshore in-water cover (see Figures C-3 through C-10 in Appendix D, Chapter 1). These areas may provide rearing habitat for juvenile fish if spawning areas are found nearby.

2.3.1.3.3 Overwintering

Deeper zones of lakes that are well-oxygenated can offer overwintering habitat for lacustrine fish (DFO 2008). To date, no waterbody overwintering habitat has been identified through desk-based searches of existing datasets listed in **Table 1-1**. The 2022 AHM field surveys did not include surveys of deeper zones of lakes. However, bathymetric studies were planned in several lakes in the BIS study areas as part of the Environmental Media Baseline Program (EMBP (CanNorth 2021)). Full limnological studies were also planned as part of the EMBP in several lakes within the BIS study areas and several reference lakes outside of the RSA_{AQU}. Once available, Zoetica will review these data for potential overwintering fish habitat.

2.3.1.4 Wetland Habitat

Wetland environments are mid-way between aquatic and land-based ecosystems, as they are sometimes dry and sometimes wet. Wetlands offer unique habitat for fish, are biologically productive areas, and have high amounts of cover that may offer good foraging opportunities for fish and protection from predators. Many fish species may use wetlands for some or all of their life history phases.

2.3.1.4.1 Spawning

Wetlands may offer areas for northern pike to spawn. Northern pike often lay eggs attached to standing vegetation in wetland areas (DFO 2008). This vegetation protect eggs from sinking to the bottom, where they can be buried by muck or predated upon by other species (DFO 2008). To date, no spawning habitat has been identified through desk-based searches of existing datasets (**Table 1-1**) or during AHM surveys (see Appendix D, Chapter 1) in wetlands within the BIS aquatic study areas. Many of the wetlands surveyed during the 2022 AHM field surveys were dry at the time of survey (in July and August; see Figure A-3 in Appendix D, Chapter 1). However, field crews recorded shoreline and in-water habitat during AHM surveys in wetlands in the AOI and LSA_{AQU} that contained water. Additional Tier 1 studies are anticipated in 2024 to fill data gaps, including spring AHM field surveys of wetlands to account for habitat characteristics during the relevant period for spring spawning fish. Additional Tier 1 eDNA metabarcoding studies are also anticipated in spring of 2024 to detect the presence of fish and other biota that may use seasonally wetted wetlands for various life history requirements. Data collected from future AHM field studies and eDNA studies (see Appendix E, Chapter 1) in wetlands may help to determine the potential for spring-spawning fish, such as northern pike, to use wetlands for spawning. These data will be incorporated in future iterations of the BIS Baseline Report.

2.3.1.4.2 Rearing

Several species of fish, such as bass, bluegills, and black crappies, may periodically swim into wetlands for cover or to feed on forage fish within wetlands (DFO 2008). Wetlands are biologically productive areas that host diverse species, including insects and foraging fish.

To date, no rearing habitat has been identified through desk-based searches of existing datasets (**Table 1-1**) or during AHM surveys (see Appendix D, Chapter 1) in wetlands within the BIS aquatic study areas. However, during AHM surveys, field crews recorded shoreline and in-water habitat at surveyed wetlands that contained water in the AOI and LSA_{AQU}. In addition, field crews conducted eDNA studies in the summer and fall of 2022 to determine the potential for these waterbodies to support habitat for various species, including rearing habitat for fish. Results of eDNA are summarized in Appendix E, Chapter 1 and in Section 2.3.3.1. At the time of writing this 2023 BIS Baseline Report (September 2023), more data are required to interpret patterns in habitat use.

2.3.1.4.3 Overwintering

Wetlands that do not freeze to the bottom during winter months may provide overwintering habitat, especially for smaller fish species such as minnows and other bait fish (Henning 2004). To date, no overwintering habitat has been identified through desk-based searches of existing datasets (**Table 1-1**) or during AHM field surveys (see Appendix D, Chapter 1) in wetlands within the BIS aquatic study areas.

2.3.2 Presence and Distribution of Species of Interest

2.3.2.1 Species of Conservation Concern

Based on searched desk-based datasets (see Section 1.2.2) a total of five fish species of conservation concern have been recorded in the BIS aquatic study areas, four of which are SAR and one (greater redhorse) that is considered provincially rare (**Table 2-1**). One species of conservation concern reported in desk-based sources, pugnose shiner, was also detected during Tier 1 fieldwork in 2022. There were no observations of fish of conservation concern within the AOI. One location within the NHIC 1 km grid squares partially overlapped the LSA_{AQU}. Within the RSA_{AQU}, most observations of species of conservation concern were located at the mouth of the Saugeen River at its confluence with Lake Huron, with only two species of conservation concern reported south of the confluence of the Teeswater with the Saugeen (**Figure A-1**).

Table 2-1. Fish species of conservation concern with NHIC and GBIF observation records within the BIS study areas.

Common Name	Scientific Name	SARO	SRANK	*SARA*	COSEWIC	Provincial Recovery Strategy & Govt Response	Federal Recovery Strategy & Critical Habitat
Black Redhorse	*Moxostoma duquesnei*	THR	S2	THR	THR	-	-
Greater Redhorse	*Mosoxtoma valenciennesi*	-	S3	-	-	-	-
Pugnose Shiner	*Notropis anogenus*	THR	S2	THR	THR	RS, GR	RS, CH
Lake Sturgeon	*Acipenseridae fulvescens*	THR	S2		THR	RS	-
Northern Brook Lamprey	*Ichthyomyzon fossor*	SC	S3	SC	SC	-	-

Notes:
1. The official list of Species at Risk in Ontario (SARO) is provided in *Ontario Regulation 230/08* under the Ontario *Endangered Species Act, 2007*. SRANK is the Subnational Conservation Rank (where S1, S2, S3, SH are considered rare species by NHIC).
2. Conservation status ranks: THR = Threatened, SC = Special Concern; S2 = Imperiled, S3 = Vulnerable. Conservation statuses are current as of March 11, 2021, when public data were downloaded from the NHIC and the federal species at risk public registry.
3. RS = a provincial and/or federal recovery strategy is available for the species. GR = Ontario government response statement that outlines the actions the government intends to take or support to help recover the species. CH = critical habitat has been identified for the species within the applicable biodiversity value-specific study area.

The greater redhorse is the only species of interest that has NHIC 1 km grid squares that partially overlap the LSA_{AQU}. NHIC occurrences of greater redhorse were recorded northeast of the AOI, within the 1 km^2 grids on **Figure A-1**. In addition, two GBIF[4] records of greater redhorse were located on the Teeswater River north of the LSA_{AQU}. Greater redhorse is not a SAR but has a subnational conservation rank (SRANK) of S3 indicating that it is provincially rare and at moderate risk of extirpation in Ontario.

NHIC occurrences of pugnose shiner, a SAR designated as Threatened under the Ontario *ESA* and federal *SARA*, also occur within the Teeswater Quaternary Watershed north of the LSA_{AQU} (**Figure A-1**). In Ontario, pugnose shiner has a provincial recovery strategy (OMNR 2013) and government response statement available (MECP 2014). The government response statement also noted pugnose shiner to occur in the

[4] Note: where a species has only been detected using desk-based data, caution should be taken as those data could be as old as 1970, and the conditions supporting the species' presence in the area may have changed.

Teeswater River at the Cargill Mill Ponds. The pugnose shiner also has a federal recovery strategy (DFO 2012) and critical habitat defined within the recovery strategy that overlaps with the LSA_{AQU} (see Section 2.3.1.1). A NatureServe conservation rank of S2 indicates that the pugnose shiner is at high risk of extirpation in Ontario (NatureServe n.d.). Pugnose shiner was also detected during Tier 1 eDNA metabarcoding studies in the fall at Clam Lake, a waterbody in the LSA_{AQU} north of the AOI. eDNA collections in summer and fall at Cargill Mill Pond did not detect pugnose shiner, though it is known Critical Habitat for the species. There are several potential reasons for the lack of detection of pugnose shiner by eDNA metabarcoding studies in Cargill Mill Pond (discussed in detail in Section 5.1 of Appendix E, Chapter 1) and future investigation is warranted for the detections of pugnose shiner in Clam Lake versus the lack of detection in Cargill Mill Pond.

Additional SAR detected in the RSA_{AQU} include northern brook lamprey, black redhorse, and lake sturgeon. GBIF records of northern brook lamprey were reported near the confluence of the Saugeen River with the Teeswater River (**Figure A-1**; **Table A-2**). GBIF records of black redhorse were located at the mouth of the Saugeen River (**Figure A-1**; **Table A-2**). NHIC 1 km grid squares for lake sturgeon were also located near the mouth of the Saugeen River (**Figure A-1**).

In addition, Zoetica's previous investigations of NHIC observation (not occurrence) data for Zoetica's BPPA Report found three additional SAR recorded in the RSA_{AQU}: the northern sunfish (*Lepomis peltastes*) provincially and federally listed as Special Concern, silver shiner (*Notropis photogenis*) provincially and federally listed as Threatened, and American eel (*Anguilla rostrata*) provincially listed as Endangered and federally as Threatened (see Appendix D of Zoetica's BPPA Report (Zoetica 2021)). Since writing the BPPA, Zoetica has received an updated version of the NHIC verified occurrence data but has not yet received the requested updated NHIC observation data. Once received by Zoetica, these data will be included in future iterations of the BIS Baseline Report along with relevant data collected during field programs.

2.3.2.2 Species of Interest to Stakeholders and Rights-Holders and Species of Potential Socio-economic Importance

To date, no fish species were mentioned during biodiversity-focused engagement conducted for the Project. However, lake whitefish are important to communities in the SON-South Bruce siting area as they are noted to be a species of socio-ecological importance playing a vital role in the ecosystems of Lake Huron and in cultural and economic contexts for the SON who have harvested them since time immemorial (Lowitt et al. 2017, Gobin and Lauzon 2019, 2020). Lake whitefish are currently a commercially fished species providing sustenance to the SON community, and commercial value to the local economy. The SON, in collaboration with Parks Canada and MNRF, currently run a fisheries assessment program focused on integrating Indigenous Knowledge (IK) and western science-based approaches for understanding and addressing concerns about fish, specifically lake whitefish, in the waters of the SON traditional territory (Environment Office SON 2021). Based on searches of the MNRF Aquatic Resource Area (ARA) dataset and the GBIF dataset, lake whitefish were only recorded in Lake Huron and were not detected within other areas of the RSA_{AQU}.

2.3.2.3 Invasive Species

In the Early Detection and Distribution Mapping System (EDDMapS) Ontario and GBIF invasive species occurrences datasets, four invasive fish species (regulated or non-regulated) have been detected within the RSA_{AQU}: rainbow smelt, threespine stickleback, round goby, and white perch. All records of invasive fish species occurred at or near the mouth of the Saugeen River (**Figure A-1**; **Table A-2**). Round goby is a regulated species listed on the federal Aquatic Invasive Species Regulation under the *Fisheries Act* as subject to prohibitions and controls, and people are prohibited from possession of this species. Round goby is also listed by the Invasive Species Centre in Ontario. Rainbow smelt and round goby are listed on the Ontario Invasive Species Awareness Program aimed at addressing threats posed by invasive species in Ontario. Threespine stickleback and white perch are additional species that are tracked by EDDMapS Ontario as they are exotic to the province and may be considered invasive but have not been indicated by other sources/organizations that track invasive species of particular concern.

2.3.3 Additional Baseline Data Collection to Inform the IA

2.3.3.1 *Fish Community Characterization*

In the MNRF ARA dataset, 83 fish species were reported in watercourses and waterbodies within the RSA_{AQU} and potential reference areas. Seven fish species not included in the ARA dataset were reported in GBIF and NHIC records within the RSA_{AQU} (**Figure A-2**; **Table A-3**). Seventeen fish species were detected in the AOI, 43 in the LSA_{AQU}, and 72 in the RSA_{AQU}. Fifty-one species were reported in Lake Huron, some of which were also detected in the RSA_{AQU} and LSA_{AQU} (**Table A-3**). A review of fish inventory data within the Greenock Swamp ANSI revealed 20 species present within the GSWC (**Table A-3**), including one additional species (ninespine stickleback) in the LSA_{AQU} that was not recorded in ARA, GBIF, or NHIC records within the same area. Zoetica explored the Fish ON-Line webmap (MNRF 2020) for detections of species in addition to those reported in the GBIF, NHIC and ARA datasets, but found none. The highest species richness occurred within Lake Huron (51 species) followed by the Saugeen River (43 species), Willow Creek (33 species), Beatty Saugeen (29 species), Mill Creek (28 species), and South Saugeen (27 species) (**Figure A-2**; **Table A-3**; **Table A-4**). Several species recorded in the GBIF and NHIC datasets at the mouth of the Saugeen River likely also occur in Lake Huron, including round goby, threespine stickleback, black redhorse, and lake sturgeon. In general, richness decreases the further upstream a watercourse or waterbody is from the Saugeen River and Lake Huron.

Forty unique species were reported in the Teeswater River, which is the main system running through the LSA_{AQU} and AOI. Within various sections of the Teeswater River, the number of species ranged between 12 and 21 species. Upstream of the LSA_{AQU} and AOI, 21 species were recorded in the Teeswater River (section 1 in **Table A-4** and on **Figure A-2**). Seventeen species were recorded in the Teeswater River directly downstream of the AOI (section 2 in **Table A-4** and on **Figure A-2**). These sections (1 and 2) of the Teeswater River are classified as having cold-water regimes. Seven species were reported in the Teeswater River downstream of the AOI that were not reported upstream of the AOI (see **Table A-4**). As the Teeswater enters the GSWC, it changes from a coldwater regime to a coolwater regime. In the coolwater section of the Teeswater River within the GSWC (section 3 in **Table A-4** and on **Figure A-2**), 15 species were reported, all of which also occurred upstream of this section of the river. As the Teeswater exits the LSA_{AQU}, a total of 25 species were reported in the coolwater sections of the river (sections 4 and 5 in **Table A-4** and on **Figure A-2**) including six species that were not reported upstream. The Teeswater River changes from a coolwater regime to a warmwater regime downstream of the Cargill Mill Ponds. In the warmwater sections of the Teeswater River (sections 6 and 7 in **Table A-4** and on **Figure A-2**) 23 species were reported, including three that were not reported upstream. Potential reference watercourses for the Teeswater include the Beatty Saugeen and North Saugeen (2 sections). Of the potential reference watercourses, the Beatty Saugeen was most similar in temperature regime and species assemblage to sections 1 and 2 of the Teeswater River, upstream and downstream of the AOI, respectively (**Table A-4**).

Within the LSA_{AQU}, several lakes, including Silver and Clam Lakes, are known to be fishing lakes. **Table A-5** presents the species reported in the larger lakes contained within the LSA_{AQU} along with potential reference lakes including Robson, Hines, Arran, and Clarke's Lakes. Twelve species were reported in Silver Lake and 15 species were reported in Clam Lake (**Figure A-2**; **Table A-5**). Several species including brook stickleback, fathead minnow, finescale dace, and shorthead redhorse were only detected in Clam Lake relative to the other lakes, and walleye was only detected in Silver Lake (**Table A-5**). Other lakes within the LSA_{AQU} contained between two and nine reported species (see **Table A-5**). Of the potential reference lakes, Arran Lake had the most species (21) and included many species not reported in lakes in the LSA_{AQU} (see **Table A-5**). Hines and Robson Lakes both hosted similar species and had a total of 14 species each. These lakes were also most similar in species to Clam and Silver Lakes. Clarke's Lake was similar in species to those reported in Silver and Clam Lakes, with a total of 10 species (see **Table A-5**).

The most reported species in watercourses and waterbodies in the RSA_{AQU} and potential reference areas were common shiner and creek chub, followed by white sucker (**Figure 2-1**). Other commonly reported species (recorded in greater than 50 locations) included brook trout, central mudminnow, blacknose dace, brook stickleback, rock bass, mottled sculpin, and northern redbelly dace. All species reported in the LSA_{AQU} (**Table A-3**) were also reported in watercourses and waterbodies in the RSA_{AQU} and/or in potential reference areas except for greenside darter, which was reported in the Teeswater River (section 2; **Figure A-2**; **Table A-4**). In addition, walleye was reported in Silver Lake but not in any other lakes within the LSA_{AQU} or RSA_{AQU} (**Figure A-2**; **Table A-5**). However, walleye was reported in Hamilton Creek (**Figure A-2**) near Robson Lake (a potential reference lake). While no detections of walleye were reported in Robson Lake, this lake flows into Hamilton Creek, and thus, walleye may also be present in Robson Lake. The RSA_{AQU} also captures a small portion of Lake Huron surrounding the mouth of the Saugeen River (data reported separately from RSA_{AQU}). Fifteen species were found to be unique to Lake Huron (**Table A-3**). However, these species aren't necessarily found within the 500 m radius at the confluence of the Saugeen River, which defines the extent of the RSA_{AQU} within Lake Huron.

During Tier 1 field surveys conducted in the BIS study areas and potential reference areas, several species of fish were detected through eDNA metabarcoding studies in select reaches of watercourses, waterbodies, and wetlands (Appendix E, Chapter 1) or incidentally during other Tier 1 studies (**Table A-7**; studies described in Chapter 1). Thirty-one fish species and the genus *Esox*, which includes the species northern pike, were detected across the AOI and LSA_{AQU} during eDNA metabarcoding studies (see Table 4-9 in Appendix E, Chapter 1). Two species, brook silverside and longear sunfish, have not previously been reported in the BIS study areas or potential reference areas. eDNA metabarcoding studies detected brook silverside in the fall in Silver Lake as well as in the outlet of Silver Lake. Longear sunfish were detected in Clam, Hines, and Robson Lakes, the outlet of Robson Lake, Cargill Mill Pond on the Teeswater River, both the inlet and outlet of Cargill Mill Pond, the Teeswater River upstream of the AOI, and in sections of the Teeswater River within the AOI. In addition, eDNA studies detected banded killifish in Hines Lake. Banded killifish were only previously reported in Lake Huron. Only white sucker and blacknose shiner had barcode gaps on at least one of the primers used in the eDNA study indicating further work to confirm the presence of species in the AOI and LSA_{AQU} may be required in future Tiers of study. During other Tier 1 studies conducted as part of the BIS in 2022, one species (brook trout) and at least 11 species reported to the genus level were recorded during field studies (**Table A-7** in Appendix A). In most cases field crews were unable to identify fish to the species level as Tier 1 studies did not include targeted fish studies. Targeted fish community characterization studies are planned as part of Tier 2 studies, once a site has been selected.

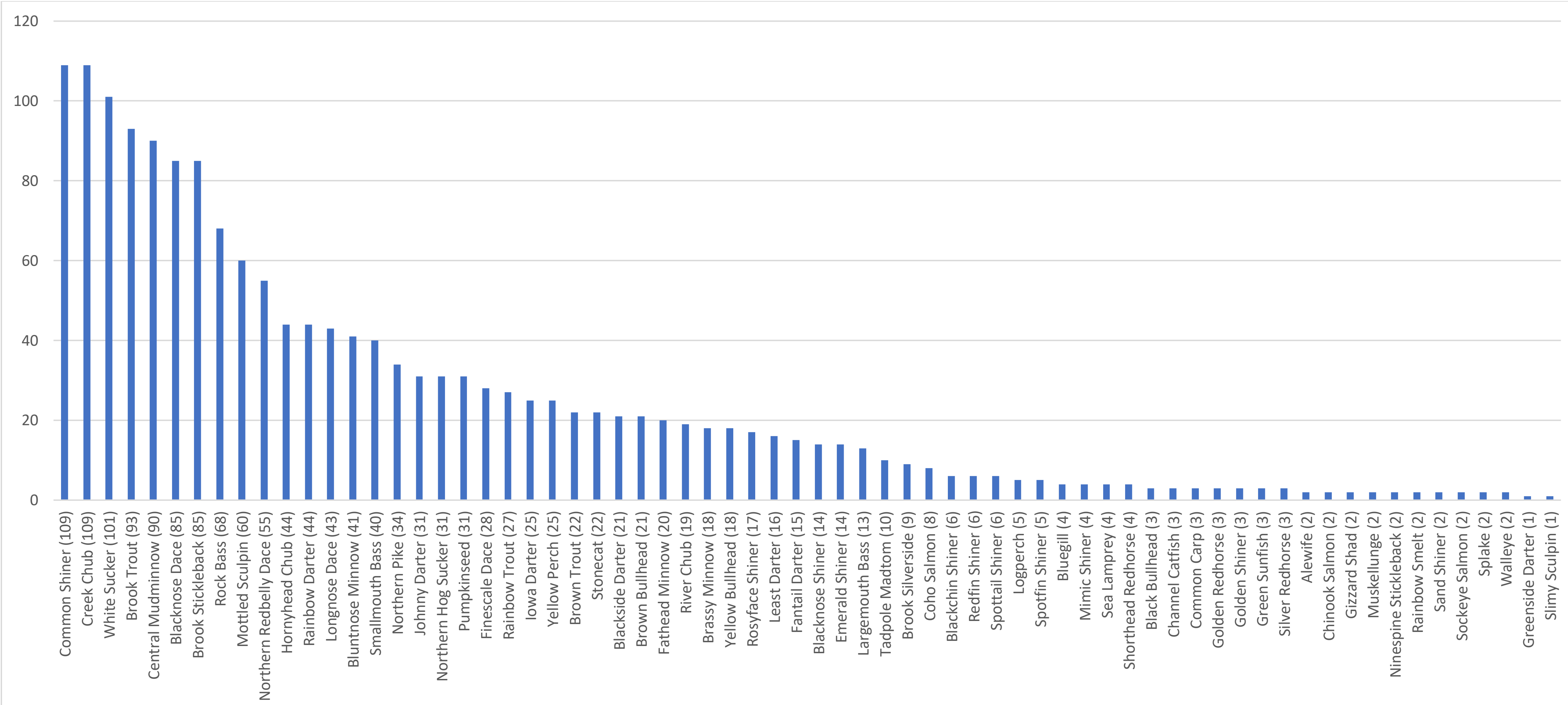

Figure 2-1. Frequency of fish species reported in watercourses and waterbodies in the RSA_{AQU} and potential reference areas. Note: Frequency graph does not include observations in Lake Huron, but includes occurrences in potential reference areas.

2.4 Discussion

To meet the requirements of the TISG Template and the objectives outlined in Section 2.1.1, the 2023 BIS Baseline Report presents initial results of important fish habitats, detections of species of interest, and information on fish community characterization. Results presented to date are based on desk-based searches of available data and initial Tier 1 field studies (AHM, eDNA, and incidental observations collected during TEM) that were initiated in the summer of 2022. Additional Tier 1 studies are anticipated to continue in 2024, and data collected will be incorporated into future iterations of the BIS Baseline Report. Zoetica's proposed Tier 2 studies, planned to commence after site selection, include additional community-level surveys to detect many fish species in watercourses, waterbodies, and wetlands in the study areas and to verify habitat and desk-based reported data collected in Tier 1 studies. Future data collection will also enable a retrospective analysis of newly identified species of interest, if needed.

2.4.1 Presence, Distribution and Abundance of Habitat in the BIS Aquatic Study Areas

The watercourses and waterbodies in the RSA_{AQU} support a wide variety of large- and small- bodied fish species occupying various trophic positions and requiring differing habitats to support their life history requirements (see **Table A-7**). To date, initial Tier 1 studies have successfully identified potentially important fish habitat through desk-based searches of existing information. Two important fish habitats were highlighted in desk-based sources, including critical habitat for pugnose shiner located in the RSA_{AQU} on the Teeswater River downstream of the AOI and LSA_{AQU}, and a brook trout spawning area located in the southern portion of the LSA_{AQU} south of the AOI. No seasonally important fish habitat has been detected to date in the AOI based on searched desk-based sources.

Tier 1 AHM field studies commenced in the summer of 2022 within the AOI, LSA_{AQU}, and select areas of the RSA_{AQU}. These studies included the characterization of aquatic habitats and the identification of potentially important fish habitat such as spawning, rearing, overwintering, and migratory habitat. No additional spawning, rearing, overwintering, or migratory habitat was reported during initial Tier 1 field studies; however, several habitats (e.g., ripple, pool, groundwater seeps and springs) were detected and may provide possible spawning and rearing areas. Additional Tier 1 studies anticipated to be conducted in 2024 may reveal additional potentially important habitat. Further discussion on fish habitat and habitat for other aquatic biota from initial Tier 1 AHM studies is presented in Appendix D, Chapter 1. Should the SON-South Bruce site be selected, future Tier 2 studies will aim to characterize fish communities in the LSA_{AQU} to confirm potentially important habitat for fish in these areas.

2.4.2 Presence and Distribution of Species of Interest in the BIS Aquatic Study Areas

Five species of conservation concern have been detected within the BIS aquatic study areas based on searches of desk-based data. None of the fish species of conservation concern from existing desk-based sources had been reported within the AOI. All fish species of conservation concern that have been detected using desk- and field- based studies conducted to date have been detected in the RSA_{AQU}, with one (and potentially two) exceptions – the potential pugnose shiner that was detected using eDNA and metabarcoding techniques in Clam Lake and the greater redhorse, which had NHIC 1 km^2 grids that partially overlaid the LSA_{AQU}. However, the 1 km^2 grid squares and Clam Lake occurred in areas that were upstream of the Teeswater River, and it is unlikely that the Project would interact with fish detected in these locations unless these species also occurred in the Teeswater River downstream of the AOI. Of greatest relevance to the Project were detections of species of conservation concern downstream of the LSA_{AQU} on the Teeswater River. Pugnose shiner and greater redhorse were both reported on sections of the Teeswater River downstream of 20where the river exits the GSWC. However, it is unlikely that fish outside of the LSA_{AQU} will be impacted by the Project unless they also use areas within the LSA_{AQU}. Northern brook lamprey was reported in the main segment of the Saugeen River near the confluence with the Teeswater, and black redhorse and lake sturgeon were reported near the mouth of the Saugeen River (at the confluence with Lake Huron). However, these species of conservation concern are unlikely to be impacted by the Project as these records are beyond 50 km of the Project location the species have not been detected within the Teeswater River, and effects of the Project are not anticipated to extend beyond the LSA_{AQU}. Similarly, American eel, silver shiner, and northern sunfish were previously recorded in the RSA_{AQU} in an older version of the NHIC observation data but are not anticipated to interact with the Project for the same reasons.

Tier 1 eDNA metabarcoding field studies initiated in the summer of 2022 within aquatic habitats in the LSA_{AQU} detected pugnose shiner in Clam Lake. However, eDNA metabarcoding conducted in Cargill Mill Pond, where critical habitat for pugnose shiner is known to occur, did not detect the species. Additional studies are required to confirm results of eDNA metabarcoding studies (see Appendix E, Chapter 1 for further details). Alternatively, if the detections of pugnose shiner in Clam Lake are confirmed, additional Tier 1 eDNA metabarcoding studies could assess additional distribution of the species within the BIS study areas. Additional spring eDNA metabarcoding studies are planned as part of future Tier 1 studies in the SON-South Bruce BIS study areas. These data will be incorporated in future iterations of the BIS Baseline Report once collected by the field data collection contractor and received by Zoetica. Tier 1 eDNA metabarcoding data along with desk-based data can then be used to help design fish characterization studies that can confirm the presence of fish species of conservation concern.

2.4.3 Fish Community Characterization in the BIS Aquatic Study Areas

To date, 90 fish species have been detected in the BIS aquatic study areas through desk-based searches of existing datasets. A greater species richness occurred in the Saugeen River and Lake Huron and richness generally decreased moving upstream into the Teeswater River and into the LSA_{AQU} and AOI. Within the AOI, a total of 17 fish species have been reported. Only one location within the AOI had reported data in the ARA database and this was the section of the Teeswater River (section 2) that intersects the AOI. This section contained 17 species, two of which, common carp and greenside darter, were not reported in other sections of the Teeswater River but were reported within the RSA_{AQU}.

During eDNA metabarcoding studies that commenced in the summer of 2022, two additional species, brook silverside and longear sunfish, were detected within the LSA_{AQU}. Additionally, several species (e.g., pugnose shiner and banded killifish) were detected in waterbodies where they were not previously reported in the MNRF ARA database. However, additional studies to confirm eDNA metabarcoding results may be required and are planned for spring 2024. Once these data are collected by the field data collection contractor and received by Zoetica, relevant data will be analyzed to determine presence of any additional potentially occurring species and these data will be integrated into Chapter 8 in future iterations of the BIS Baseline Report. In addition, these Tier 1 studies will direct future Tier 2 studies that will be required to confirm the presence of fish species in representative watercourses, waterbodies, and wetlands in the AOI and LSA_{AQU}. The results of Tier 2 studies along with Tier 1 desk-based and eDNA metabarcoding studies will help to characterize the fish communities within these study areas. Results will be reported in future iterations of the BIS Baseline Report.

2.4.4 Next Steps

The Project is still in early stages of baseline data collection and more information will be required in the future, should the SON-South Bruce site be selected. To date, field data collection has focussed on aquatic habitat information from watercourse, waterbody, and wetland habitat types (see Appendix D, Chapter 1) and the detection of aquatic biota through eDNA metabarcoding studies during the summer and fall (see Appendix E, Chapter 1). Due to logistics, the late start to the field season in 2022 meant that spring reconnaissance surveys to determine the extent of flooding of wetlands and spring eDNA metabarcoding could not be conducted. Zoetica and the NWMO recognize the importance of seasonally-used areas and plan to continue Tier 1 field data collection (anticipated in 2024) to fill data gaps. Many of the wetlands and first order streams surveyed within the AOI and LSA_{AQU} were dry during the summer season and may be seasonally wetted and used by various aquatic biota, including fish, during the spring. Additional Tier 1 studies will focus on spring wetland surveys to determine the extent of seasonal flooding and to characterize spring seasonal habitat potentially used by aquatic and semi-aquatic biota and to identify potential spawning areas for spring spawning fish. Additionally, spring eDNA metabarcoding studies will be initiated to detect the presence of biota using seasonal and permanent aquatic habitat. These data will help to identify the seasonal availability and potential use of aquatic habitats within the AOI and LSA_{AQU}. In addition to spring surveys, additional AHM surveys may be conducted within the tributaries to the Teeswater River in the AOI that were not previously surveyed if permission to additional sites is granted by landowners to characterize habitat within these areas. Once additional Tier 1 field data relevant to fish and fish habitat (e.g., spring eDNA results) are received by Zoetica, these data will be analyzed and included in this chapter in future iterations of the BIS Baseline Report.

Tier 1 data collection efforts to date have focussed in areas within the AOI and LSA_{AQU}. Since an official project description has not yet been released by the NWMO and site selection is still pending, reference areas have not been identified. These areas will largely depend on the anticipated impacts to aquatic habitats within and surrounding the AOI. The GSWC is downstream of the AOI and is an ecologically important area. Few comparable lakes exist within the remaining BIS study areas, thus Zoetica included several lakes outside of the RSA_{AQU} during 2022 AHM field surveys to act as potential reference lakes. Should the SON-South Bruce site be selected for the Project and once an official project description has been released, Zoetica will review data captured to date to identify suitable reference areas within and outside of the BIS study areas, if required. Reference areas will be selected with similar habitat features and species, wherever possible.

In addition, future Tier 2 baseline studies are planned to commence after site selection (if the SON-South Bruce site is selected) and are aimed at providing a more thorough characterization of fish biodiversity in the aquatic habitats within the BIS study areas. Methods for characterizing fish biodiversity in the BIS study areas include collecting fish using various fishing techniques (see Zoetica's BPPA report (Zoetica 2021) for further details). Fishing techniques will be determined based on known or suspected species presence determined through desk-based and field-based Tier 1 studies in areas within the AOI and LSA_{AQU} potentially impacted by the Project, and areas determined to be potentially important for fish to carry out important life history phases (e.g., spawning, rearing, migration, and overwintering). Species collected for

Tier 2 studies will be recorded and used to verify species lists generated via desk-based methods and validate eDNA detections of species.

Biodiversity and condition metrics for fish are anticipated to be included as part of Tier 2 fish community characterization studies. Once more is known about the fish community structure in these areas, aquatic food web interactions will be explored in various aquatic habitat types in the AOI, LSA_{AQU}, and potentially the RSA_{AQU}. Data collected from these Tier 2 studies will also help to identify additional important habitats for fish within the BIS aquatic study areas including spawning, rearing, overwintering, and migratory habitat. The presence of fish is required to verify potentially important areas for fish to carry out various life history phases and to determine potential migratory routes. Results will be included in future iterations of the BIS Baseline Report when studies have been completed.

3.0 PRIMARY AND SECONDARY PRODUCERS

3.1 Introduction

Primary and secondary aquatic producers are captured under fish and fish habitat within the *Fisheries Act* (2019) as they are sources of food for fish. Mussels and crayfish are aquatic invertebrate species that are defined as fish under the *Fisheries Act* (2019), and for the purposes of the BIS are captured as primary and secondary producers due to their life history requirements. Specifically, the *Fisheries Act* (2019) prohibits causing harmful alteration, disruption and destruction of fish and fish habitat, including food supply.

Primary and secondary aquatic producers include chlorophyll-a, periphyton, plankton, benthic invertebrates, and other aquatic invertebrates. Primary and secondary aquatic producers form an essential part of the food web for fish and other aquatic and semi-aquatic biota. Primary and secondary aquatic producers are often abundant and easy to study, providing robust baseline data collection. They are also good indicators of environmental change, as they often respond to various levels of change in water and sediment quality. These early changes may be the first tangible biological effects, which can cause ripple effects through the aquatic food web. In addition, primary and secondary aquatic producers often exhibit taxon-specific responses to stressors, making them ideal candidates for inclusion as valued components (VCs) in IAs, as changes in the relative abundance of various primary and secondary aquatic producer taxa can translate small changes in water quality up the food web (including to fish that eat these producers).

Several aquatic invertebrate species of conservation concern also have the potential to occur in the BIS aquatic study areas (see Appendix D in Zoetica's BPPA Report (Zoetica 2021)). In addition, several aquatic invertebrate species are considered invasive species (regulated or non-regulated) in Ontario and can potentially occur within the BIS aquatic study areas (see **Table B-1**). During engagement, stakeholders and rights-holders identified benthic invertebrate health and overall aquatic health as topics to be included in the BIS (see Appendix B of Zoetica's BPPA Report (Zoetica 2021)). These species are considered potential species of interest for the 2023 BIS Baseline Report.

Primary and secondary aquatic producers are included in the EMBP (CanNorth 2021) rather than the BIS, as they are often sampled in conjunction with physical environmental media such as water and sediment. Data on primary and secondary producers, and potential impacts on them, will also need to be interpreted within the BIS, as primary and secondary producers are important food sources for fish. As primary and secondary aquatic producers can be indicators of biotic integrity and aquatic ecosystem health (Hill *et al.* 2000), various measures of primary and secondary aquatic producer communities are included in the biodiversity program.

3.1.1 Objectives

Several studies aim to collect baseline data to help inform the Project's biodiversity IA. General objectives for fish and fish habitat are listed in Section 1.1. Specific objectives of primary and secondary producer studies to meet the requirements of the TISG Template (IAAC 2023) are to:

1. Achieve the general objectives listed in Section 1.1; and
2. Provide community-level species richness/diversity data that can indicate areas within the AOI and LSA_{AQU} that may host a greater richness of species.

3.2 Methods

3.2.1 Study Areas

The BIS study areas for primary and secondary producers include the AOI and LSA_{AQU} (see figures and descriptions in Section 3.0, Chapter 1). In the EMBP, the study areas for primary and secondary aquatic producers are linked to the Water Quality and Sediment Quality study components (CanNorth 2021) as sampling of benthic invertebrates is co-collected with water and sediment for chemistry analysis.

3.2.2 Benthic Invertebrate Studies

The collection of primary and secondary aquatic producers has been proposed as part of the EMBP baseline data collection activities, starting in 2022 in areas that may be affected by changes to water chemistry (CanNorth 2021). The survey designs for aquatic primary and secondary producer studies considered: spatial and temporal requirements needed for characterizing communities of aquatic primary and secondary producers using currently available guidelines, including the Ontario Benthos Biomonitoring Network (OBBN) and the Canadian Aquatic Biomonitoring Network (CABIN) benthic invertebrate survey protocols, and protocols for the collection of plankton, periphyton, and chlorophyll-a outlined in the EMBP (CanNorth 2021). The BIS expands on the collection of primary and secondary aquatic producers for assessing potential changes to overall species richness and abundance that could alter food web dynamics for fish. Additionally, eDNA studies commenced in the summer of 2022 as part of Tier 1 studies for the BIS Program (see Appendix E, Chapter 1) and included primers for the detection of aquatic and semi-aquatic invertebrates.

3.3 Results

3.3.1 Presence, Distribution and Abundance of Important Habitat

3.3.1.1 Critical Habitat

Critical habitat for rainbow[5] mussel (Special Concern, S1) is proposed within the Saugeen River watershed on the Saugeen River and the Teeswater River (see **Figure B-1**). The proposed federal recovery strategy for rainbow mussel describes critical habitat as the reaches of the Saugeen River that include all contiguous ALIS segments from the uppermost to lowermost stream segments with species present (DFO 2018). The Teeswater River is included from its confluence with the main stem of the Saugeen River, upstream to where it enters the GSWC. The separate uppermost area of critical habitat includes an approximately 15 km reach of the upper Teeswater River that flows through the Town of Teeswater. The entire bankfull width of the channel is included in this critical habitat description for all river segments identified (DFO 2018). After the draft version of the recovery strategy was published on the *SARA* species registry in 2018, rainbow mussel was downlisted to Special Concern (in 2019). Areas proposed as critical habitat within the recovery strategy may still represent important habitat for the species.

3.3.1.2 Significant Wildlife Habitat

A summary of candidate and confirmed SWH identified to date for primary and secondary producers and aquatic invertebrates is presented in Appendix C, Chapter 1. Desk-based ecosite analyses indicated that terrestrial crayfish could potentially occur throughout the AOI and LSA_{TER}, and the presence of terrestrial crayfish (visual incidental observations of chimneys/burrows) was confirmed during 2022 field studies

[5] In Ontario, “rainbow” and “rainbow mussel” are used interchangeably in SARO documents, while in the federal recovery strategy they are referred to as “rainbow”. For the BIS, the term “rainbow mussel” is used for clarity.

(see Section 3.3.2.1). Fourteen candidate SWH plots were found within the AOI in marshes and swamps. Chimneys or burrows were observed at 10 locations in the AOI, and one of those was identified to the digger crayfish species. Based on the MNRF's definition of terrestrial crayfish SWH, all 14 of these records are confirmed as SWH (see Appendix C, Chapter 1).

3.3.2 Presence and Distribution of Species of Interest

3.3.2.1 Species of Conservation Concern

A search of the datasets listed in **Table 1-1** revealed one species of conservation concern, the river bluet within the LSA_{AQU}. The river bluet is a species of damselfly with a provincial rank of S3, meaning that it is provincially rare. The river bluet was detected on the Teeswater River east (upstream) of the AOI (**Figure B-1**; **Table B-2**).

Zoetica's previous investigations of NHIC observation (not occurrence) data found that rainbow mussel has been recorded in the AOI and LSA_{AQU}. Rainbow mussel is provincially and federally listed as a species of Special Concern (see Appendix D of Zoetica's BPPA Report (Zoetica 2021)). Since writing the BPPA, Zoetica has received an updated version of the NHIC verified occurrence data but has not yet received the requested updated NHIC observation data. Once received by Zoetica, these data will be included in future iterations of the BIS Baseline Report. Since proposed critical habitat for rainbow mussel is defined within the AOI and LSA_{AQU} and is described as present in all segments of the Teeswater River where rainbow mussel occurs, the updated version of the NHIC observation data is likely to include rainbow mussel observations within these study areas.

During 2022 field studies, the presence of terrestrial crayfish (visual incidental observations of individuals and chimneys/burrows) including digger crayfish and Great Plains mudbug were confirmed. Digger crayfish and Great Plains mudbug are not a *SARA*- or *SARO*-listed species, but in Ontario have a NatureServe conservation status of S3, indicating that these species are vulnerable and at moderate risk of extirpation (NatureServe n.d.). Observations of terrestrial crayfish burrows were dispersed throughout the AOI and/or LSA_{TER} (**Figure B-2**; **Table B-3**). There was also a single observation of digger crayfish burrows in western AOI / LSA_{TER} (Grid square 6972; **Figure B-2**; **Table B-3**). Within the LSA_{AQU}, terrestrial crayfish burrows and visual observations of terrestrial crayfish were scattered throughout the GSWC (primarily on the eastern side) north of the AOI (**Figure B-2**; **Table B-3**) including burrows of Great Plains mudbug and a digger crayfish. Terrestrial crayfish burrows were also observed in the southern portion of the LSA_{AQU} near and within the Wingham Wetland Complex (**Figure B-2**, **Table B-3**).

During eDNA metabarcoding studies conducted in 2022 for the BIS (Appendix E, Chapter 1), digger crayfish were also detected in the fall at a reach on the Teeswater River in the northwest side of the AOI, at the outlet of Schmidt Lake, and at a wetland south of Cunningham Lake in the LSA_{AQU} north of the AOI (see Figure I-1 in Appendix E, Chapter 1).

3.3.2.2 Species of Interest to Stakeholders and Rights-holders

Other than terrestrial crayfish, no primary and secondary producer species of interest were mentioned during engagement conducted to date for the BIS. Terrestrial crayfish were also noted as species that occur in the Teeswater River system, and that they are easy to locate due to their chimney structures. Digger crayfish are also a species of conservation concern, and thus are discussed in Section 3.3.2.1. Future engagement may focus on species of interest to stakeholders and rights-holders, and if any primary and secondary producer species are mentioned during future engagement, they will be reported in Chapter 8 in future iterations of the BIS Baseline Report.

3.3.2.3 Invasive Species

A search of the EDDMaps and GBIF datasets revealed one invasive primary and secondary producer species, rusty crayfish, reported within the LSA_{AQU}. Rusty crayfish was reported in the northern portion of the LSA_{AQU}, along the Teeswater River within the GSWC (**Figure B-1**; **Table B-2**). Rusty crayfish are thought to be introduced in Ontario by anglers from other areas who discard crayfish they were using as bait. Rusty crayfish are known to eat large amounts of aquatic vegetation and compete with other native crayfish for food and resources. Due to their aggressive nature, they are also better able to avoid being eaten by native fish relative to their native counterparts. Section 29 (4) of the Ontario Fishery Regulations (2007) prohibits the overland transport of all species of crayfish, both alive and dead, to avoid the spread of rusty crayfish to natural waterbodies. Rusty crayfish were also detected during eDNA metabarcoding studies conducted in the BIS study areas (see Appendix E, Chapter 1). Rusty crayfish were detected in both the summer and fall sampling events in reaches in the Teeswater River in the AOI, as well as in the summer at a reach of the Teeswater River in the GSWC in the LSA_{AQU} north of the AOI (see Figure I-2a in Appendix E, Chapter 1).

3.3.3 Additional Baseline Data Collection to Inform the IA

3.3.3.1 Community Characterization

In 2022, no comprehensive targeted studies were conducted to characterize community composition within the LSA_{AQU}. However, Tier 1 BIS field studies were initiated in 2022 in the LSA_{AQU} and may produce data relevant to primary and secondary producers. In addition, studies conducted as part of the EMBP (CanNorth 2021) were also initiated in 2022. The following sections outline Tier 1 BIS studies and EMBP studies that may produce data relevant to primary and secondary producers. At the time of writing the 2023 BIS Baseline Report (September 2023), data from these studies were not available. Once Zoetica receives these data, results relevant to biodiversity will be included in future iterations of the BIS Baseline Report.

3.3.3.1.1 Primary Producers

Some information, including information on algae and chlorophyll-a, was collected along with water samples as part of the EMBP (CanNorth 2021). Once Zoetica receives these data, results relevant to biodiversity will be included in future iterations of the BIS Baseline Report.

3.3.3.1.2 Aquatic and Semi-Aquatic Invertebrates (Secondary Producers)

In the summer and fall of 2022, eDNA metabarcoding field studies were conducted within watercourses, waterbodies, and wetlands in the LSA_{AQU} using primers targeted at fish and other vertebrates as well as invertebrates (Appendix E, Chapter 1). A total of 563 invertebrate species were detected within the LSA_{AQU}, including 126 insect families with 510 insect species, and 22 non-insect families including one diatom (class Bacillariophyceae) which is a primary producer (see Section 4.2.6 in Appendix E, Chapter 1). In addition to aquatic and semi-aquatic invertebrates detected through eDNA metabarcoding studies, several aquatic invertebrates were incidentally observed during 2022 field surveys for TEM, AHM, and eDNA within the AOI, LSA_{AQU}, or RSA_{AQU} (**Table B-4**). None of the aquatic invertebrates were recorded to the species level; thus, it is unclear whether they are species of interest.

3.3.3.1.3 Benthic Invertebrates

Benthic invertebrate studies were initiated in August 2022 alongside sediment collections in the LSA_{AQU} as part of the EMBP (CanNorth 2021). These studies also included the use of eDNA invertebrate primers to capture some aquatic and semi-aquatic invertebrate species. Once Zoetica receives these data, results relevant to biodiversity will be included in future iterations of the BIS Baseline Report.

3.3.3.1.4 Phytoplankton and Zooplankton

No phytoplankton or zooplankton studies have been conducted to date for the Project. Phytoplankton and zooplankton studies are planned as part of the EMBP (CanNorth 2021). Once Zoetica receives these data, results relevant to biodiversity will be included in future iterations of the BIS Baseline Report.

3.4 Discussion

Section 3.0 of the current Chapter 8 focused on analyses of desk-based data for primary and secondary producer species' habitat and observations. A search of existing datasets revealed proposed critical habitat for rainbow mussel within the AOI and LSA_{AQU}. The proposed critical habitat extends along the Teeswater River east of the AOI into the AOI and continues again north of the AOI along the Teeswater River in the GSWC. Searches of existing GBIF and NHIC data did not include reports of rainbow mussel in the Teeswater River; however, while Zoetica did not have an updated version of the NHIC observation data, a previous version of the NHIC observation data included rainbow mussel within the BIS study areas (see the BPPA Report (Zoetica 2021)). In addition, the proposed federal recovery strategy for rainbow mussel describes critical habitat as the reaches of the Saugeen River (including the Teeswater River) that include all contiguous ALIS segments from the uppermost stream segments with species present to the lowermost stream segments with species present. This indicates that rainbow mussel is likely present in the Teeswater River within the AOI and LSA_{AQU}. In addition, it is possible that rainbow mussel is present in the sections of the Teeswater River that are not included as critical habitat in the proposed federal recovery strategy. Tier 1 eDNA metabarcoding studies commenced in the summer of 2022 but did not detect rainbow in the Teeswater River. There are several possible reasons for the lack of detections of rainbow discussed in Appendix E, Chapter 1. However, given that proposed critical habitat exists in the Teeswater River it is assumed that rainbow occur in these areas.

In addition to important habitat reported in the AOI and LSA_{AQU}, one aquatic invertebrate species of conservation concern, river bluet, was detected during desk-based searches of databases and Tier 1 eDNA studies conducted in 2022 detected the digger crayfish, in the fall within the AOI / LSA_{TER} (see Appendix E, Chapter 1). Incidental observations recorded during Tier 1 BIS field studies conducted in the summer of 2022 revealed many terrestrial crayfish burrows in the AOI and LSA_{AQU}, including burrows belonging to digger crayfish and Great Plains mudbug (**Figure B-2**). Several visual observations of terrestrial crayfish (not identified to species) were also reported in the LSA_{AQU} north of the AOI. Future Tier 1 studies and targeted Tier 2 studies, should the SON-South Bruce site be selected, are likely to reveal additional aquatic invertebrate species of conservation concern (e.g., rainbow). Additionally, rusty crayfish, an invasive species was reported to occur in the LSA_{AQU} north of the AOI in desk-based sources and was detected in the AOI during Tier 1 eDNA metabarcoding studies. Data collected to date on species of interest will help Zoetica in planning future Tier 2 studies, should the SON-South Bruce site be selected.

3.4.1 Next Steps

To date, Tier 1 fieldwork has focussed on collecting aquatic habitat information from watercourses, waterbodies, and wetlands (see Appendix D, Chapter 1) and detecting aquatic biota through eDNA metabarcoding studies (see Appendix E, Chapter 1). Spring reconnaissance surveys to determine the extent of flooding of wetlands and spring eDNA metabarcoding were not conducted in 2022 but are planned for 2024. Spring surveys will determine whether the wetlands and first order streams that were dry during the summer surveys in 2022 are seasonally wetted and potentially provide habitat for primary and secondary producers. Data collected in the spring will help to identify the seasonal availability and potential use of aquatic habitats within the AOI and LSA_{AQU}. Once additional Tier 1 field data relevant to fish and fish habitat (e.g., spring eDNA results) are received by Zoetica, these data will be analyzed and included in this chapter in future iterations of the BIS Baseline Report.

In addition to Tier 1 studies conducted as part of the BIS, water quality studies including the collection of chlorophyll-a were carried out as part of the EMBP (CanNorth 2021) in 2021. Benthic invertebrate studies also planned as part of the EMBP commenced in the summer of 2022. Future iterations of the BIS Baseline Report will include summarizations of these data as they pertain to biodiversity. For example, the BIS may include reviews of primary and secondary producer data collected as part of the EMBP for any trends in abundance and biomass across various habitat types and geographical locations.

In addition, future Tier 2 baseline studies are planned to commence after site selection (if the SON-South Bruce site is selected) and are aimed at providing a more thorough characterization of fish and fish habitat within the BIS study areas. Once more is known about the fish community characterization in the BIS aquatic study areas (see Section 2.2.4.1), information gathered for primary and secondary producers will be used to understand and characterize food web interactions within these study areas.

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APPENDIX A – SUPPLEMENTARY INFORMATION FOR FISH

This appendix provides supplementary information for fish discussed in Section 2.0.

A.1 Tables

Table A-1. List of regulated and non-regulated invasive fish species of concern in Ontario. This list does not imply potential occurrence in the SON-South Bruce area, as several invasive species "on the radar" have not yet been found in Ontario or even Canada; however, these species are known to have significant ecological, social, health, and/or economic impacts in other areas of North America and worldwide, where they have been introduced. Species highlighted grey are those that have EDDMapS Ontario records within the extent of the BIS study areas. Note that species may have been confirmed within the study areas through other databases, inventories, studies, or local observations; however, these data sources need to be further investigated.

Subgroup	Common Name	Scientific Name	Ontario *ISA*[1]		Aquatic Invasive Species Regulations[2]			Ont. ISAP[3]	ISC[4]
			PRO.	RES.	Import	Possess, Transport, Release	Non-Indigenous		
Large-bodied Fishes	Grass carp	*Ctenopharyngodon idella*	X		X	X		X	X
Large-bodied Fishes	Silver carp	*Hypopthalmichthys molitrix*	X		X	X		X	X
Large-bodied Fishes	Bighead carp	*Hypopthalmichthys nobilis*	X		X	X		X	X
Large-bodied Fishes	Black carp	*Mylopharyngodon piceus*	X		X	X		X	X
Large-bodied Fishes	Snakeheads	All species in the family Channidae	X			X		X	X
Large-bodied Fishes	Zander	*Sander lucioperca*	X					X	
Large-bodied Fishes	Wels catfish	*Silurus glanis*	X					X	
Small-bodied Fishes	Stone mokoro	*Pseudorasbora parva*	X					X	
Small-bodied Fishes	Round goby	*Neogobius melanostomus*				X		X	X
Large-bodied Fishes	Rudd	*Scardinius erythrophthalmus*				X		X	
Small-bodied Fishes	Eurasian ruffe	*Gymnocephalus cernua*				X		X	
Small-bodied Fishes	Tubenose goby	*Proterorhinus semilunaris*				X		X	
Large-bodied Fishes	Prussian carp	*Carassius gibelio*						X	X
Other Fishes	Sea lamprey	*Petromyzon marinus*						X	X
Large-bodied Fishes	Goldfish	*Carassius auratus*						X	
Large-bodied Fishes	Tench	*Tinca tinca*						X	
Small-bodied Fishes	Rainbow smelt	*Osmerus mordax*						X	
Large-bodied Fishes	White perch	*Morone americana*				X			

Notes:
1. Prohibited "PRO." and Restricted "RES." species regulated under the Ontario *Invasive Species Act* (*ISA*) are presented on the Ontario Ministry of Natural Resources and Forestry's (MNRF) website, accessed on July 12, 2021: https://www.ontario.ca/page/managing-invasive-species-ontario
2. The federal Aquatic Invasive Species Regulations (SOR/2015-121) under the *Fisheries Act* includes schedules of Species Subject to Prohibitions and Controls (Part 2) and Species Subject to Controls Only in Areas Where They Are Not Indigenous (Part 3). Within the schedule Part 2, certain invasive species are prohibited from Importation, Possession, Transportation, and/or Release. The regulations are current to June 28, 2021; accessed on July 27, 2021.
3. Ontario's Invading Species Awareness Program (ISAP) is a partnership between the MNRF and the Ontario Federation of Anglers and Hunters. The webpages for Invasive Aquatic Plants, Forest Pests & Pathogens, Invasive Fish, Invasive Invertebrates, Invasive Terrestrial Plants, and Invasive Wildlife were accessed on July 27, 2021: http://www.invadingspecies.com/invaders/
4. The Invasive Species Centre (ISC) is a resource for Ontario and the rest of Canada. Based in Sault Ste. Marie, Ontario, the Board of Directors Organizations include the Great Lakes Fishery Commission, Grand Council Treaty #3, City of Ottawa, International Joint Commission, Wildlife Habitat Canada, University of Waterloo, BioForest, Nature Conservancy of Canada, Natural Resources Canada, Fisheries and Oceans Canada, and the CFIA. The webpages for Invasive Fish, Invasive Plants, Invasive Insects, Invasive Aquatic Plants, and Invasive Pathogens were accessed on July 27, 2021: https://www.invasivespeciescentre.ca/invasive-species/

Table A-2. Fish species of interest reported in GBIF and EDDMapS records within the BIS study area.

Grid	Source	Species	Count	Coordinates	AOI	LSA_{AQU}	RSA_{AQU}
7027	EDDMapS	Rainbow smelt	U	470809, 4927520	0	0	1
7027	EDDMapS	Rainbow smelt	U	470450, 4927594	0	0	1
7027	EDDMapS	White Perch	U	470851, 4927475	0	0	1
7228	GBIF	Black Redhorse	2	-	0	0	1
7328	EDDMapS	Round goby	U	473809, 4928022	0	0	1
7426	EDDMapS	Round goby	6	474197, 4926016	0	0	1
7789	GBIF	Greater Redhorse	1	-	0	0	1
7806	GBIF	Northern Brook Lamprey	48	-	0	0	1
8093	GBIF	Greater Redhorse	1	-	0	0	1

Notes:
See **Figure A-1** for Grid locations of masked observations. Coordinates are not provided due to the sensitive nature of provincially rare species.
For the purposes of this table, the indicated study area includes overlap with other study area(s) that may be encompassed within its boundaries.

Table A-3. Fish species detected in the LSA_{AQU}, RSA_{AQU}, potential reference areas, and Lake Huron.

Common Name	Scientific Name	AOI	LSA_{AQU}	Greenock Swamp Wetland Complex[1]	RSA_{AQU}	RSA_{AQU} outside LSA_{AQU}	Potential Reference Areas (Outside RSA_{AQU})	Lake Huron
Catostomidae – suckers								
Black Redhorse[2]	*Moxostoma duquesnei*	-	-	-	Y	Y	-	-
Golden Redhorse	*Moxostoma erythrurum*	-	-	-	Y	Y	Y	-
Greater Redhorse[3]	*Moxostoma valenciennesi*	-	Y	-	Y	Y	-	-
Longnose Sucker	*Catostomus catostomus*	-	-	-	-	-	-	Y
Northern Hog Sucker	*Hypentelium nigricans*	Y	Y	-	Y	Y	Y	-
Shorthead Redhorse	*Moxostoma macrolepidotum*	-	Y	-	Y	Y	Y	Y
Silver Redhorse	*Moxostoma anisurum*	-	-	-	Y	Y	Y	-
White Sucker	*Catostomus commersonii*	Y	Y	Y	Y	Y	Y	Y
Centrarchidae – sunfishes								
Black Crappie	*Pomoxis nigromaculatus*	-	-	-	-	-	-	Y
Bluegill	*Lepomis macrochirus*	-	Y	Y	Y	Y	Y	Y
Green Sunfish	*Lepomis cyanellus*	-	-	-	-	-	Y	-

Common Name	Scientific Name	AOI	LSA$_{AQU}$	Greenock Swamp Wetland Complex[1]	RSA$_{AQU}$	RSA$_{AQU}$ outside LSA$_{AQU}$	Potential Reference Areas (Outside RSA$_{AQU}$)	Lake Huron
Largemouth Bass	*Micropterus salmoides*	-	Y	Y	Y	Y	Y	Y
Pumpkinseed	*Lepomis gibbosus*	-	Y	Y	Y	Y	Y	Y
Rock Bass	*Ambloplites rupestris*	Y	Y	Y	Y	Y	Y	Y
Smallmouth Bass	*Micropterus dolomieu*	Y	Y	Y	Y	Y	Y	Y
Cottidae – sculpins								
Mottled Sculpin	*Cottus bairdii*	-	Y	-	Y	Y	Y	Y
Slimy Sculpin	*Cottus cognatus*	-	-	-	-	-	Y	-
Leuciscidae – minnows								
Blackchin Shiner	*Notropis heterodon*	-	-	-	Y	Y	Y	-
Blacknose Dace	*Rhinichthys atratulus*	-	Y	-	Y	Y	Y	Y
Blacknose Shiner	*Notropis heterolepis*	-	Y	-	Y	Y	Y	-
Bluntnose Minnow	*Pimephales notatus*	Y	Y	Y	Y	Y	Y	Y
Brassy Minnow	*Hybognathus hankinsoni*	-	Y	-	Y	Y	Y	-
Common Shiner	*Luxilus cornutus*	Y	Y	Y	Y	Y	Y	Y
Creek Chub	*Semotilus atromaculatus*	Y	Y	Y	Y	Y	Y	Y
Emerald Shiner	*Notropis atherinoides*	Y	Y	Y	Y	Y	Y	-
Fathead Minnow	*Pimephales promelas*	-	Y	-	Y	Y	Y	Y
Finescale Dace	*Chrosomus neogaeus*	-	Y	-	Y	Y	Y	Y
Golden Shiner	*Notemigonus crysoleucas*	-	Y	-	Y	Y	Y	Y
Hornyhead Chub	*Nocomis biguttatus*	Y	Y	-	Y	Y	Y	-
Longnose Dace	*Rhinichthys cataractae*	-	Y	-	Y	Y	Y	-
Mimic Shiner	*Notropis volucellus*	-	-	-	Y	Y	Y	-
Northern Pearl Dace[4]	*Margariscus nachtriebi*	-	-	-	Y	Y		
Northern Redbelly Dace	*Chrosomus eos*	-	Y	Y	Y	Y	Y	Y
Pugnose Shiner	*Notropis anogenus*	-	-	-	Y	Y	-	-
Redfin Shiner	*Lythrurus umbratilis*	Y	Y	-	Y	Y	-	-
River Chub	*Nocomis micropogon*	-	Y	-	Y	Y	Y	-
Rosyface Shiner	*Notropis rubellus*	-	-	-	Y	Y	Y	-
Sand Shiner	*Notropis stramineus*	-	-	-	Y	Y	Y	-
Spotfin Shiner	*Cyprinella spiloptera*	-	-	-	Y	Y	Y	-
Spottail Shiner	*Notropis hudsonius*	-	-	-	Y	Y	Y	Y
Striped Shiner[4]	*Luxilus chrysocephalus*	-	-	-	Y	Y	-	-

Common Name	Scientific Name	AOI	LSA_{AQU}	Greenock Swamp Wetland Complex[1]	RSA_{AQU}	RSA_{AQU} outside LSA_{AQU}	Potential Reference Areas (Outside RSA_{AQU})	Lake Huron
Esocidae – pikes								
Muskellunge	*Esox masquinongy*	-	-	-	Y	Y	Y	Y
Northern Pike	*Esox lucius*	-	Y	Y	Y	Y	Y	
Gasterosteidae – sticklebacks								
Brook Stickleback	*Culaea inconstans*	Y	Y	Y	Y	Y	Y	Y
Ninespine Stickleback	*Pungitius pungitius*	-	Y	Y	Y	Y	-	-
Threespine Stickleback[2]	*Gasterosteus aculeatus*	-	-	-	Y	Y	-	-
Gadidae – codfishes								
Burbot	*Lota lota*	-	-	-	-	-	-	Y
Percidae – perches and darters								
Blackside Darter	*Percina maculata*	Y	Y	-	Y	Y	Y	-
Fantail Darter	*Etheostoma flabellare*	-	-	-	Y	Y	Y	-
Greenside Darter	*Etheostoma blennioides*	Y	Y	-	Y	-	-	-
Iowa Darter	*Etheostoma exile*	-	Y	Y	Y	Y	Y	-
Johnny Darter	*Etheostoma nigrum*	-	Y	Y	Y	Y	Y	Y
Least Darter	*Etheostoma microperca*	-	-	-	Y	Y	Y	-
Logperch	*Percina caprodes*	-	-	-	Y	Y	Y	-
Rainbow Darter	*Etheostoma caeruleum*	Y	Y	-	Y	Y	Y	Y
Sauger	*Sander canadensis*	-	-	-	-	-	-	Y
Walleye	*Sander vitreus*	-	Y	Y	Y	-	Y	Y
Yellow Perch	*Perca flavescens*	-	Y	Y	Y	Y	Y	Y
Umbridae – mudminnows								
Central Mudminnow	*Umbra limi*	-	Y	Y	Y	Y	Y	Y
Salmonidae – trouts and salmons								
Bloater	*Coregonus hoyi*	-	-	-	-	-	-	Y
Brook Trout	*Salvelinus fontinalis*	Y	Y	-	Y	Y	Y	Y
Brown Trout	*Salmo trutta*	-	-	-	Y	Y	Y	Y
Chinook Salmon	*Oncorhynchus tshawytscha*	-	-	-	Y	Y	Y	Y
Coho Salmon	*Oncorhynchus kisutch*	-	-	-	Y	Y	Y	Y
Lake Trout	*Salvelinus namaycush*	-	-	-	-	-	-	Y
Lake Whitefish	*Coregonus clupeaformis*	-	-	-	-	-	-	Y
Pink Salmon	*Oncorhynchus gorbuscha*	-	-	-	-	-	-	Y

Common Name	Scientific Name	AOI	LSA_{AQU}	Greenock Swamp Wetland Complex[1]	RSA_{AQU}	RSA_{AQU} outside LSA_{AQU}	Potential Reference Areas (Outside RSA_{AQU})	Lake Huron
Rainbow Trout	*Oncorhynchus mykiss*	-	Y	-	Y	Y	Y	Y
Round Whitefish	*Prosopium cylindraceum*	-	-	-	-	-	-	Y
Sockeye Salmon[5]	Oncorhynchus nerka	-	-	-	Y	Y	Y	-
Splake	*Salvelinus fontinalis x S. namaycush*	-	-	-	Y	Y	Y	-
Acipenseridae – sturgeons								
Lake Sturgeon[2]	*Acipenser fulvescens*	-	-	-	Y	Y	-	-
Amiidae – bowfins								
Bowfin	*Amia calva*	-	-	-	-	-	-	Y
Atherinopsidae – New World silversides								
Brook Silverside	*Labidesthes sicculus*	Y	Y	-	Y	Y	-	Y
Clupeidae – herrings								
Alewife	*Alosa pseudoharengus*	-	-	-	Y	Y	Y	-
Gizzard Shad	*Dorosoma cepedianum*	-	-	-	Y	Y	Y	-
Cyprinidae – carps								
Common Carp	*Cyprinus carpio*	Y	Y	-	Y	Y	-	Y
Fundulidae – topminnows								
Banded Killifish	*Fundulus diaphanus*	-	-	-	-	-	-	Y
Gobiidae – gobies								
Round Goby[2]	*Neogobius melanostomus*	-	-	-	Y	Y	-	-
Ictaluridae – North American catfishes								
Black Bullhead	*Ameiurus melas*	-	-	-	Y	Y	Y	Y
Brown Bullhead	*Ameiurus nebulosus*	-	Y	Y	Y	Y	Y	Y
Channel Catfish	Ictalurus punctatus	-	-	-	Y	Y	Y	Y
Stonecat	*Noturus flavus*	-	Y	-	Y	Y	Y	-
Tadpole Madtom	*Noturus gyrinus*	-	Y	-	Y	Y	-	-
Yellow Bullhead	*Ameiurus natalis*	-	Y	-	Y	Y	Y	-
Lepisosteidae – gars								
Longnose Gar	*Lepisosteus osseus*	-	-	-	-	-	-	Y
Moronidae – temperate basses								
White Bass	*Morone chrysops*	-	-	-	-	-	-	Y
White Perch	*Morone americana*	-	-	-	-	-	-	Y
Osmeridae – smelts								

Common Name	Scientific Name	AOI	LSA_{AQU}	Greenock Swamp Wetland Complex[1]	RSA_{AQU}	RSA_{AQU} outside LSA_{AQU}	Potential Reference Areas (Outside RSA_{AQU})	Lake Huron
Rainbow Smelt	*Osmerus mordax*	-	-	-	Y	Y	Y	Y
Petromyzontidae – lampreys								
Northern Brook Lamprey	*Ichthyomyzon fossor*	-	-	-	Y	Y	-	-
Sea Lamprey	*Petromyzon marinus*	-	-	-	Y	Y	Y	-
Sciaenidae – drums and croakers								
Freshwater Drum	*Aplodinotus grunniens*	-	-	-	-	-	-	Y
	Total	***17***	***43***	***20***	***72***	***70***	***62***	***51***

Notes:

1. Data only includes what is reported in the Greenock Swamp ANSI inventory document (Johnson 1994)
2. Round goby, threespine stickleback, black redhorse, and lake sturgeon were reported in NHIC Occurrence, GBIF, or EDDMapS Ontario datasets at the confluence of the Saugeen River with Lake Huron but were not reported in the MNRF ARA dataset within Lake Huron. However, these species likely occur in Lake Huron.
3. Greater redhorse NHIC 1 km^2 blocks partially overlap the LSA_{AQU} but this species may not be present in the LSA_{AQU} as they can occur anywhere within the 1 km^2 grids.
4. Northern pearl dace and striped shiner were reported in the RSA_{AQU} in GBIF records but not in the MNRF ARA database.
5. Sockeye salmon is likely a misidentification of another salmon species, as sockeye are not known to be present in Lake Huron and the Saugeen River

Table A-4. Species of fish known to occur in the Teeswater River upstream and downstream of the AOI and potential reference rivers. Data from the MNRF Aquatic Resource Area Polygon dataset. Note: Section number refers to the section of the Teeswater River defined on Figure A-2.

Species		**Teeswater River**					**Saugeen River**	**Potential Reference Rivers**		
Common Name	**Scientific Name**	**Section 1**	**Section 2**	**Section 3**	**Section 4 & 5**	**Section 6 & 7**	**Main Section**	**Beatty Saugeen**	**North Saugeen Section 1**	**North Saugeen Section 2**
	Temperature Regime	**Cold**	**Cold**	**Cool**	**Cool**	**Warm**	**Cold**	**Cold**	**Cool**	**Cool**
Catostomidae - suckers										
Black Redhorse	*Moxostoma duquesnei*	-	-	-	-	-	Y	-	-	-
Golden Redhorse	*Moxostoma erythrurum*	-	-	-	-	Y	Y	-	-	-
Greater Redhorse	*Moxostoma valenciennesi*	-	-	-	Y	-	-	-	-	-
Northern Hog Sucker	*Hypentelium nigricans*	Y	Y	-	-	-	-	-	-	-
Shorthead Redhorse	*Moxostoma macrolepidotum*	-	-	-	-	-	Y	-	-	-
Silver Redhorse	*Moxostoma anisurum*	-	-	-	-	-	Y	-	-	-
White Sucker	*Catostomus commersonii*	Y	Y	-	Y	Y	Y	Y	Y	-
Centrarchidae -sunfishes										
Largemouth Bass	*Micropterus salmoides*	-	-	Y	Y	Y	-	-	-	-
Pumpkinseed	*Lepomis gibbosus*	-	-	-	Y	Y	Y	Y	-	-
Rock Bass	*Ambloplites rupestris*	Y	Y	Y	Y	Y	Y	Y	Y	-
Smallmouth Bass	*Micropterus dolomieu*	Y	Y	Y	Y	Y	Y	-	Y	Y
Cottidae - sculpins										
Mottled Sculpin	*Cottus bairdii*	Y	-	-	-	-	-	Y	-	-
Leuciscidae - minnows										
Blackchin Shiner	*Notropis heterodon*	-	-	-	-	-	-	Y	-	-
Blacknose Dace	*Rhinichthys atratulus*	Y	-	-	Y	-	Y	Y	Y	-
Blacknose Shiner	*Notropis heterolepis*	Y	-	-	-	-	-	Y	-	-
Bluntnose Minnow	*Pimephales notatus*	Y	Y	-	-	Y	Y	Y	-	-
Brassy Minnow	*Hybognathus hankinsoni*	-	-	-	-	-	Y	-	-	-
Common Shiner	*Luxilus cornutus*	Y	Y	Y	Y	Y	Y	Y	Y	Y
Creek Chub	*Semotilus atromaculatus*	Y	Y	Y	Y	Y	Y	Y	Y	Y
Emerald Shiner	*Notropis atherinoides*	-	Y	-	-	-	Y	Y	Y	-
Fathead Minnow	*Pimephales promelas*	-	-	-	-	-	Y	Y	-	-
Finescale Dace	*Chrosomus neogaeus*	-	-	-	Y	-	-	-	-	-
Hornyhead Chub	*Nocomis biguttatus*	Y	Y	Y	Y	Y	Y	Y	Y	Y
Longnose Dace	*Rhinichthys cataractae*	-	-	-	Y	Y	y	Y	Y	Y

Species		Teeswater River					Saugeen River	Potential Reference Rivers		
Common Name	**Scientific Name**	**Section 1**	**Section 2**	**Section 3**	**Section 4 & 5**	**Section 6 & 7**	**Main Section**	**Beatty Saugeen**	**North Saugeen Section 1**	**North Saugeen Section 2**
	Temperature Regime	**Cold**	**Cold**	**Cool**	**Cool**	**Warm**	**Cold**	**Cold**	**Cool**	**Cool**
Mimic Shiner	*Notropis volucellus*	-	-	-	-	-	Y	-	-	-
Northern Redbelly Dace	*Chrosomus eos*	Y	-	-	-	-	Y	Y	-	-
Pugnose Shiner	*Notropis anogenus*	-	-	-	Y	-	-	-	-	-
Redfin Shiner	*Lythrurus umbratilis*	-	Y	-	-	Y	-	-	-	-
River Chub	*Nocomis micropogon*	-	-	Y	Y	Y	Y	Y	-	-
Rosyface Shiner	*Notropis rubellus*	Y	-	-	Y	Y	Y	Y	-	-
Sand Shiner	*Notropis stramineus*	-	-	-	-	-	Y	-	-	-
Spotfin Shiner	*Cyprinella spiloptera*	-	-	-	-	-	Y	-	Y	-
Spottail Shiner	*Notropis hudsonius*	-	-	-	-	-	-	Y	-	-
Esocidae - pikes										
Muskellunge	*Esox masquinongy*	-	-	-	-	-	Y	-	-	-
Northern Pike	*Esox lucius*	-	-	Y	Y	Y	Y	-	-	-
Gasterosteidae - sticklebacks										
Brook Stickleback	*Culaea inconstans*	-	Y	-	Y	-	Y	Y	-	-
Threespine stickleback	*Gasterosteus aculeatus*	-	-	-	-	-	Y	-	-	-
Percidae – perches and darters										
Blackside Darter	*Percina maculata*	-	Y	Y	Y	Y	Y	-	-	Y
Fantail Darter	*Etheostoma flabellare*	-	-	-	Y	-	Y	Y	-	-
Greenside Darter	*Etheostoma blennioides*	-	Y	-	-	-	-	-	-	-
Iowa Darter	*Etheostoma exile*	-	-	Y	Y	Y	-	Y	-	-
Johnny Darter	*Etheostoma nigrum*	-	-	Y	Y	Y	Y	Y	Y	-
Least Darter	*Etheostoma microperca*	Y	-	-	-	-	-	-	Y	-
Rainbow Darter	*Etheostoma caeruleum*	Y	Y	-	Y	Y	Y	Y	Y	-
Yellow Perch	*Perca flavescens*	-	-	-	Y	-	Y	-	-	-
Umbridae - mudminnows										
Central Mudminnow	*Umbra limi*	Y	-	Y	Y	Y	Y	Y	-	-
Salmonidae – trouts and salmons										
Brook Trout	*Salvelinus fontinalis*	Y	Y	-	-	Y	Y	Y	-	-

Species		**Teeswater River**					**Saugeen River**	**Potential Reference Rivers**		
Common Name	**Scientific Name**	**Section 1**	**Section 2**	**Section 3**	**Section 4 & 5**	**Section 6 & 7**	**Main Section**	**Beatty Saugeen**	**North Saugeen Section 1**	**North Saugeen Section 2**
	Temperature Regime	**Cold**	**Cold**	**Cool**	**Cool**	**Warm**	**Cold**	**Cold**	**Cool**	**Cool**
Brown Trout	*Salmo trutta*	-	-	-	-	-	Y	Y	-	-
Chinook Salmon	*Oncorhynchus tshawytscha*	-	-	-	-	-	Y	-	-	-
Coho Salmon	*Oncorhynchus kisutch*	-	-	-	-	-	Y	-	-	-
Rainbow Trout	*Oncorhynchus mykiss*	-	-	-	-	-	Y	Y	Y	-
Sockeye Salmon[1]	*Oncorhynchus nerka*	-	-	-	-	-	Y	-	-	-
Splake	*Salvelinus fontinalis x S. namaycush*	-	-	-	-	-	Y	-	-	-
Acipenseridae - sturgeons										
Lake Sturgeon	*Acipenser fulvescens*	-	-	-	-	-	Y	-	-	-
Atherinopsidae – New World silversides										
Brook Silverside	*Labidesthes sicculus*	Y	Y	-	-	-	-	-	-	-
Clupeidae - herrings										
Alewife	*Alosa pseudoharengus*	-	-	-	-	-	Y	-	-	-
Gizzard Shad	*Dorosoma cepedianum*	-	-	-	-	-	Y	-	-	-
Cyprinidae - carps										
Common Carp	*Cyprinus carpio*	-	Y	-	-	-	-	-	-	-
Gobiidae - gobies										
Round Goby	*Neogobius melanostomus*	-	-	-	-	-	Y	-	-	-
Ictaluridae – North American catfishes										
Brown Bullhead	*Ameiurus nebulosus*	Y	-	-	-	-	-	Y	Y	-
Channel Catfish	*Ictalurus punctatus*	-	-	-	-	Y	-	-	-	-
Stonecat	*Noturus flavus*	Y	-	Y	Y	Y	Y	-	-	-
Tadpole Madtom	*Noturus gyrinus*	-	-	Y	Y	-	-	-	-	Y
Yellow Bullhead	*Ameiurus natalis*	Y	-	Y	Y	-	-	-	-	-
Osmeridae - smelts										
Rainbow Smelt	*Osmerus mordax*	-	-	-	-	-	Y	-	-	-
Petromyzontidae – lampreys										
Northern Brook Lamprey	*Ichthyomyzon fossor*	-	-	-	-	-	Y	-	-	-
Sea Lamprey	*Petromyzon marinus*	-	-	-	-	-	Y	Y	-	-
	Total	***21***	***17***	***15***	***25***	***23***	***48***	***29***	***15***	***7***
Note: 1. Sockeye salmon is likely a misidentification of another salmonid species as sockeye are not known to occur in Lake Huron.										

Table A-5. Species of fish reported in lakes in the LSA_{AQU} and in potential reference lakes.

Species		**Larger Lakes in LSA_{AQU}**					**Reference Lakes**			
Common Name	**Scientific Name**	**Schmidt**	**Cunningham**	**Clam**	**Silver**	**McFarlane**	**Arran**	**Hines**	**Robson**	**Clarke's**
	Temperature Regime	**Cool**	**Cool**	**Cool**	**Cool**	**Cool**	**Cool**	**Cold**	**Cool**	**Cold**
Catostomidae - suckers										
Shorthead Redhorse	Moxostoma macrolepidotum	-	-	Y	-	-	-	-	-	-
White Sucker	Catostomus commersonii	-	-	Y	Y	-	Y	Y	Y	Y
Centrarchidae - sunfishes										
Bluegill	Lepomis macrochirus	-	-	-	Y	-	-	Y	Y	-
Green Sunfish	Lepomis cyanellus	-	-	-	-	-	-	Y	Y	Y
Largemouth Bass	Micropterus salmoides	-	-	Y	Y	Y	Y	-	Y	-
Pumpkinseed	Lepomis gibbosus	-	-	Y	Y	Y	Y	Y	Y	-
Rock Bass	Ambloplites rupestris	-	-	Y	Y	Y	Y	Y	Y	Y
Smallmouth Bass	Micropterus dolomieu	-	-	Y	Y	Y	Y	Y	Y	Y
Leuciscidae - minnows										
Blackchin Shiner	Notropis heterodon	-	-	-	-	-	Y	-	-	-
Blacknose Shiner	Notropis heterolepis	-	-	Y	-	-	Y	Y	-	-
Bluntnose Minnow	Pimephales notatus	-	-	-	Y	Y	Y	Y	Y	Y
Brassy Minnow	Hybognathus hankinsoni	-	-	-	-	-	Y	-	-	-
Common Shiner	Luxilus cornutus	-	-	-	-	-	Y	Y	Y	Y
Creek Chub	Semotilus atromaculatus	-	-	-	-	Y	Y	Y	-	-
Emerald Shiner	Notropis atherinoides	-	-	-	-	-	Y	-	-	-
Fathead Minnow	Pimephales promelas	-	-	Y	-	-	-	-	-	-
Finescale Dace	Chrosomus neogaeus	-	-	Y	-	-	-	-	-	-
Golden Shiner	Notemigonus crysoleucas	-	-	-	-	-	Y	-	-	-
River Chub	Nocomis micropogon	-	-	-	-	-	Y	-	-	-
Spottail Shiner	Notropis hudsonius	-	-	-	-	-	-	-	Y	-
Esocidae - pikes										
Northern Pike	Esox lucius	Y	Y	Y	Y	Y	Y	Y	Y	Y
Gasterosteidae - sticklebacks										
Brook Stickleback	Culaea inconstans	-	-	Y	-	-	-	-	-	-
Percidae – perches and darters										
Iowa Darter	Etheostoma exile	-	-	Y	Y	-	Y	Y	Y	Y
Johnny Darter	Etheostoma nigrum	-	-	-	-	-	Y	-	-	-
Logperch	Percina caprodes	-	-	-	-	-	-	Y	Y	Y
Walleye	Sander vitreus	-	-	-	Y	-	-	-	-	-

Species		**Larger Lakes in LSA_{AQU}**					**Reference Lakes**			
Common Name	**Scientific Name**	**Schmidt**	**Cunningham**	**Clam**	**Silver**	**McFarlane**	**Arran**	**Hines**	**Robson**	**Clarke's**
	Temperature Regime	**Cool**	**Cool**	**Cool**	**Cool**	**Cool**	**Cool**	**Cold**	**Cool**	**Cold**
Yellow Perch	Perca flavescens	Y	Y	Y	Y	Y	Y	Y	Y	Y
Umbridae - mudminnows										
Central Mudminnow	Umbra limi	-	-	Y	-	Y	-	-	-	-
Ictaluridae – North American catfishes										
Brown Bullhead	Ameiurus nebulosus	-	-	Y	Y	-	Y	-	-	-
Channel Catfish	Ictalurus punctatus	-	-	-	-	-	Y	-	-	-
Yellow Bullhead	Ameiurus natalis	-	-	-	-	-	Y	-	-	-
	Total	***2***	***2***	***15***	***12***	***9***	***21***	***14***	***14***	***10***

Table A-6. Incidental observations of fish rates during TEM, AHM, and eDNA within the AOI, LSA_{AQU}, or RSA_{AQU} from field surveys in 2022.

Common Name	**Scientific Name**	**SAR**	**Rare**	**Introduced /Invasive**	**Notes**
Fish (True Fishes)					
Brook trout	*Salvelinus fontinalis*	N	N	N	
Bullhead sp.	Ameiurus sp.	NA	NA	NA	
Centrarchid (sunfishes)	Centrarchidae sp.	NA	NA	NA	
Chub	Cyprinidae sp.	NA	NA	NA	
Cyprinid sp.	Cyprinidae sp.	NA	NA	NA	
Dace minnows	Cyprinidae spp.	NA	NA	NA	
Darter	Percidae sp.	NA	NA	NA	
Minnows	Leuciscidae sp.	NA	NA	NA	
Sculpin sp.	Cottoidea sp.	NA	NA	NA	
Stickleback	Gasterosteidae sp.	NA	NA	NA	
Sucker	Catostomidae sp.	NA	NA	NA	
Trout	Salmonidae sp.	NA	NA	NA	
Unidentified Fishes	NA	NA	NA	NA	Included records of Baitfish, Small fish, and YOY fish from AHM and EDNA surveys

Table A-7. Life history characteristics of species reported in the AOI, LSA_{AQU}, and RSA_{AQU} through desk-based searches of datasets listed in **Table 1-1**. Life history information collated from the Ontario Freshwater Fishes Life History Database.

Species (Scientific Name)	Common Name(s)	General Abundance[1]	Economic Importance	General Habitat	Environment	Trophic Class	Thermal Regime	Habitat Preference	Spawning Habitat	Spawning Season	Spawning Month(s)	Spawning Temp (°C)	Fecundity	Nursery Habitat	Age at Maturity (years)	Lifespan (years)
Catostomidae - suckers																
Moxostoma duquesnei	Black Redhorse	rare	none	riverine	benthic	invertivore	warm	• pools and runs of creeks and small to medium rivers with sand, gravel and rocky substrates where siltation is minimal	• riverine	spring	May-June	14-21	1,343-17,252	riverine	3-6	10-17
Moxostoma erythrurum	Golden Redhorse	uncommon	none	riverine	benthic	invertivore	warm	• pools, runs and riffles of creeks and small to large rivers with varied substrates and moderate gradients; preferred water temperature range 26-27.5°C	• riverine	spring	May-June	10-22.5	5,041-35,000	riverine	3 (m) 4 (f)	7-11
Moxostoma valenciennesi	Greater Redhorse	uncommon	none	lacustrine riverine	benthic	invertivore	warm	• moderate to swift current riffles, runs and pools of medium to large rivers with clear water and substrates of gravel, cobble or boulders; lakes	• riverine	spring	May-June	13-19	25,190-71,920	riverine	5 (m) 6 (f)	12-20
Erimyzon sucetta	Lake Chubsucker	rare	none	lacustrine riverine	benthic	invertivore herbivore	warm	• clear, slow streams, shallow weedy lakes, ponds, wetlands and impoundments with clay, silt, sand or detritus substrates; preferred water temperature range 28-34°C	• lacustrine riverine	spring	May-June	16-23	998-18,478	lacustrine riverine	2-3	6-8
Catostomus catostomus	Longnose Sucker	common	forage fish; commercial fishery	lacustrine riverine	benthic	invertivore	cool	• clear, cold, deep water (up to 55 m) of lakes and tributary streams; occasionally brackish water; preferred water temperature range 8-17°C	• riverine	spring	April-May	5-15	10,270-89,000	lacustrine	4-6 (m) 5-7 (f)	19-28
Hypentelium nigricans	Northern Hog Sucker	common	baitfish (occasional)	riverine	benthic	invertivore herbivore	warm	• riffles runs and pools of clear creeks and small rivers with gravel, cobble substrates; rare in lakes; preferred water temperature range 25-29°C	• riverine	spring	April-May	11-22	30000	riverine	2-3 (m) 3-4 (f)	10-11
Moxostoma macrolepidotum	Shorthead Redhorse	common	none	lacustrine riverine	benthic	invertivore	warm	• pools runs and riffles in small to large rivers with sand and gravel substrates and lake shallows; preferred water temperature range 26-27.5°C	• Gravel beds in riffle areas in watercourses	spring	April-June	10-18	7,544 - 44,000	riverine	3-5	11-20
Moxostoma anisurum	Silver Redhorse	uncommon	none	lacustrine riverine	benthic	invertivore	cool	• mud- to rock-bottomed pools and runs of small to large rivers; occasionally lakes and impoundments	• riverine	spring	April-June	9-14.5	14,910-36,340	riverine	5-8	12-26
Catostomus commersonii	White Sucker	common	forage fish, baitfish, coarse fish	lacustrine riverine	benthic	invertivore detritivore	cool	• pools and riffles of creeks and rivers, warm shallow lakes and embayments of larger lakes, usually at depths of 6-9 m; preferred water temperature range 17-24°C	• Gravel beds in watercourses	spring	April-June	10-20	12,500 - 140,000	lacustrine riverine	2-3 (m) 3-4 (f)	15-25
Centrarchidae – sunfishes																
Pomoxis nigromaculatus	Black Crappie	common	pan fish	lacustrine riverine	benthopelagic	invertivore carnivore	cool	• clear, quiet waters of large ponds, small lakes, bays and shallower areas of larger lakes and areas of low flow in larger rivers, associated with abundant aquatic vegetation and mud or sand substrate; preferred water temperature range 21-25°C	• Sand or mud substrate in lakes or watercourses	spring	May-June	14-22	10,836 - 334,396	lacustrine riverine	2-3	8-13

Species (Scientific Name)	Common Name(s)	General Abundance[1]	Economic Importance	General Habitat	Environment	Trophic Class	Thermal Regime	Habitat Preference	Spawning Habitat	Spawning Season	Spawning Month(s)	Spawning Temp (°C)	Fecundity	Nursery Habitat	Age at Maturity (years)	Lifespan (years)
Lepomis macrochirus	Bluegill	common	pan fish	lacustrine riverine	benthopelagic	invertivore	warm	• vegetated small lakes, ponds, shallow weedy bays of larger lakes and pools of creeks and small to large rivers; preferred water temperature range 24-30°C	• lacustrine riverine	summer	June-August	19-26	2,450-45,575	lacustrine riverine	2-3 (m) 3-4 (f)	8-11
Lepomis cyanellus	Green Sunfish	common	pan fish	lacustrine riverine	benthopelagic	invertivore carnivore	warm	• quiet pools and backwaters of sluggish streams, ponds, lakes and impoundments, often near aquatic vegetation; preferred water temperature range 27-31°C	• lacustrine riverine	summer	June-August	20-28	2,000 - 10,000	lacustrine riverine	2-3	5-8
Micropterus salmoides	Largemouth Bass	common	sport fish	lacustrine riverine	benthopelagic	invertivore carnivore	warm	• Clear, warm, shallow lakes, bays, ponds, marshes and backwaters and pools of creeks and small to large rivers, often with soft mud or sand substrate and dense aquatic vegetation; usually at depths <6 m; preferred water temperature range 26-30°C	• Sand or mud substrate in lakes or watercourses	spring	May-June	15-21	4,550 - 54,732	lacustrine riverine	3-4 (m) 4-5 (f)	12-23
Lepomis peltastes	Northern Sunfish	uncommon	none	lacustrine riverine	benthopelagic	invertivore	warm	• warm, clear, quiet pools in creeks and rivers, ponds and lake shallows with aquatic vegetation and sand/silt/marl substrates; preferred water temperature 21°C	• lacustrine riverine	summer	June-July	20-25	480-3,560	lacustrine riverine	2-3	6-9
Lepomis gibbosus	Pumpkinseed	common	pan fish	lacustrine riverine	benthopelagic	invertivore carnivore	warm	• warm, shallows of lakes and ponds, quiet, pools of creeks and small rivers, with aquatic vegetation and organic debris; preferred water temperature range 22-30°C	• Shallow lakes or watercourses with abundant instream vegetation	spring-summer	May-August	17-26	2,451 - 10,633	lacustrine riverine	2-3	7-10
Ambloplites rupestris	Rock Bass	common	pan fish	lacustrine riverine	benthopelagic	invertivore carnivore	cool	• rocky or vegetated shallows of lakes and pools of creeks and small to medium rivers; reported to depths of 21 m; preferred water temperature range 21-26°C	• Shallow lakes or watercourses	spring	May-June	18-23	2,000 - 11,000	lacustrine riverine	3-5	8-131
Micropterus dolomieu	Smallmouth Bass	common	sport fish	lacustrine riverine	benthopelagic	invertivore carnivore	cool	• clear, gravel-bottomed runs and flowing pools of small to large rivers and shallow (5-7 m), rocky and sandy areas of lakes; preferred water temperature range 20-27°C	• Sand, gravel or rock substrate in lakes or watercourses	spring	May-June	13-20	1,724 - 27,200	lacustrine riverine	3-4 (m) 4-5 (f)	8-18
Cottidae – sculpins																
Cottus bairdii	Mottled Sculpin	common	forage fish baitfish (limited)	lacustrine riverine	benthic	invertivore	cool	• cobble and gravel riffles of cool creeks, small rivers and rocky shores of lakes (<16 m deep); preferred water temperature range 13-18°C	• Under a rock or ledge in lakes or watercourses	spring	April-May	5-16	35 - 949	lacustrine riverine	2-3	4-6
Cottus cognatus	Slimy Sculpin	common	forage fish baitfish (limited)	lacustrine riverine	benthic	invertivore	cold	• gravelly, rocky riffles of cold water streams and rocky substrates in deep (37-108 m), cooler waters of lakes; preferred water temperature range 9-14°C	• Under a rock or ledge in lakes or watercourses	spring	April-May	4-10	42 - 1,157	lacustrine riverine	2-3	4-7
Leuciscidae – minnows																

Species (Scientific Name)	Common Name(s)	General Abundance[1]	Economic Importance	General Habitat	Environment	Trophic Class	Thermal Regime	Habitat Preference	Spawning Habitat	Spawning Season	Spawning Month(s)	Spawning Temp (°C)	Fecundity	Nursery Habitat	Age at Maturity (years)	Lifespan (years)
Notropis heterodon	Blackchin Shiner	common	forage fish baitfish (occasional)	lacustrine riverine	benthopelagic	invertivore	cool	• nearshore of clear, vegetated lakes and quiet pools and slow runs in creeks and small rivers with sandy substrates	• Deposits adhesive eggs over aquatic vegetation in lakes and watercourses	summer	June-August	no data	675 - 1,800	lacustrine riverine e	1	2-4
Notropis heterolepis	Blacknose Shiner	common	baitfish	lacustrine riverine	benthopelagic	invertivore herbivore	cool	• clear vegetated lakes and pools of creeks and small rivers with sandy substrates	• Deposits adhesive eggs over sand or aquatic vegetation in lakes or watercourses	summer	June-July	no data	850 - 1,420	lacustrine riverine	1	2-3
Pimephales notatus	Bluntnose Minnow	common	forage fish baitfish (occasional)	lacustrine riverine	benthopelagic	detritivore	warm	• sand and gravel bottomed shallows of clear lakes, creeks, rivers and ponds; preferred water temperature range 26-29°C	• Spawns under rocks or woody debris in lakes or watercourses	summer	June-August	19-26	365 - 4,195	lacustrine riverine	2-3 (m) 1-2 (f)	3-5
Hybognathus hankinsoni	Brassy Minnow	common	forage fish baitfish (occasional)	lacustrine riverine	benthic	planktivore detritivore	cool	• pools of sluggish, clear creeks and small rivers with soft substrates, boggy lakes and shallow bays; often stained waters; usually associated with aquatic vegetation	• lacustrine riverine	spring-summer	May-July	16-27	120 - 2,500	lacustrine riverine	1-2	3-5
Luxilus cornutus	Common Shiner	common	forage fish baitfish	riverine	benthopelagic	invertivore	cool	• pools near riffles in clear, cool creeks and small to medium rivers, and nearshore in clear-water lakes; preferred water temperature 21.9°C	• Spawns under rocks or woody debris in lakes or watercourses	spring	May-June	16-26	400 - 3,940	riverine	1-3	5-7
Semotilus atromaculatus	Creek Chub	common	baitfish	riverine	benthopelagic	invertivore carnivore	cool	• pools of clear creeks and small rivers over sand, gravel and cobble substrates; rare in lakes and large rivers; preferred water temperature 20.8°C	• Spawns in gravel substrate above riffles in watercourses	spring	May-June	12-17	500 - 7,539	riverine	3 (m) 2 (f)	5-10
Rhinichthys atratulus	Eastern Blacknose Dace	limited distribution	forage fish bait fish (occasional)	riverine	benthic	invertivore	cool	• runs and pools of clear, cool, swiftly-flowing creeks and small rivers with gravelly substrate; preferred water temperature range 19-25°C	• riverine	spring	May-June	15.5-22	166-1,116	riverine	2	3-4
Notropis atherinoides	Emerald Shiner	common	forage fish baitfish	lacustrine riverine	benthopelagic	planktivore	cool	• pools and runs of medium to large rivers with sand or gravel substrates and open waters of lakes; preferred water temperature range 9-23°C	• Spawns in gravel in lakes and watercourses	summer	June-August	20-24	868 - 8,733	lacustrine riverine	1-2	2 (m) 3-4 (f)
Pimephales promelas	Fathead Minnow	common	forage fish baitfish	lacustrine riverine	benthopelagic	detritivore invertivore	warm	• still waters of ponds, lakes, creeks and small rivers with muddy substrate; preferred water temperature range 21-29°C	• Spawns under rocks or woody debris in lakes or watercourses	spring-summer	May-August	14-29	255 - 2,622	lacustrine riverine	1-2	3-6
Chrosomus neogaeus	Finescale Dace	common	forage fish baitfish	lacustrine riverine	benthopelagic	invertivore planktivore	cool	• lakes, bogs, ponds and sluggish pools of creeks and small rivers with silty substrates and aquatic vegetation; usually stained water; preferred water temperature 24.1°C	• Spawns in woody debris in watercourses and lakes	spring	April-May	11-18	250 - 5,850	lacustrine riverine	2	4-8

Species (Scientific Name)	Common Name(s)	General Abundance[1]	Economic Importance	General Habitat	Environment	Trophic Class	Thermal Regime	Habitat Preference	Spawning Habitat	Spawning Season	Spawning Month(s)	Spawning Temp (°C)	Fecundity	Nursery Habitat	Age at Maturity (years)	Lifespan (years)
Notemigonus crysoleucas	Golden Shiner	common	forage fish baitfish	lacustrine	benthopelagic	invertivore herbivore	cool	• clear, weedy, quiet waters of lakes, ponds, reservoirs and pools of small to large rivers with muddy substrate; preferred water temperature range 17-24°C	• Spawns in instream vegetation in watercourses and lakes	summer	June-August	20-27	2,680 - 4,670	lacustrine	2-3	5-8
Nocomis biguttatus	Hornyhead Chub	common	bait fish	riverine	benthopelagic	invertivore herbivore	cool	• pools and runs of clear, slow-flowing, gravelly small- to medium-sized streams, often tributary to larger rivers	• riverine	spring-summer	May-July	16-26	460-995	riverine	2-3	4
Rhinichthys cataractae	Longnose Dace	common	forage fish baitfish (occasional)	lacustrine riverine	benthic	invertivore	cool	• cobble, boulder or gravel riffles of clean, cool, swiftly-flowing creeks and small to medium rivers, and rocky shores of lakes; preferred water temperature range 13-21°C	• Deposits eggs over substrate in riffles in watercourses	spring-summer	May-July	11-23	150 - 3,374	riverine	2-3	4 (m) 5 (f)
Notropis volucellus	Mimic Shiner	common	forage fish baitfish (occasional)	lacustrine riverine	benthopelagic	invertivore herbivore	warm	• pools of creeks and small to large rivers, open waters and quiet backwaters of lakes; often associated with sand and gravel substrates	• Deposits adhesive eggs over aquatic vegetation	summer	June-July	no data	67 - 960	lacustrine riverine	1	2-3
Margariscus nachtriebi	Northern Pearl Dace	common	forage fish bait fish	lacustrine riverine	benthopelagic	invertivore carnivore	cool	• pools of cool, clear headwater streams, bogs, ponds and small lakes with silt, sand or gravel bottoms, close to aquatic vegetation; preferred water temperature 16.2°C	• lacustrine riverine	spring	May-July	12-18	621-4,240	lacustrine riverine	1 (m) 2 (f)	3 (m) 4 (f)
Chrosomus eos	Northern Redbelly Dace	common	forage fish baitfish	lacustrine riverine	benthopelagic	invertivore planktivore	cool	• lakes, bogs, ponds and pools of creeks with organic substrates and aquatic vegetation; usually stained water; preferred water temperature 25.3°C	• Spawns in algal beds in lakes and watercourses	spring-summer	May-July	13-21	435 - 6,450	lacustrine riverine	1 (m) 2 (f)	3-7
Notropis anogenus	Pugnose Shiner	rare	none	lacustrine riverine	benthopelagic	detritivore	cool	• clear weedy lakes and quiet vegetated pools and runs of creeks and rivers with clean sandy or marl substrates; often associated with wild rice beds	• lacustrine riverine	summer	June-July	21-29	530-1,275	lacustrine riverine	1	3
Lythrurus umbratilis	Redfin Shiner	uncommon	forage fish	riverine	benthopelagic	invertivore	cool	• warm, clear to turbid, quiet to flowing pools of creeks and small to medium rivers with abundant aquatic vegetation and clean cobble, gavel or sand substrates; preferred water temperature 20.5°C	• riverine	summer	June-August	21+	219-887	riverine	1	2-3
Nocomis micropogon	River Chub	common	bait fish	riverine	benthopelagic	planktivore invertivore	cool	• swift currents and pools in medium sized creeks and rivers of high to moderate gradients with clean clear water and gravel to boulder substrates; preferred water temperature 21.7°C	• riverine	spring	May-June	15-20.5	400-725	riverine	2-3 (m) 3 (f)	4-5
Notropis rubellus	Rosyface Shiner	common	forage fish	riverine	benthopelagic	Invertivore detritivore herbivore	warm	• clear, flowing pools and runs of small to medium rivers with sand and gravel substrates; preferred water temperature range 22-28°C	• riverine	spring-summer	May-July	20-27	450-1,482	riverine	1-2	3
Notropis stramineus	Sand Shiner	common	forage fish bait fish	lacustrine riverine	benthopelagic	Invertivore detritivore	warm	• sand and gravel runs and pools of warm, clear creeks and small to large	• lacustrine riverine	summer	June-August	21-27	150-2,660	lacustrine riverine	1	2-3

Species (Scientific Name)	Common Name(s)	General Abundance[1]	Economic Importance	General Habitat	Environment	Trophic Class	Thermal Regime	Habitat Preference	Spawning Habitat	Spawning Season	Spawning Month(s)	Spawning Temp (°C)	Fecundity	Nursery Habitat	Age at Maturity (years)	Lifespan (years)
								rivers, and sandy shallows of lakes with rooted aquatic vegetation								
Cyprinella spiloptera	Spotfin Shiner	common	forage fish bait fish (occasional)	riverine	benthopelagic	Invertivore herbivore	warm	• sand and gravel runs and pools of creeks and small to medium rivers with moderate gradient; occasionally lake shallows; preferred water temperature 29.5°C	• riverine	summer	June-August	21-24	207-1,580	riverine	1-2	4-5
Notropis hudsonius	Spottail Shiner	common	forage fish bait fish	lacustrine riverine	benthopelagic	Invertivore planktivore	cool	• lakes, rivers and streams with slow to moderate current and sand, gravel, mud or silt substrates; preferred water temperature range 13-22°C	• lacustrine riverine	spring	May-June	15-22	746-8,898	lacustrine riverine	1-2	3-5
Luxilus chrysocephalus	Striped Shiner	common	forage fish bait fish	riverine	benthopelagic	invertivore	cool	• pools near riffles in clear to fairly turbid, warm creeks and small- to medium-sized rivers with moderate current and gravel or cobble substrate, often associated with aquatic vegetation	• riverine	spring-summer	May-July	15-27	900-1,150	riverine	2	4-6
Esocidae - pikes																
Esox masquinongy	Muskellunge (muskie)	common	sport fish commercial fishery (historical)	lacustrine riverine	benthopelagic	carnivore	warm	• clear, cool to warm waters of medium to large lakes and slow rivers; preferred water temperature range 22-26°C	• Shallow vegetated floodplains of lakes and watercourses	spring	April-May	9-16	6,315 - 454,717	lacustrine riverine	3-6 (m) 4-8 (f)	15-30
Esox lucius	Northern Pike	common	sport fish commercial fishery	lacustrine riverine	benthopelagic	carnivore	cool	• clear, cool to warm, weedy bays of lakes and slow, meandering, heavily vegetated rivers; preferred water temperature range 17-24°C	• Shallow vegetated floodplains of lakes and watercourses	spring	March-May	4-11	7,691 - 595,200	lacustrine riverine	2-3 (m) 3-4 (f)	10-26
Gasterosteidae – sticklebacks																
Culaea inconstans	Brook Stickleback	common	forage fish baitfish (incidental)	lacustrine riverine	benthopelagic	planktivore invertivore	cool	• small, boggy headwater streams, shallow lake margins, ponds, and clear pools and backwaters of creeks and small rivers; usually associated with aquatic vegetation; occasionally brackish water; preferred water temperature 21.3°C	• Constructs organic debris nest	spring-summer	May-July	8-19	40 - 451	lacustrine riverine	1	2-3
Pungitius pungitius	Ninespine Stickleback	common	forage fish baitfish (incidental)	lacustrine riverine	benthopelagic	planktivore	cool	• shallow vegetated nearshore of lakes, ponds, pools of sluggish streams, and marine/estuarine environments; preferred water temperature range 9-16°C	• Constructs organic debris nest	summer	June-July	9-17	20 - 174	lacustrine riverine	1 (m) 1-2 (f)	1-2 (m) 3-4 (f)
Gasterosteus aculeatus	Threespine Stickleback	common	forage fish	lacustrine riverine estuarine marine	benthopelagic	invertivore	cool	• shallow vegetated areas of creeks and rivers, protected bays of lakes with mud or sand bottom, and coastal marine/estuarine environments; preferred water temperature range 9-12°C	• lacustrine riverine	spring-summer	May-July	10-22	41-885	lacustrine riverine	1	1-3
Gadidae – codfishes																

Species (Scientific Name)	Common Name(s)	General Abundance[1]	Economic Importance	General Habitat	Environment	Trophic Class	Thermal Regime	Habitat Preference	Spawning Habitat	Spawning Season	Spawning Month(s)	Spawning Temp (°C)	Fecundity	Nursery Habitat	Age at Maturity (years)	Lifespan (years)
Lota lota	Burbot (ling)	common	sport fish (incidental)	lacustrine riverine	benthic	invertivore carnivore	cold	• moderate to deep waters (to 90 m) of lakes, large cool rivers and streams, often under rocks, among roots or in holes in the banks; preferred water temperature range 7-18°C	• Sand or gravel substrate in lakes or large watercourses under ice cover	winter	January-March	1-4	45,600 - 1,444,122	lacustrine riverine	3 - 7 (m) 4 - 8 (f)	10-20
Percidae - perches and darters																
Percina maculata	Blackside Darter	uncommon	forage fish baitfish (incidental)	riverine	benthic	invertivore	cool	• quiet reaches and pools of creeks and small to medium rivers with moderate current and cobble, gravel or sand substrates, utilizing cover afforded by coarse woody debris, aquatic vegetation and undercut banks	• riverine	spring	May-June	16-17	121-1,758	riverine	1-2	4
Etheostoma flabellare	Fantail Darter	common	forage fish baitfish (incidental)	riverine	benthic	invertivore	cool	• shallow, rocky riffles of creeks and small to medium rivers with deep pools and slow to moderate currents; preferred water temperature 22.4°C	• riverine	spring	May-June	13-17	37-588	riverine	1-2	4-5
Etheostoma blennioides	Greenside Darter	uncommon	forage fish	riverine	benthic	invertivore	warm	• algae-covered rocky riffles of creeks and small to medium rivers with clear water and moderate to fast current; preferred water temperature 25.4°C	• riverine	spring	April-June	10-19	181-3.664	riverine	1-2	3-5
Etheostoma exile	Iowa Darter	Common	baitfish (incidental)	lacustrine riverine	benthic	invertivore	cool	• clear waters of lakes, and slow-flowing pools of creeks and small to medium rivers, having rooted aquatic vegetation and organic to sand substrates; preferred water temperature range 12-25°C	• Shallow water with woody debris or roots in watercourses and lakes	spring	April-June	12-16	312 - 2,048	lacustrine	1	3-4
Etheostoma nigrum	Johnny Darter[2]	common	forage fish baitfish (incidental)	lacustrine riverine	benthic	invertivore	cool	• sandy, silty, gravelly, sometimes rocky, pools of creeks and small to medium rivers, and sandy shores of lakes; reported to a depth of 42 m in the Great Lakes; preferred water temperature 22.8°C	• under rocks in watercourses and lakes	spring	May-June	12-21	48 - 1,248	lacustrine riverine	1	3 (m) 4 (f)
Etheostoma microperca	Least Darter	uncommon	none	lacustrine riverine	benthic	invertivore	warm	• among submergent vegetation in clear lakes, stream margins and pools of creeks and small rivers with soft sand, mud or organic substrates	• lacustrine riverine	spring	May-June	13-18	31-1,102	lacustrine riverine	1	1
Percina caprodes	Logperch	common	forage fish baitfish (occasional)	lacustrine riverine	benthic	invertivore	warm	• sand, gravel or rocky beaches in lakes and over similar substrates in creeks and rivers, avoiding silted areas and swift currents; reported at depths up to 39 m in Lake Erie	• Sand or gravel substrate in lakes or watercourses	spring	May-June	10-18	402 - 3,172	lacustrine riverine	1-2	3-4
Etheostoma caeruleum	Rainbow Darter	common	forage fish baitfish (incidental)	riverine	benthic	invertivore	cool	• fast-flowing gravel and cobble riffles of clear creeks and small to medium rivers; preferred water temperature 19.8°C	• riverine	spring	April-June	15-18	82-1,462	riverine	1	3-5
Sander canadensis	Sauger	uncommon	commercial fishery sport fish	lacustrine riverine	benthopelagic	invertivore carnivore	cool	• sand and gravel runs, pools and backwaters of small to large rivers, and shallow, turbid lakes; usually inhabit surface waters (<6 m);	• Sand or gravel substrate in lakes or watercourses	spring	May-June	6-12	4,208 - 209,920	lacustrine riverine	2-3 (m) 4-6 (f)	7-13

Species (Scientific Name)	Common Name(s)	General Abundance[1]	Economic Importance	General Habitat	Environment	Trophic Class	Thermal Regime	Habitat Preference	Spawning Habitat	Spawning Season	Spawning Month(s)	Spawning Temp (°C)	Fecundity	Nursery Habitat	Age at Maturity (years)	Lifespan (years)
								preferred water temperature range 20-24°C								
Sander vitreus	Walleye (yellow pickerel)	common	commercial fishery sport fish	lacustrine riverine	benthopelagic	invertivore carnivore	cool	• lakes (at depths up to 21 m), and pools, backwaters and runs of medium to large rivers; preferred water temperature range 19-23°C	• Gravel or rocky substrate in lakes or watercourses	spring	April-June	4-11	22,000 - 615,000	lacustrine riverine	3-4 (m) 4-5 (f)	12-26
Perca flavescens	Yellow Perch	common	forage fish commercial fishery panfish	lacustrine riverine	benthopelagic	invertivore carnivore	cool	• lakes, ponds and pools of creeks and small to large rivers with moderate aquatic vegetation and clear water, usually at depths <9 m; preferred water temperature range 18-24°C	• Over vegetation or woody debris in lakes and watercourses	spring	April-May	6-12	950 - 210,000	lacustrine	2-3 (m) 3-4 (f)	7-12
Umbridae – mudminnows																
Umbra limi	Central Mudminnow[3]	common	forage fish baitfish	Riverine	benthic	invertivore	cool	• heavily vegetated ponds, wetlands, bogs or pools of small creeks and quiet, shallow (0.5 m) areas of lakes with mud and organic substrates	• Areas with instream vegetation in watercourses and lakes	spring	April-May	10-16	189 - 3,828	riverine	1-2 (m) 2-3 (f)	4-9
Salmonidae - trouts and salmons																
Coregonus hoyi	Bloater	common	commercial fishery forage fish	lacustrine	pelagic	planktivore invertivore	cold	• clear, deep waters (38-121 m), usually 55-91 m, at water temperatures of 1.5-11.4°C; preferred water temperature range 4-7°C	• lacustrine	fall-winter	November-March	<5	1,387 - 34,891	lacustrine	2-3	9-10 (m) 10-11 (f)
Salvelinus fontinalis	Brook (speckled) Trout	common	sport fish	lacustrine riverine	benthopelagic	invertivore carnivore	cold	• cold, clear, well-oxygenated streams, rivers, ponds and lakes with a maximum water temperature of less than 22°C	• Gravel substrates in riffles in watercourses or groundwater upwelling areas in lakes	fall	September-November	3.5-9	88 - 6,894	lacustrine riverine	2-3	4-8
Salmo trutta	Brown Trout	common	sport fish	lacustrine riverine	benthopelagic	invertivore carnivore	cold	• cool creeks and rivers with moderate flow, gravelly substrates and riffle-pool habitat, and lake shallows; preferred water temperature range 15-18°C	• riverine	fall	October-November	6-9		riverine	2-4 (m) 3-5 (f)	5-12
Oncorhynchus tshawytscha	Chinook Salmon	common	sport fish	lacustrine marine	pelagic	invertivore carnivore	cold	• mid-waters (15-60 m) in or below the thermocline; preferred water temperature range 12-16°C	• riverine	fall	September-October	5.5-14.5		lacustrine marine	4-5	4-5
Oncorhynchus kisutch	Coho Salmon	uncommon	sport fish	lacustrine marine	pelagic	invertivore carnivore	cold	• mid-waters (16-60 m); preferred water temperature range 11-17°C	• riverine	fall	October-November	1-8		riverine	3-4	3-4
Salvelinus namaycush	Lake Trout	common	commercial fishery sport fish	lacustrine	benthopelagic	invertivore carnivore	cold	• cold deeper waters (12-23m) of lakes, below the thermocline in summer; preferred water temperature range 9-13°C	• Rocky substrates in lakes in shallow or deep water lakes	fall	September-November	9-14	1,093 - 18,051	lacustrine	3-7 (m) 4-8 (f)	15-30
Coregonus clupeaformis	Lake Whitefish	common	commercial fishery sport fish	lacustrine riverine	benthic	invertivore carnivore	cold	• cool waters (18-37 m) of lakes and large rivers below the thermocline; preferred water temperature range 8-14°C	• Rocky substrates in lakes and potentially	fall	October-December	1-8	5,958 - 121,700	lacustrine riverine	4-7	12-28

Species (Scientific Name)	Common Name(s)	General Abundance[1]	Economic Importance	General Habitat	Environment	Trophic Class	Thermal Regime	Habitat Preference	Spawning Habitat	Spawning Season	Spawning Month(s)	Spawning Temp (°C)	Fecundity	Nursery Habitat	Age at Maturity (years)	Lifespan (years)
									larger watercourses							
Oncorhynchus gorbuscha	Pink Salmon	uncommon	sport fish	lacustrine marine	pelagic	invertivore	cold	• mid-waters (6-36 m); preferred water temperature range 13-17°C	• riverine	fall	September-October	8-14		lacustrine marine	2-3	2-3
Oncorhynchus mykiss	Rainbow Trout (steelhead)	common	sport fish	lacustrine riverine	benthopelagic	invertivore carnivore	cold	• mid-waters of lakes; creeks and rivers with moderate flow, gravelly bottoms and riffle-pool habitat; preferred water temperature range 12-18°C	• Gravel substrates in watercourses	Spring	March-May	4-10	200 - 12,749	riverine	2-4 (m) 3-5 (f)	3-8
Prosopium cylindraceum	Round Whitefish	common	commercial fishery	lacustrine riverine	benthopelagic	invertivore carnivore	cold	• shallow waters (<37 m) of deep lakes and clear streams; preferred water temperature 17.5°C	• lacustrine riverine	fall	November-December	2-4.5	1,076-26,732	lacustrine riverine	2-4	16-25
Salvelinus fontinalis x S. namaycush	splake (backcross)	uncommon	sport fish	lacustrine	benthopelagic	invertivore carnivore	cold	• mid-waters (9-11m) of lakes, near the thermocline; preferred water temperature range 10-16°C	• lacustrine	fall	October-November	6-14	855 - 6,075	lacustrine	3-4	7-9
Acipenseridae – sturgeons																
Acipenser fulvescens	Lake Sturgeon	uncommon	commercial fishery (historical)	lacustrine riverine	benthic	invertivore herbivore	cool	• bottoms of lakes and large rivers, usually 5 to 10 m deep, over clay, mud, sand and gravel; preferred water temperature range 15-17°C	• lacustrine riverine	spring	May-June	11-18	48,420-885,360	lacustrine riverine	12-20 (m) 14-33 (f)	50-60 (m) 80-155 (f)
Amiidae – bowfins																
Amia calva	Bowfin	common	coarse fish	lacustrine riverine	benthopelagic	carnivore	warm	• warm, weedy lake embayments and sluggish pools and backwaters of lowland rivers; preferred water temperature range 28-32°C	• lacustrine	spring	May-June	16-19	2,765-98,737	lacustrine	3-4 (m) 4-5 (f)	6 (m) 10-12 (f)
Atherinopsidae - New World silversides																
Labidesthes sicculus	Brook Silverside	common	forage fish	lacustrine riverine	pelagic	planktivore invertivore	warm	• surface waters (10-12 cm) of lakes and reservoirs, usually in open water, and quiet pools of rivers; preferred water temperature 24.5°C	• lacustrine riverine	spring-summer	May-August	17-23	73-785	lacustrine riverine	1	1
Clupeidae – herrings																
Alosa pseudoharengus	Alewife	common	forage fish	lacustrine marine	pelagic	planktivore	cold	• open, waters (16-28 m) to a depth of 50 m (summer) or 90 m (winter); preferred water temperature range 16-21°C	• lacustrine riverine	summer	June-August	13-21	2,180-22,407	lacustrine riverine	1-2 (m) 2-3 (f)	5-8
Dorosoma cepedianum	Gizzard Shad	common	forage fish	lacustrine riverine	pelagic	herbivore	cool	• open surface waters (<33 m) of medium to large rivers, lakes and impoundments over mud bottom; often ascends creeks and small rivers with well-developed pools; preferred water temperature range 19-23°C	• lacustrine riverine	summer	June-July	17-23	22,404-543,912	lacustrine riverine	2-3	6-10
Cyprinidae – carps																
Cyprinus carpio	Common Carp	common	coarse fish commercial fishery	lacustrine riverine	benthopelagic	invertivore detritivore	warm	• pools of small to large low gradient rivers, lakes, reservoirs and ponds, with abundant aquatic vegetation, at depths of <30 m; preferred water temperature range 27-32°C	• lacustrine riverine	spring-summer	May-August	17-26	36,000-2,208,000	lacustrine riverine	2-4 (m) 3-5 (f)	9-20
Fundulidae - topminnows																

Species (Scientific Name)	Common Name(s)	General Abundance[1]	Economic Importance	General Habitat	Environment	Trophic Class	Thermal Regime	Habitat Preference	Spawning Habitat	Spawning Season	Spawning Month(s)	Spawning Temp (°C)	Fecundity	Nursery Habitat	Age at Maturity (years)	Lifespan (years)
Fundulus diaphanus	Banded Killifish	common	none	lacustrine riverine	benthopelagic	invertivore planktivore	cool	• quiet, shallow, margins of lakes, ponds and sluggish streams in areas with sand and gravel substrates and patches of aquatic macrophytes; preferred water temperature 21°C	• lacustrine riverine	summer	June-August	19-24	426-1,062	lacustrine riverine	1-2	3-4
Gobiidae – gobies																
Neogobius melanostomus	Round Goby	common	invasive species	lacustrine riverine	benthic	invertivore	cool	• cobble, gravel and sandy substrates in the lower to middle reaches of rivers and nearshore of lakes (to 20 m); optimum water temperature range 23-26°C	• lacustrine riverine	spring-summer	May-July	9-26	198-1,818	lacustrine riverine	2-3 (m) 1-2 (f)	4-5 (m) 3-4 (f)
Ictaluridae - North American catfishes																
Ameiurus melas	Black Bullhead	uncommon	none	lacustrine riverine	benthic	invertivore carnivore	warm	• lakes, ponds, impoundments, and oxbows, pools and backwaters of creeks and rivers with low gradient and soft substrates	• lacustrine riverine	spring	May-June	16-24	1,040-6,820	lacustrine riverine	2-3	6-10
Ameiurus nebulosus	Brown Bullhead	common	commercial fishery	lacustrine riverine	benthic	invertivore herbivore carnivore	warm	• pools and sluggish runs over sand to mud substrates in creeks and rivers, impoundments, ponds and lake embayments; preferred water temperature range 25-31°C	• lacustrine riverine	spring	May-June	14-25	1,050-13,800	lacustrine riverine	2-3	8-12
Ictalurus punctatus	Channel Catfish	common	commercial fishery sport fish	lacustrine riverine	benthic	invertivore carnivore	warm	• deep pools and runs in small to large rivers with sand, gravel or cobble substrates, and cool, clear, deeper waters of lakes; preferred water temperature range 25-31°C	• lacustrine riverine	spring-summer	May-July	18-27	1,052-70,000	lacustrine riverine	5-7	15-27
Noturus flavus	Stonecat	common	none	riverine	benthic	invertivore carnivore	warm	• cobble and boulder riffles and runs of creeks and small to large rivers, and gravel shoals of lakes; preferred water temperature 25.1°C	• riverine	summer	June-August	23-29	767-1,205	riverine	3 (m) 4-5 (f)	6-10
Noturus gyrinus	Tadpole Madtom	uncommon	none	lacustrine riverine	benthic	invertivore planktivore	warm	• quiet, slow moving, pools and backwaters of creeks and small to large rivers, and clear waters of shallow lakes, ponds, and stream mouths, with soft, muddy substrates and extensive vegetation	• riverine	summer	June-July	20-25	43-529	lacustrine riverine	1-2	3-4
Ameiurus natalis	Yellow Bullhead	uncommon	none	lacustrine riverine	benthic	invertivore carnivore	warm	• pools and backwaters over muddy substrates in sluggish creeks and small to large rivers, oxbows, ponds, impoundments and heavily vegetated areas of shallow bays and small lakes; preferred water temperature range 27-29°C	• lacustrine riverine	spring	May-June	16-24	1,652-6,600	lacustrine riverine	2-3	6-12
Lepisosteidae – gars																
Lepisosteus osseus	Longnose Gar	common	sport fish	lacustrine riverine	benthopelagic	carnivore	warm	• vegetated, sluggish pools, backwaters and oxbows of medium to large rivers and weedy, quiet shallows of warm lakes with silty, sandy substrates; often near logs and brushpiles;	• lacustrine	spring	May-June	16.5-21	1,110-77,156	lacustrine	3-4 (m) 4-6 (f)	9-17 (m) 16-22 (f)

Species (Scientific Name)	Common Name(s)	General Abundance[1]	Economic Importance	General Habitat	Environment	Trophic Class	Thermal Regime	Habitat Preference	Spawning Habitat	Spawning Season	Spawning Month(s)	Spawning Temp (°C)	Fecundity	Nursery Habitat	Age at Maturity (years)	Lifespan (years)
								preferred water temperature range 25.3-33.1°C								
Moronidae – temperate basses																
Morone chrysops	White Bass	uncommon	commercial fishery (historical)	lacustrine riverine	benthopelagic	invertivore carnivore	warm	• open, surface waters (<14 m) of lakes and pools of small to large rivers with moderate current and sand to gravel substrates; preferred water temperature range 28-32°C	• lacustrine riverine	spring	May-June	14-22.5	61,700-1,049,207	lacustrine riverine	2 (m) 3 (f)	7-9
Morone americana	White Perch	common	commercial fishery pan fish	lacustrine riverine estuarine marine	benthopelagic	invertivore carnivore	warm	• shallows of lakes and bays, pools and quiet water areas of medium to large rivers, usually over mud substrate; preferred water temperature range 26-30°C	• lacustrine riverine	spring	May-June	11-16	5,100-388,736	lacustrine riverine estuarine	2-3 (m) 3-4 (f)	7-10
Osmeridae – smelts																
Osmerus mordax	Rainbow Smelt	common	forage fish commercial fishery sport fish invasive species	lacustrine marine	pelagic	invertivore carnivore	cold	• cool, clear, mid-waters (14-64 m) of lakes and medium to large rivers; preferred water temperature range 7-16°C	• lacustrine riverine	spring	March-April	4.5-11	1,700-69,600	lacustrine estuarine	2-3	5-7
Petromyzontidae – lampreys																
Ichthyomyzon fossor	Northern Brook Lamprey	uncommon	none	riverine	benthic	herbivore	cool	• adults in clean, clear riffles and runs of small rivers with gravel and sand substrates; ammocoetes occupy quiet water with sand, silt and detritus substrates	• riverine	spring	May-June	13-20.5	501-1,979	riverine	3-7	4-8
Petromyzon marinus	Sea Lamprey	common	invasive species	lacustrine marine	benthopelagic	herbivore detritivore (carnivore)	cool	• feeding adults in open waters of lakes and large rivers; ammocoetes inhabit flowing areas of streams, burrowing in sandy silt substrates; preferred water temperature range 6-15°C	• riverine	spring	May-June	11-24	13,974-107,138	riverine	3-7	5-9
Sciaenidae – drums and croakers																
Aplodinotus grunniens	Freshwater Drum (sheepshead)	common	commercial fishery sportfish (incidental)	lacustrine riverine	benthic	invertivore carnivore	warm	• sandy, silty bottoms of lakes and reservoirs (to 18 m), and pools in low to moderate-gradient, often turbid, rivers; preferred water temperature range 24-28°C	• lacustrine riverine	spring-summer	May-July	18-26	27,400-850,000	lacustrine riverine	3-5 (m) 4-6 (f)	21 (m) 32 (f)

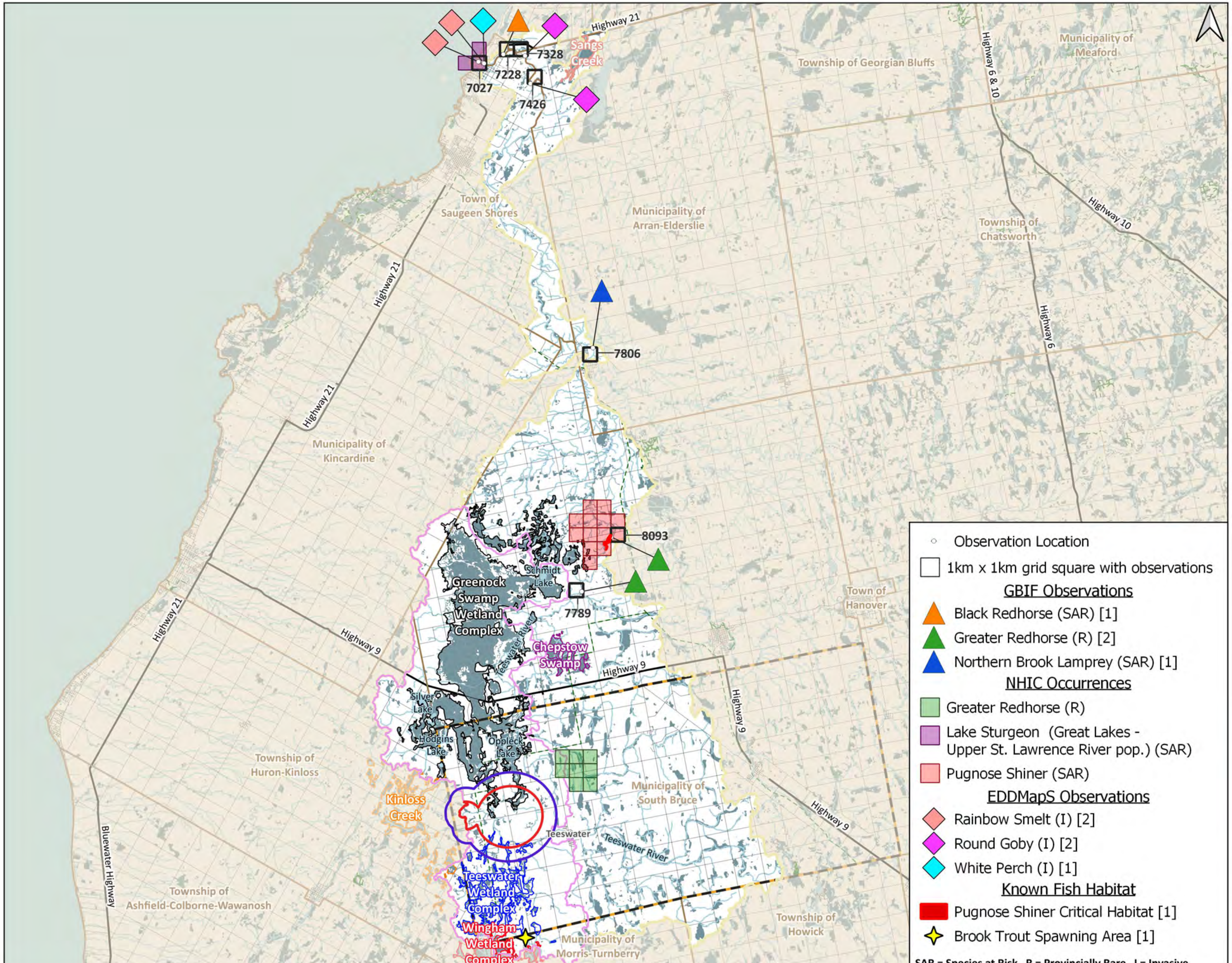
Notes:
1. General Abundance is used in The Ontario Freshwater Fishes Life History Database (Eakins 2020); however, no description is provided to contextualize abundance.
2. Johnny Darter were present in the Ontario GeoHub webmap of the MNRF ARA dataset but were not included in the dataset download from Ontario GeoHub. Zoetica is investigating whether these observations should be included in future iterations of the BIS Baseline Report.
3. Central mudminnow were detected by Tulloch Engineering Inc. in a small study area that partially overlaps the eastern portion of the RSA_{AQU}. However, no information was available to determine whether this species was detected within the boundary of the RSA_{AQU}.

A.2 Figures

NWMO Biodiversity Impact Studies

Species of Interest Desk-based Observations: Fish and Fish Habitat

Figure A-1



- Area of Interest (AOI)
- Local Study Area (LSA_{TER})
- Local Study Area (LSA_{AQU})
- Regional Study Area (RSA_{AQU})
- Lake
- Wetland
- Watercourse
- Highway
- Local Road
- South Bruce Boundary
- Municipal Boundary

Of all wetlands shown, only Provincially Significant Wetlands (PSWs) are labelled. The colour of the outline surrounding PSWs matches the colour of the respective PSW label.

PSW boundaries may not match wetland boundaries due to changes in aquatic habitat coverage since their creation compared to 2022.

1:270,000

0 4 8 km

ZOETICA

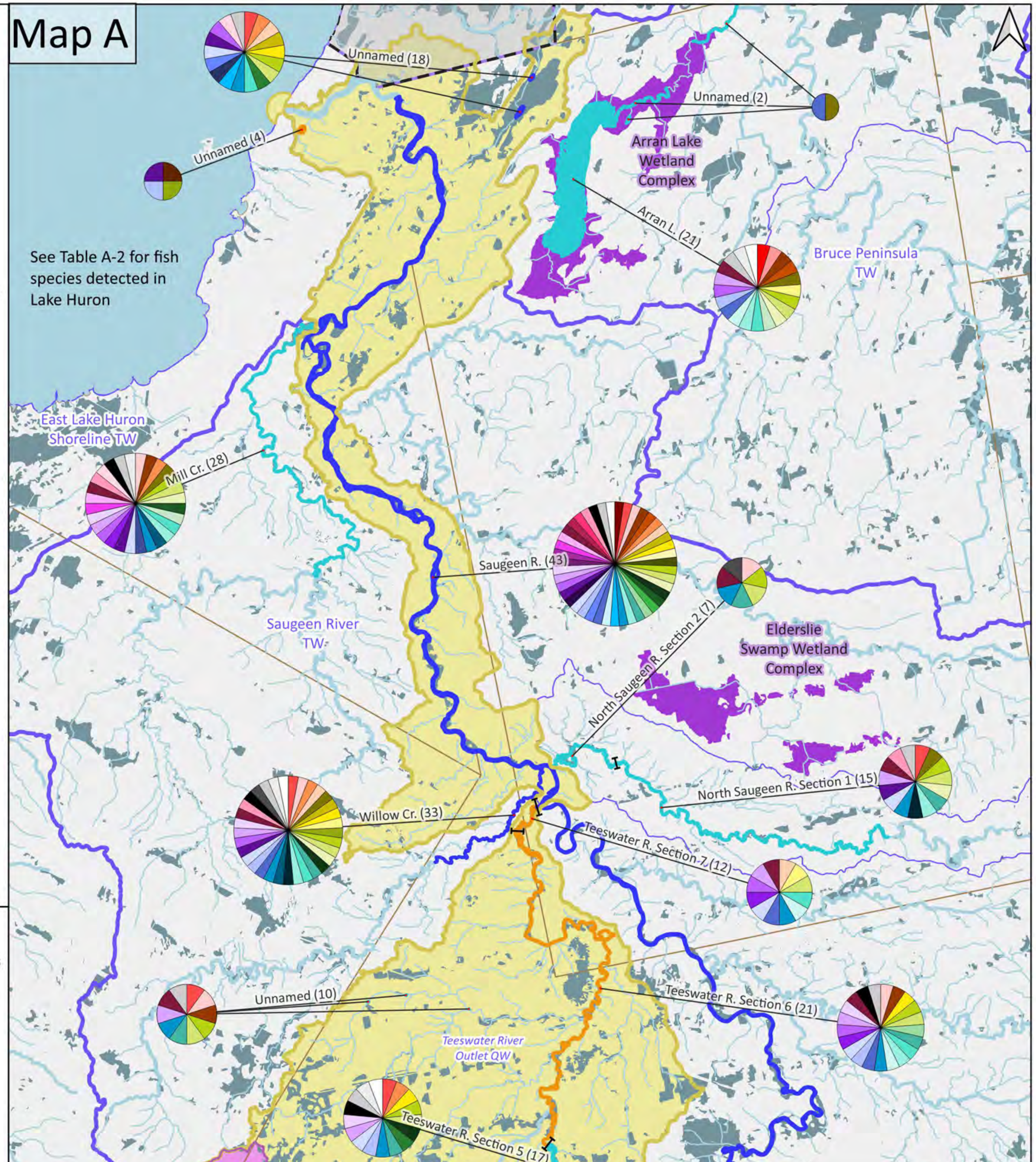
Data received from:
Ontario GeoHub — Fish Activity Area (MNRF); OHN Waterbody (MNRF); OHN Watercourse (MNRF); MNRF Road Segments (MNRF); Municipal Boundary - Lower and Single Tier (MMAH); Wetlands (MNRF)
NWMO — AOI; NHIC Species Occurrences (MNRF)
GBIF.org — GBIF Occurrence Download - Accessed Oct., 2021
EDDMapS Ontario — Invasive Species Observations - Accessed Jan 12, 2022
Wetlands and water features are mapped using ecosite data within the LSA_{ECO} and data available from Ontario GeoHub outside the LSA_{ECO}.

Project CRS: NAD83 / UTM zone 17N		
Author: AH	Reviewed by: AB	Approved by: HB
January 18, 2024	Map ID: NWMO_BIS_A078	

Fish Species Leged for Pie Charts

Alewife	Least Darter
Black Bullhead	Logperch
Blackchin Shiner	Longnose Dace
Blacknose Dace	Mimic Shiner
Blacknose Shiner	Mottled Sculpin
Blackside Darter	Muskellunge
Bluegill	Ninespine Stickleback
Bluntnose Minnow	Northern Hog Sucker
Brassy Minnow	Northern Pike
Brook Silverside	Northern Redbelly Dace
Brook Stickleback	Pumpkinseed
Brook Trout	Rainbow Darter
Brown Bullhead	Rainbow Smelt (I)
Brown Trout	Rainbow Trout
Central Mudminnow	Redfin Shiner
Channel Catfish	River Chub
Chinook Salmon	Rock Bass
Coho Salmon	Rosyface Shiner
Common Carp	Sand Shiner
Common Shiner	Sea Lamprey (I)
Creek Chub	Shorthead Redhorse
Emerald Shiner	Silver Redhorse
Fantail Darter	Slimy Sculpin
Fathead Minnow	Smallmouth Bass
Finescale Dace	Sockeye Salmon
Gizzard Shad	Splake
Golden Redhorse	Spotfin Shiner
Golden Shiner	Spottail Shiner
Green Sunfish	Stonecat
Greenside Darter	Tadpole Madtom
Hornyhead Chub	Walleye
Iowa Darter	White Sucker
Johnny Darter	Yellow Bullhead
Largemouth Bass	Yellow Perch

Notes:
- In the pie chart, the fish species will appear in the same order as the legend starting at the top and moving clockwise. Pie chart size is scaled to the number of species.
- The name of the lake or river will appear along the callout line for the pie chart. The number in brackets is the number of species in that lake or river.
(I) Species considered invasive



NWMO Biodiversity Impact Studies

Lakes and Watercourses with Known Species Presence in the North of the RSA_{AQU}

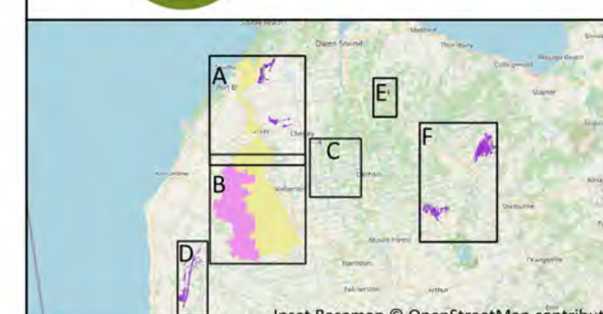
Figure A-2a

- Local Study Area (LSA_{AQU})
- Regional Study Area (RSA_{AQU})
- Lake With No Species Information
- Watercourse
- Wetland
- Reference Wetland
- Tertiary Watershed (TW) Boundary
- Quaternary Watershed (QW) Boundary
- Municipal Boundary
- South Bruce Boundary
- Saugeen No. 29
- Breaks in the ARA Dataset

Lake with Species Information
- Cold Regime
- Cool Regime
- Warm Regime

1:140,000
0 2 4 km

ZOETICA



Data received from:
Ontario GeoHub — Aquatic Resource Area [ARA] polygon segment (MNRF); Indian Reserve (MNRF); OHN Waterbody (MNRF); OHN Watercourse (MNRF); Ontario Watershed Boundaries (MNRF); Municipal Boundary - Lower Tier (MMAH); Wetlands (MNRF)

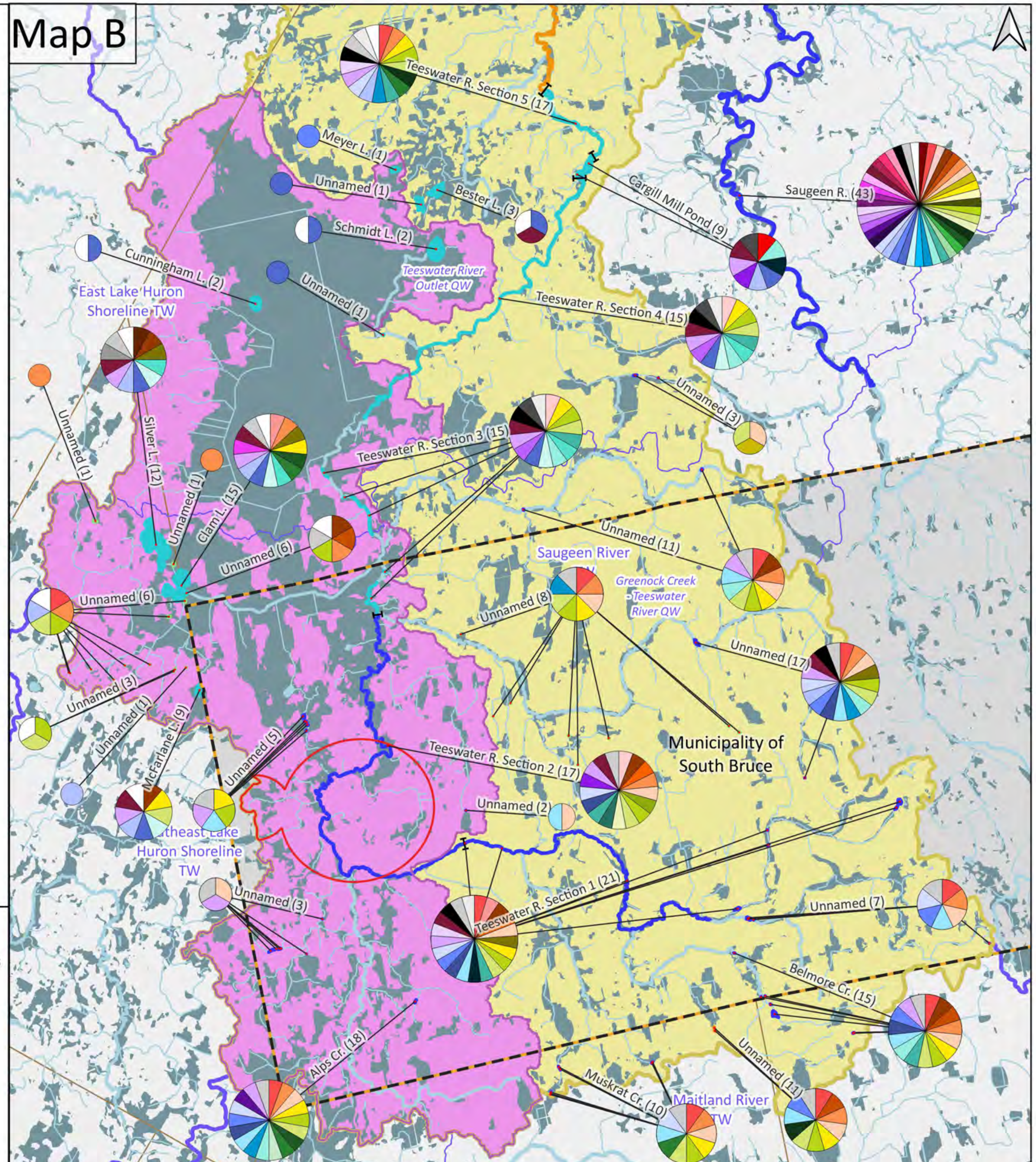
Project CRS: NAD83 / UTM zone 17N

Author: DM	Reviewed by: AB	Approved by: AB
September 28, 2023	Map ID: NWMO_BIS_D191a	

Fish Species Leged for Pie Charts

- Alewife
- Black Bullhead
- Blackchin Shiner
- Blacknose Dace
- Blacknose Shiner
- Blackside Darter
- Bluegill
- Bluntnose Minnow
- Brassy Minnow
- Brook Silverside
- Brook Stickleback
- Brook Trout
- Brown Bullhead
- Brown Trout
- Central Mudminnow
- Channel Catfish
- Chinook Salmon
- Coho Salmon
- Common Carp
- Common Shiner
- Creek Chub
- Emerald Shiner
- Fantail Darter
- Fathead Minnow
- Finescale Dace
- Gizzard Shad
- Golden Redhorse
- Golden Shiner
- Green Sunfish
- Greenside Darter
- Hornyhead Chub
- Iowa Darter
- Johnny Darter
- Largemouth Bass
- Least Darter
- Logperch
- Longnose Dace
- Mimic Shiner
- Mottled Sculpin
- Muskellunge
- Ninespine Stickleback
- Northern Hog Sucker
- Northern Pike
- Northern Redbelly Dace
- Pumpkinseed
- Rainbow Darter
- Rainbow Smelt (I)
- Rainbow Trout
- Redfin Shiner
- River Chub
- Rock Bass
- Rosyface Shiner
- Sand Shiner
- Sea Lamprey (I)
- Shorthead Redhorse
- Silver Redhorse
- Slimy Sculpin
- Smallmouth Bass
- Sockeye Salmon
- Splake
- Spotfin Shiner
- Spottail Shiner
- Stonecat
- Tadpole Madtom
- Walleye
- White Sucker
- Yellow Bullhead
- Yellow Perch

Notes:
- In the pie chart, the fish species will appear in the same order as the legend starting at the top and moving clockwise. Pie chart size is scaled to the number of species.
- The name of the lake or river will appear along the callout line for the pie chart. The number in brackets is the number of species in that lake or river.
(I) Species considered invasive



NWMO Biodiversity Impact Studies

Lakes and Watercourses with Known Species Presence in the South of the RSA_{AQU}

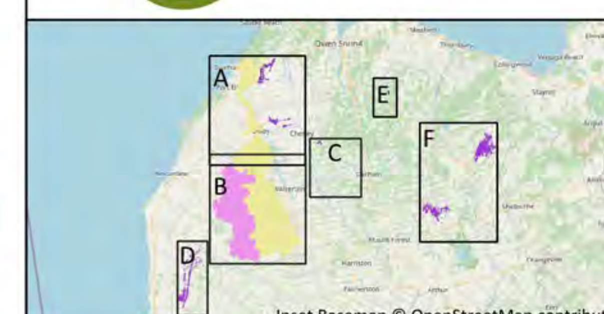
Figure A-2b

- Area of Interest (AOI)
- Local Study Area (LSA_{AQU})
- Regional Study Area (RSA_{AQU})
- Lake With No Species Information
- Watercourse
- Wetland
- Tertiary Watershed (TW) Boundary
- Quaternary Watershed (QW) Boundary
- Municipal Boundary
- South Bruce Boundary
- Breaks in the ARA Dataset

Lake with Species Information
- Cold Regime
- Cool Regime
- Warm Regime
- Unknown Regime

1:140,000
0 2 4 km

ZOETICA



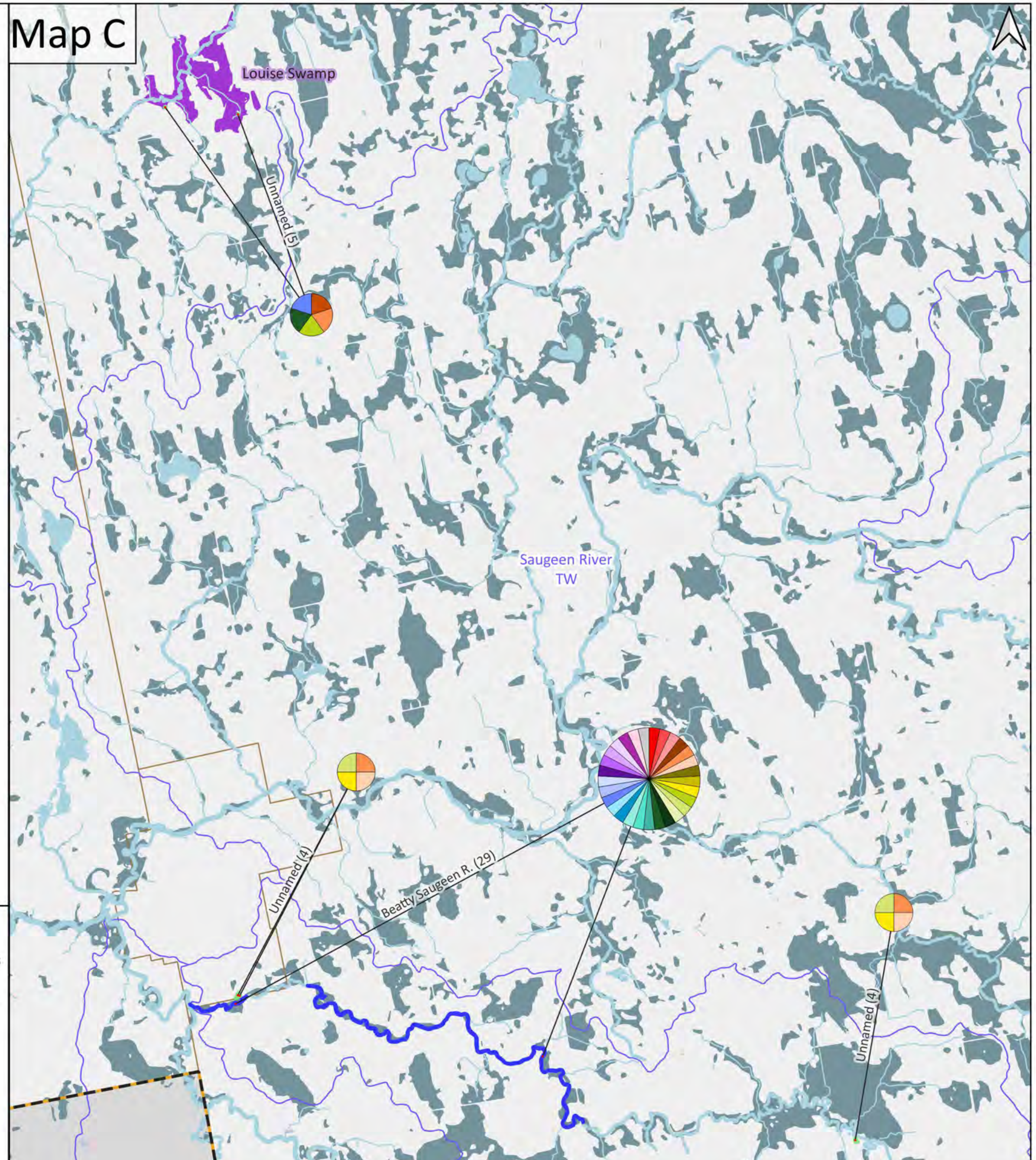
Data received from:
Ontario GeoHub — Aquatic Resource Area [ARA] polygon segment (MNRF); OHN Waterbody (MNRF); OHN Watercourse (MNRF); Ontario Watershed Boundaries (MNRF); Municipal Boundary - Lower Tier (MMAH); Wetlands (MNRF)
NWMO — AOI

Project CRS: NAD83 / UTM zone 17N		
Author: DM	Reviewed by: AB	Approved by: AB
September 28, 2023	Map ID: NWMO_BIS_D191b	

Fish Species Leged for Pie Charts

Alewife	Least Darter
Black Bullhead	Logperch
Blackchin Shiner	Longnose Dace
Blacknose Dace	Mimic Shiner
Blacknose Shiner	Mottled Sculpin
Blackside Darter	Muskellunge
Bluegill	Ninespine Stickleback
Bluntnose Minnow	Northern Hog Sucker
Brassy Minnow	Northern Pike
Brook Silverside	Northern Redbelly Dace
Brook Stickleback	Pumpkinseed
Brook Trout	Rainbow Darter
Brown Bullhead	Rainbow Smelt (I)
Brown Trout	Rainbow Trout
Central Mudminnow	Redfin Shiner
Channel Catfish	River Chub
Chinook Salmon	Rock Bass
Coho Salmon	Rosyface Shiner
Common Carp	Sand Shiner
Common Shiner	Sea Lamprey (I)
Creek Chub	Shorthead Redhorse
Emerald Shiner	Silver Redhorse
Fantail Darter	Slimy Sculpin
Fathead Minnow	Smallmouth Bass
Finescale Dace	Sockeye Salmon
Gizzard Shad	Splake
Golden Redhorse	Spotfin Shiner
Golden Shiner	Spottail Shiner
Green Sunfish	Stonecat
Greenside Darter	Tadpole Madtom
Hornyhead Chub	Walleye
Iowa Darter	White Sucker
Johnny Darter	Yellow Bullhead
Largemouth Bass	Yellow Perch

Notes:
- In the pie chart, the fish species will appear in the same order as the legend starting at the top and moving clockwise. Pie chart size is scaled to the number of species.
- The name of the lake or river will appear along the callout line for the pie chart. The number in brackets is the number of species in that lake or river.
(I) Species considered invasive



NWMO Biodiversity Impact Studies

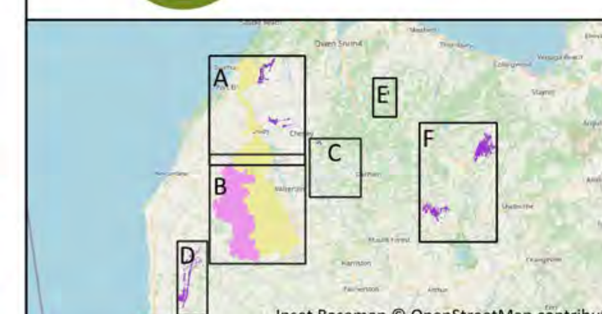
Lakes and Watercourses with Known Species Presence in Reference Areas

Figure A-2c

- Lake With No Species Information
- Watercourse
- Wetland
- Reference Wetland
- Quaternary Watershed (QW) Boundary
- Municipal Boundary
- South Bruce Boundary

Lake with Species Information
- Cold Regime
- Unknown Regime

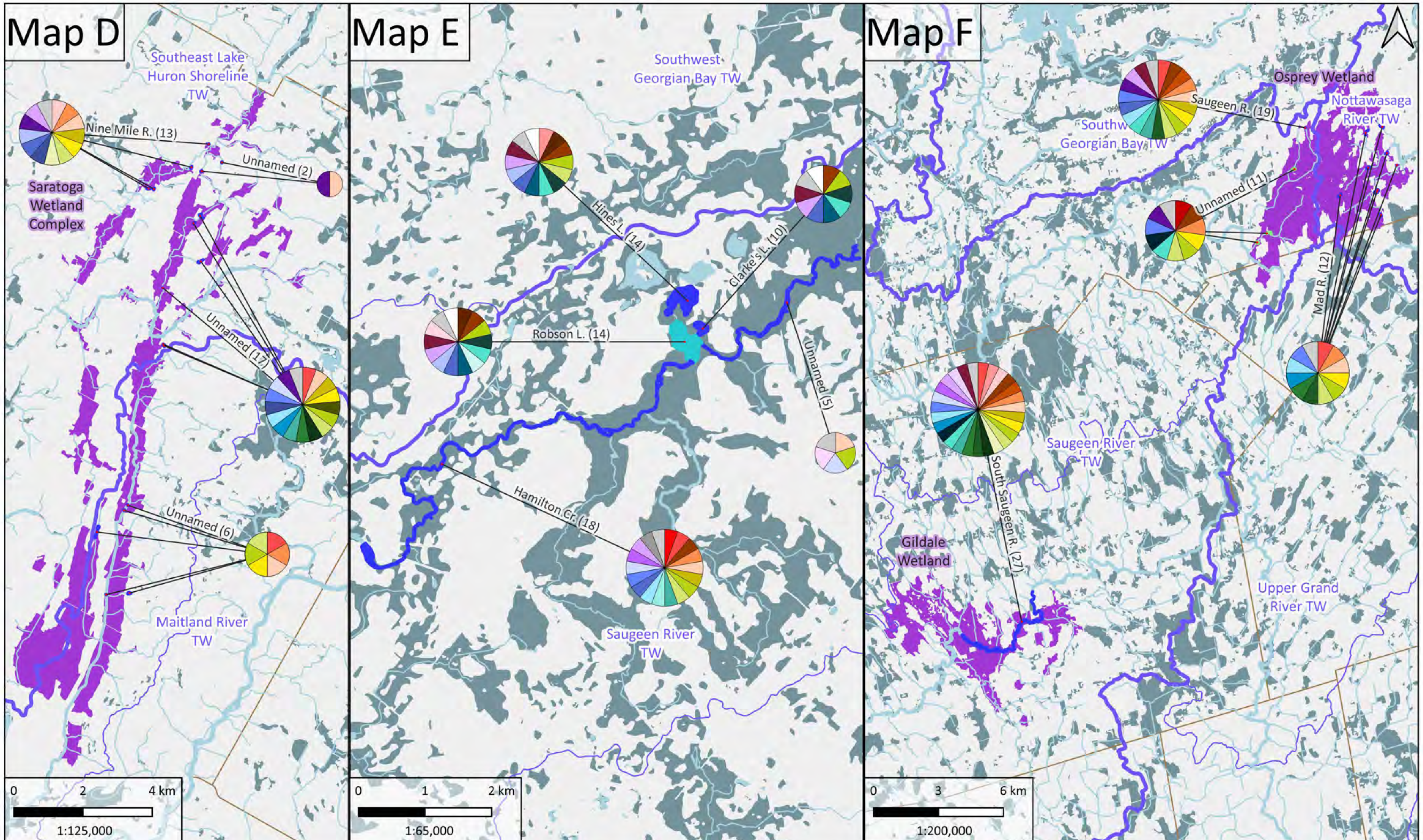
1:75,000
0 2 4 km



Data received from:
Ontario GeoHub — Aquatic Resource Area [ARA] polygon segment (MNRF); OHN Waterbody (MNRF); OHN Watercourse (MNRF); Ontario Watershed Boundaries (MNRF); Municipal Boundary - Lower Tier (MMAH); Wetlands (MNRF)

Project CRS: NAD83 / UTM zone 17N

Author: DM	Reviewed by: AB	Approved by: AB
September 28, 2023	Map ID: NWMO_BIS_D191c	



NWMO Biodiversity Impact Studies

Lakes and Watercourses with Known Species Presence in Reference Areas

Figure A-2d

- Lake With No Species Information
- Watercourse
- Wetland
- Reference Wetland
- Tertiary Watershed (TW) Boundary
- Quaternary Watershed (QW) Boundary
- Municipal Boundary

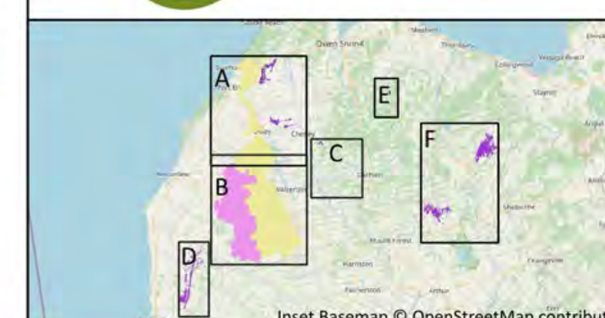
Lake with Species Information

- Cold Regime
- Cool Regime
- Unknown Regime

Notes:

- In the pie chart, the fish species will appear in the same order as the legend starting at the top and moving clockwise. Pie chart size is scaled to the number of species.
- The name of the lake or river will appear along the callout line for the pie chart. The number in brackets is the number of species in that lake or river.

(I) Species considered invasive



Data received from:
Ontario GeoHub — Aquatic Resource Area [ARA] polygon segment (MNRF); OHN Waterbody (MNRF); OHN Watercourse (MNRF); Ontario Watershed Boundaries (MNRF); Municipal Boundary - Lower Tier (MMAH); Wetlands (MNRF)

Project CRS: NAD83 / UTM zone 17N		
Author: DM	Reviewed by: AB	Approved by: AB
September 29, 2023	Map ID: NWMO_BIS_D191d	

Fish Species Leged for Pie Charts

- Alewife
- Black Bullhead
- Blackchin Shiner
- Blacknose Dace
- Blacknose Shiner
- Blackside Darter
- Bluegill
- Bluntnose Minnow
- Brassy Minnow
- Brook Silverside
- Brook Stickleback
- Brook Trout
- Brown Bullhead
- Brown Trout
- Central Mudminnow
- Channel Catfish
- Chinook Salmon
- Coho Salmon
- Common Carp
- Common Shiner
- Creek Chub
- Emerald Shiner
- Fantail Darter
- Fathead Minnow
- Finescale Dace
- Gizzard Shad
- Golden Redhorse
- Golden Shiner
- Green Sunfish
- Greenside Darter
- Hornyhead Chub
- Iowa Darter
- Johnny Darter
- Largemouth Bass
- Least Darter
- Logperch
- Longnose Dace
- Mimic Shiner
- Mottled Sculpin
- Muskellunge
- Ninespine Stickleback
- Northern Hog Sucker
- Northern Pike
- Northern Redbelly Dace
- Pumpkinseed
- Rainbow Darter
- Rainbow Smelt (I)
- Rainbow Trout
- Redfin Shiner
- River Chub
- Rock Bass
- Rosyface Shiner
- Sand Shiner
- Sea Lamprey (I)
- Shorthead Redhorse
- Silver Redhorse
- Slimy Sculpin
- Smallmouth Bass
- Sockeye Salmon
- Splake
- Spotfin Shiner
- Spottail Shiner
- Stonecat
- Tadpole Madtom
- Walleye
- White Sucker
- Yellow Bullhead
- Yellow Perch

APPENDIX B – SUPPLEMENTAL INFORMATION FOR PRIMARY AND SECONDARY PRODUCERS

B.1 Tables

Table B-1. List of regulated and non-regulated invasive aquatic invertebrate species of concern in Ontario. This list does not imply potential occurrence in the SON-South Bruce area, as several invasive species "on the radar" have not yet been found in Ontario or even Canada; however, these species are known to have significant ecological, social, health, and/or economic impacts in other areas of North America and worldwide, where they have been introduced. Species highlighted grey are those that have EDDMapS Ontario records within the extent of the BIS study areas. Note that species may have been confirmed within the study areas through other databases, inventories, studies, or local observations; however, these data sources need to be further investigated.

Subgroup	**Common Name**	**Scientific Name**	**Ontario *ISA*[1]**		**Aquatic Invasive Species Regulations[2]**			**Ont. ISAP[3]**	**ISC[4]**
			PRO.	**RES.**	**Import**	**Possess, Transport, Release**	**Non-Indigenous**		
Crustaceans	Killer shrimp	*Dikerogammarus villosus*	X					X	X
Crustaceans	Common yabby (crayfish)	*Cherax destructor*	X					X	
Freshwater Molluscs	Golden mussel	*Limnoperna fortunei*	X					X	
Freshwater Molluscs	Quagga mussel	*Dreissena bugensis*			X			X	X
Freshwater Molluscs	Zebra mussel	*Dreissena polymorpha*			X			X	X
Crustaceans	Bloody-red shrimp	*Hemimysis anomala*					X	X	
Crustaceans	Chinese mitten crab	*Eriocheir sinensis*					X		
Crustaceans	Spiny water flea	*Bythotrephes longimanus*						X	X
Crustaceans	Rusty crayfish	*Faxonius rusticus*						X	X
Crustaceans	Fish-hook water flea	*Cercopagis pengoi*						X	
Crustaceans	Red swamp crayfish	*Procambarus clarkii*						X	
Crustaceans	Marmorkrebs (marbled crayfish)	*Procambarus virginalis*						X	
Freshwater Molluscs	Chinese mysterysnail	*Cipangopaludina chinensis*						X	
Freshwater Molluscs	Asian clam	*Corbicula fluminea*						X	
Freshwater Molluscs	Channeled apple snail	*Pomacea canaliculata*						X	
Freshwater Molluscs	New Zealand mud snail	*Potamopyrgus antipodarum*						X	
Freshwater Molluscs	Banded mysterysnail	*Viviparus georgianus*						X	

Notes:

1. Prohibited "PRO." and Restricted "RES." species regulated under the Ontario *Invasive Species Act* (*ISA*) are presented on the Ontario Ministry of Natural Resources and Forestry's (MNRF) website, accessed on July 12, 2021: https://www.ontario.ca/page/managing-invasive-species-ontario
2. The federal Aquatic Invasive Species Regulations (SOR/2015-121) under the *Fisheries Act* includes schedules of Species Subject to Prohibitions and Controls (Part 2) and Species Subject to Controls Only in Areas Where They Are Not Indigenous (Part 3). Within the schedule Part 2, certain invasive species are prohibited from Importation, Possession, Transportation, and/or Release. The regulations are current to June 28, 2021; accessed on July 27, 2021.
3. Ontario's Invading Species Awareness Program (ISAP) is a partnership between the MNRF and the Ontario Federation of Anglers and Hunters. The webpages for Invasive Aquatic Plants, Forest Pests & Pathogens, Invasive Fish, Invasive Invertebrates, Invasive Terrestrial Plants, and Invasive Wildlife were accessed on July 27, 2021: http://www.invadingspecies.com/invaders/
4. The Invasive Species Centre (ISC) is a resource for Ontario and the rest of Canada. Based in Sault Ste. Marie, Ontario, the Board of Directors Organizations include the Great Lakes Fishery Commission, Grand Council Treaty #3, City of Ottawa, International Joint Commission, Wildlife Habitat Canada, University of Waterloo, BioForest, Nature Conservancy of Canada, Natural Resources Canada, Fisheries and Oceans Canada, and the CFIA. The webpages for Invasive Fish, Invasive Plants, Invasive Insects, Invasive Aquatic Plants, and Invasive Pathogens were accessed on July 27, 2021: https://www.invasivespeciescentre.ca/invasive-species/

Table B-2. Primary and secondary producer species of interest reported in GBIF and EDDMapS records within the BIS study area.

Grid	Source	Species	Count	Coordinates	AOI	LSA_{AQU}
7183	EDDMapS	Rusty Crayfish	200	471642, 4883637	0	1
7183	EDDMapS	Rusty Crayfish	200	471595, 4883732	0	1
7571	GBIF	River Bluet	U	-	0	1

Notes:
See **Figure B-1** for Grid locations of masked observations. Coordinates are not provided due to the sensitive nature of provincially rare species.
For the purposes of this table, the indicated study area includes overlap with other study area(s) that may be encompassed within its boundaries.

Table B-3. Field-based observations of Primary and Secondary Producer species of interest at SON-South Bruce in 2022.

Grid	Species	Observation Type	Count	Source Type	Coordinates	AOI	LSA_{AQU}
6779	Terrestrial Crayfish species	Burrow	1	Incidental	-	0	1
6783	Terrestrial Crayfish species	Burrow	>1	SWH	-	0	1
6878	Terrestrial Crayfish species	Burrow	>1	SWH	-	0	1
6972	Digger Crayfish	Burrow	med density	Incidental	-	1	1
6972	Terrestrial Crayfish species	Burrow	>1	SWH	-	1	1
6981	Great Plains Mudbug	Burrow	high density	Incidental	-	0	1
6983	Terrestrial Crayfish species	Visual	>1	SWH	-	0	1
6992	Terrestrial Crayfish species	Burrow	1	Incidental	-	0	1
6992	Terrestrial Crayfish species	Burrow	>1	SWH	-	0	1
6992	Terrestrial Crayfish species	Burrow	>1	SWH	-	0	1
6993	Terrestrial Crayfish species	Burrow	>1	SWH	-	0	1
7065	Terrestrial Crayfish species	Burrow	>1	SWH	-	0	1
7065	Terrestrial Crayfish species	Burrow	1	SWH	-	0	1
7072	Terrestrial Crayfish species	Burrow	1	Incidental	-	1	1
7072	Terrestrial Crayfish species	Burrow	1	SWH	-	1	1
7080	Terrestrial Crayfish species	Burrow	3	SWH	-	0	1
7163	Terrestrial Crayfish species	Burrow	>1	SWH	-	0	1
7164	Terrestrial Crayfish species	Burrow	med density	Incidental	-	0	1
7164	Terrestrial Crayfish species	Burrow	med density	Incidental	-	0	1

7164	Terrestrial Crayfish species	Burrow	low density	SWH	-	0	1
7172	Terrestrial Crayfish species	Burrow	low density	Incidental	-	1	1
7172	Terrestrial Crayfish species	Burrow	med density	Incidental	-	1	1
7172	Terrestrial Crayfish species	Burrow	>1	SWH	-	1	1
7172	Terrestrial Crayfish species	Burrow	>1	SWH	-	1	1
7174	Terrestrial Crayfish species	Burrow	low density	Incidental	-	1	1
7174	Terrestrial Crayfish species	Burrow	3	SWH	-	1	1
7184	Terrestrial Crayfish species	Burrow	low density	Incidental	-	0	1
7184	Terrestrial Crayfish species	Burrow	med density	Incidental	-	0	1
7184	Terrestrial Crayfish species	Burrow	1	SWH	-	0	1
7184	Terrestrial Crayfish species	Burrow	>10	SWH	-	0	1
7185	Terrestrial Crayfish species	Burrow	1	Incidental	-	0	1
7185	Terrestrial Crayfish species	Burrow	>1	SWH	-	0	1
7185	Terrestrial Crayfish species	Burrow	1	SWH	-	0	1
7190	Digger Crayfish	Burrow	1	Incidental	-	0	1
7271	Terrestrial Crayfish species	Burrow	low density	Incidental	-	1	1
7271	Terrestrial Crayfish species	Burrow	>1	SWH	-	1	1
7273	Terrestrial Crayfish species	Burrow	low density	SWH	-	1	1
7278	Terrestrial Crayfish species	Burrow	low density	Incidental	-	0	1
7278	Terrestrial Crayfish species	Burrow	low density	Incidental	-	0	1
7278	Terrestrial Crayfish species	Burrow	>1	SWH	-	0	1
7279	Great Plains Mudbug	Burrow	low density	Incidental	-	0	1
7279	Great Plains Mudbug	Burrow	1	Incidental	-	0	1
7279	Terrestrial Crayfish species	Burrow	med density	Incidental	-	0	1
7279	Terrestrial Crayfish species	Burrow	1	Incidental	-	0	1
7279	Terrestrial Crayfish species	Burrow	>1	SWH	-	0	1
7279	Terrestrial Crayfish species	Visual	1	SWH	-	0	1
7286	Terrestrial Crayfish species	Burrow	low density	Incidental	-	0	1
7286	Terrestrial Crayfish species	Burrow	>1	SWH	-	0	1
7287	Terrestrial Crayfish species	Burrow	1	Incidental	-	0	1
7288	Terrestrial Crayfish species	Burrow	med density	Incidental	-	0	1

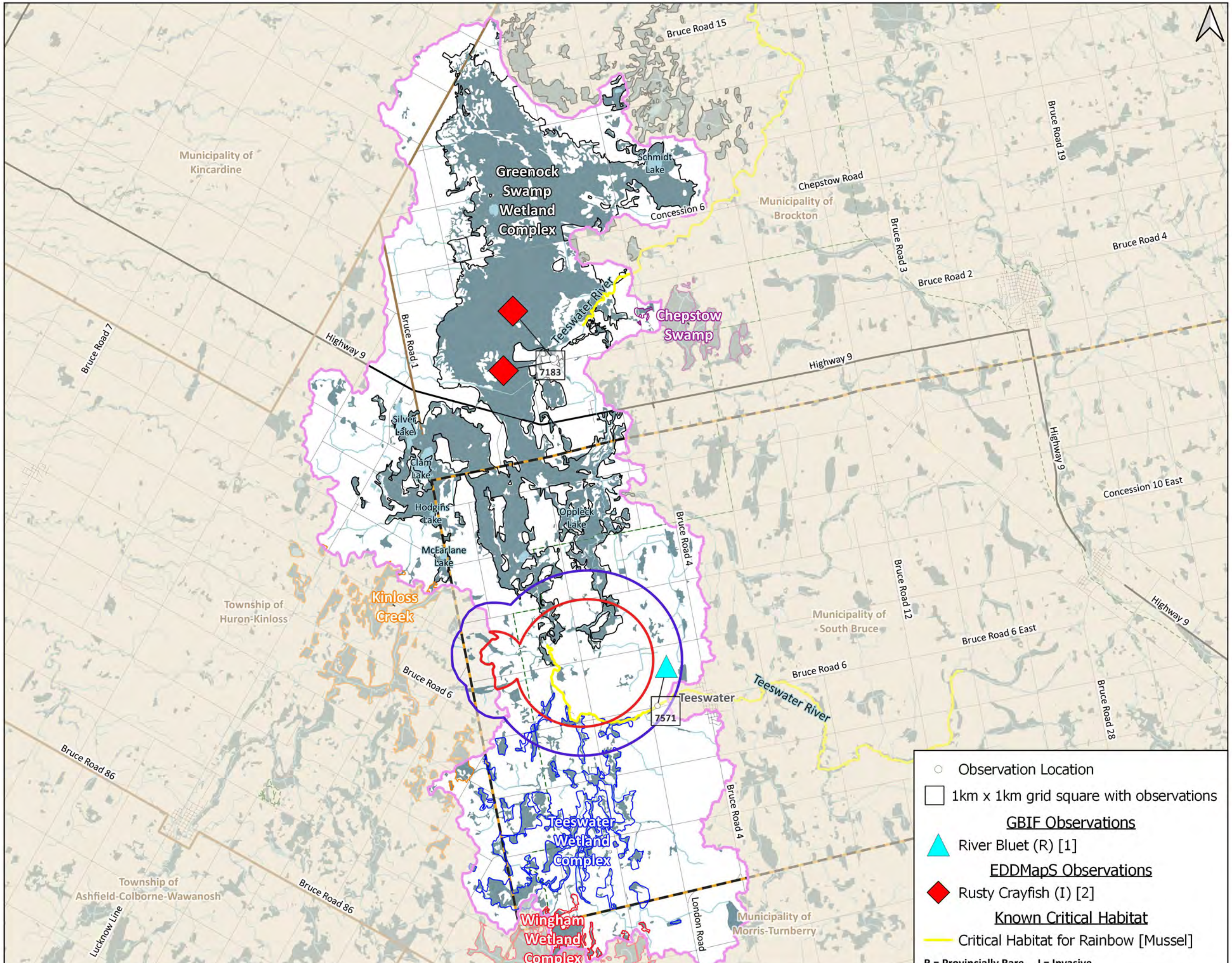
7288	Terrestrial Crayfish species	Burrow	med density	SWH	-	0	1
7373	Terrestrial Crayfish species	Burrow	low density	Incidental	-	1	1
7373	Terrestrial Crayfish species	Burrow	>1	SWH	-	1	1
7385	Terrestrial Crayfish species	Burrow	low density	Incidental	-	0	1
7386	Terrestrial Crayfish species	Visual	1	SWH	-	0	1
7389	Terrestrial Crayfish species	Visual (juv)	1	Incidental	-	0	1
7389	Terrestrial Crayfish species	Burrow	1	Incidental	-	0	1
7389	Terrestrial Crayfish species	Burrow	1	SWH	-	0	1
7389	Terrestrial Crayfish species	Visual	1	SWH	-	0	1

Notes:
See **Figure B-2** for Grid locations of masked observations. Coordinates are not provided due to the sensitive nature of provincially rare species.
For the purposes of this table, the indicated study area includes overlap with other study area(s) that may be encompassed within its boundaries.

Table B-4. Incidental observations of aquatic invertebrates during TEM, AHM, and eDNA within the AOI, LSA_{AQU}, or RSA_{AQU} from field surveys in 2022.

Common Name	Scientific Name	SAR	Rare	Introduced /Invasive	Notes
Crayfish	Cambaridae sp.	NA	NA	NA	
Mussels	Unionidae spp.	NA	NA	NA	
Water striders	Gerridae spp.	NA	NA	NA	
Unidentified Semi-aquatic or Aquatic Invertebrates	NA	NA	NA	NA	Included records of Leech, Dragonflies, and Snails (which may be aquatic or terrestrial)

B.2 Figures



NWMO Biodiversity Impact Studies

Species of Interest Desk-based Observations: Primary and Secondary Producers

Figure B-1

- Area of Interest (AOI)
- Local Study Area (LSA_{TER})
- Local Study Area (LSA_{AQU})
- Lake
- Wetland
- Watercourse
- Highway
- Local Road
- South Bruce Boundary
- Municipal Boundary

Of all wetlands shown, only Provincially Significant Wetlands (PSWs) are labelled. The colour of the outline surrounding PSWs matches the colour of the respective PSW label.

PSW boundaries may not match wetland boundaries due to changes in aquatic habitat coverage since their creation compared to 2022.

1:130,000

0 2 4 km

ZOETICA

Data received from:
Ontario GeoHub — OHN Waterbody (MNRF); OHN Watercourse (MNRF); MNRF Road Segments (MNRF); Municipal Boundary - Lower and Single Tier (MMAH); Wetlands (MNRF)
NWMO — AOI
GBIF.org — GBIF Occurrence Download - Accessed Oct., 2021
EDDMapS Ontario — Invasive Species Observations - Accessed Jan.12, 2022
Wetlands and water features are mapped using ecosite data within the LSA_{ECO} and data available from Ontario GeoHub outside the LSA_{ECO}

Project CRS: NAD83 / UTM zone 17N

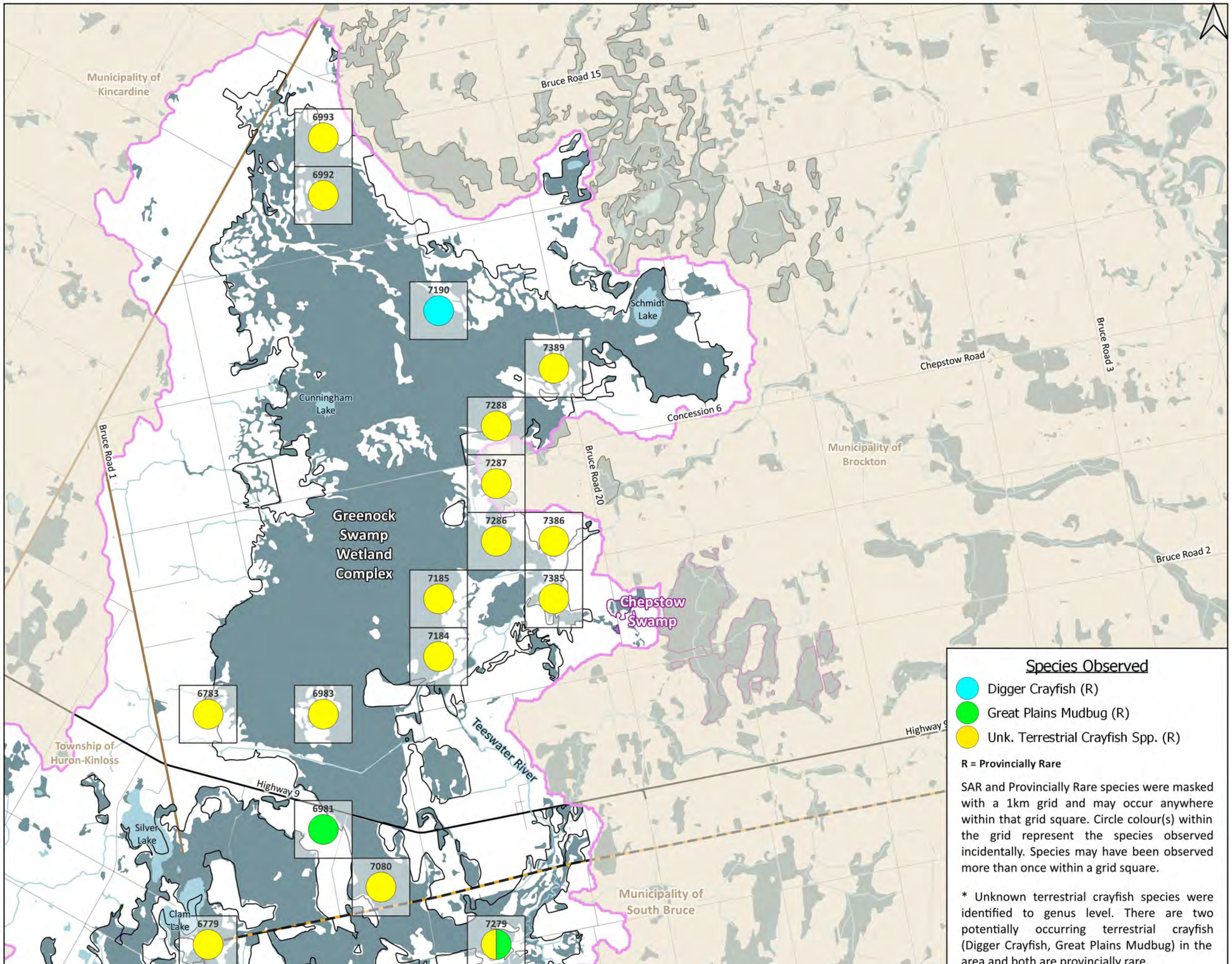
Author: AH	Reviewed by: AB	Approved by: HB

December 11, 2023	Map ID: NWMO_BIS_A077

NWMO Biodiversity Impact Studies

Primary and Secondary Producers Species of Interest Field Observations - North LSA_{AQU}

Figure B-2a



- Area of Interest (AOI)
- Local Study Area (LSA_{TER})
- Local Study Area (LSA_{AQU})
- Lake
- Wetland
- Watercourse
- Highway
- Local Road
- South Bruce Boundary
- Municipal Boundary

Of all wetlands shown, only Provincially Significant Wetlands (PSWs) are labelled. The colour of the outline surrounding PSWs matches the colour of the respective PSW label.

PSW boundaries may not match wetland boundaries due to changes in aquatic habitat coverage since their creation compared to 2022.

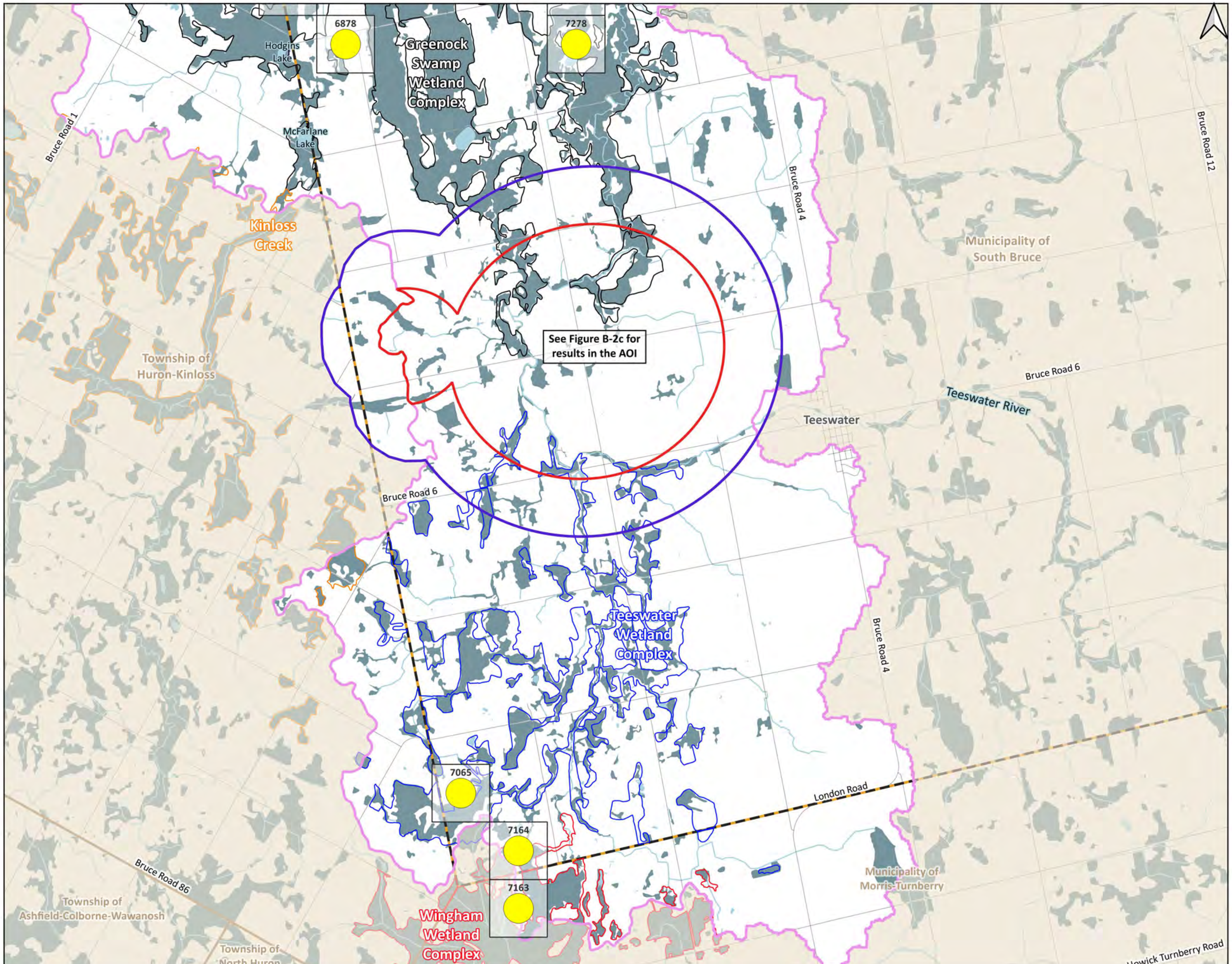
1:65,000

0 1 2 km

ZOETICA

Data received from:
Ontario GeoHub — OHN Waterbody (MNRF); OHN Watercourse (MNRF); MNRF Road Segments (MNRF); Municipal Boundary - Lower and Single Tier (MMAH); Wetlands (MNRF)
NWMO — AOI; NWMO Purchased or Optioned Land; 2022 SB TEM Ecosite Data Export V4 (Tulloch)
Wetlands and water features are mapped using ecosite data within the LSA_{ECO} and data available from Ontario GeoHub outside the LSA_{ECO}.

Project CRS: NAD83 / UTM zone 17N		
Author: AH	Reviewed by: AB	Approved by: HB
January 26, 2024	Map ID: NWMO_BIS_A121a	



NWMO Biodiversity Impact Studies

Primary and Secondary Producers Species of Interest Field Observations - South LSA_{AQU}

Figure B-2b

- Area of Interest (AOI)
- Local Study Area (LSA_{TER})
- Local Study Area (LSA_{AQU})
- Lake
- Wetland
- Watercourse
- Highway
- Local Road
- South Bruce Boundary
- Municipal Boundary

See Figure B-2a for Full Legend

Of all wetlands shown, only Provincially Significant Wetlands (PSWs) are labelled. The colour of the outline surrounding PSWs matches the colour of the respective PSW label.

PSW boundaries may not match wetland boundaries due to changes in aquatic habitat coverage since their creation compared to 2022.

1:65,000

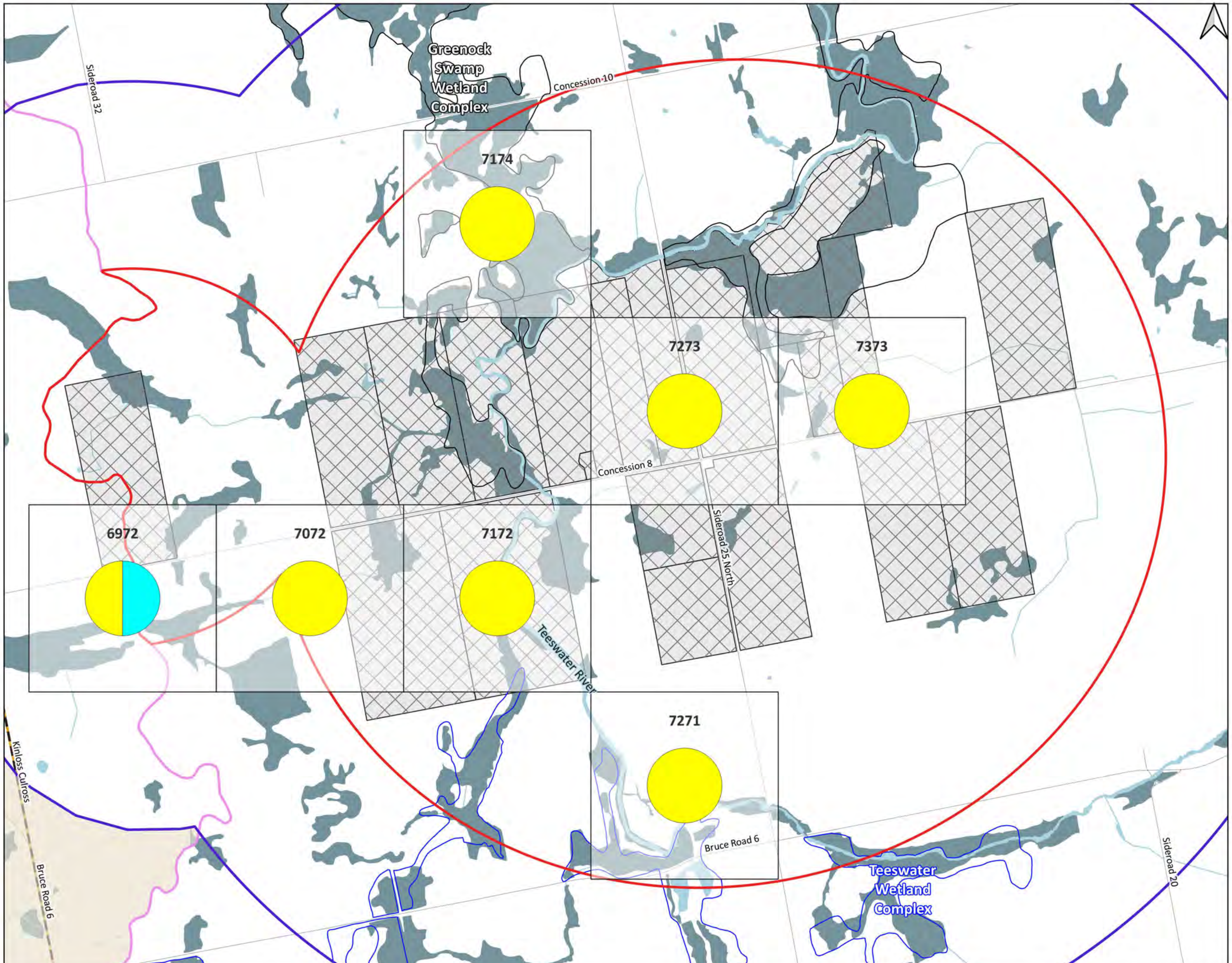
0 1 2 km

ZOETICA

Data received from:
Ontario GeoHub — OHN Waterbody (MNRF); OHN Watercourse (MNRF); MNRF Road Segments (MNRF); Municipal Boundary - Lower and Single Tier (MMAH); Wetlands (MNRF)
NWMO — AOI; NWMO Purchased or Optioned Land; 2022 SB TEM Ecosite Data Export V4 (Tulloch)
Wetlands and water features are mapped using ecosite data within the LSA_{ECO} and data available from Ontario GeoHub outside the LSA_{ECO}.

Project CRS: NAD83 / UTM zone 17N

Author: AH	Reviewed by: AB	Approved by: HB
January 26, 2024	Map ID: NWMO_BIS_A121b	



NWMO Biodiversity Impact Studies

Primary and Secondary Producers Species of Interest Field Observations - AOI

Figure B-2c

- Area of Interest (AOI)
- Local Study Area (LSA_{TER})
- Local Study Area (LSA_{AQU})
- Lake
- Wetland
- Watercourse
- Highway
- Local Road
- South Bruce Boundary
- Municipal Boundary
- NWMO Purchased or Optioned Land

See Figure B-2a for Full Legend

Of all wetlands shown, only Provincially Significant Wetlands (PSWs) are labelled. The colour of the outline surrounding PSWs matches the colour of the respective PSW label.

PSW boundaries may not match wetland boundaries due to changes in aquatic habitat coverage since their creation compared to 2022.

1:20,000

0 0.5 1 km

ZOETICA

Data received from:
Ontario GeoHub — OHN Waterbody (MNRF); OHN Watercourse (MNRF); MNRF Road Segments (MNRF); Municipal Boundary - Lower and Single Tier (MMAH); Wetlands (MNRF)
NWMO — AOI; NWMO Purchased or Optioned Land; 2022 SB TEM Ecosite Data Export V4 (Tulloch)
Wetlands and water features are mapped using ecosite data within the LSA_{ECO} and data available from Ontario GeoHub outside the LSA_{ECO}.

Project CRS: NAD83 / UTM zone 17N

Author: AH	Reviewed by: AB	Approved by: HB
January 26, 2024	Map ID: NWMO_BIS_A121c	

Report (R001)

BIODIVERSITY IMPACT STUDIES – SOUTHWESTERN ONTARIO REGION: 2023 BASELINE REPORT (CHAPTER 9: ECOSYSTEM FUNCTION AND SERVICES)

December 13, 2023

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GLOSSARY AND ABBREVIATIONS

AHM	Aquatic Habitat Mapping
ANSI	Area of Natural or Scientific Interest; areas of land and water containing natural landscapes or features that have been identified as having life science or earth science values related to protection, scientific study, or education (MMAH 2020).
AOI	Area of Interest
BBD	Beech bark disease
BIS	Biodiversity Impact Studies
BPD	Biodiversity Impact Studies – Southwestern Ontario Region: Baseline Program Design
BPPA	Biodiversity Impact Studies – Southwestern Ontario Region: Best Practices and Preferred Approaches
BV	Biodiversity Value; The biotic environmental components that will be considered for study within The Project's Biodiversity Impact Studies. A subset of biodiversity values will ultimately be scoped into the Biodiversity Impact Assessment as Valued Components
CA	Conservation Authority
CNSC	Canadian Nuclear Safety Commission
DED	Dutch elm disease
EAB	Emerald ash borer
Ecosystem function	In the context of biodiversity, ecosystem functions include the physiochemical and biological processes that occur within the ecosystem to maintain biodiversity.
Ecosystem services	Ecosystem services are the direct and indirect benefits to human well-being that the natural environment provides through healthy ecosystems. Ecosystem services include provisioning services such as the production of food and water, regulating services, such as the control of climate and disease, supporting services, such as nutrient cycles and oxygen production, and cultural services, such as spiritual and recreational benefits.
EDDMapS	Early Detection and Distribution Mapping System
eDNA	Environmental DNA
EMBP	Environmental Media Baseline Program
GBIF	Global Biodiversity Information Facility
GSWC	Greenock Swamp Wetland Complex
IA	Impact Assessment
IBAT	Integrated Biodiversity Assessment Tool
IUCN	International Union for Conservation of Nature
LSA	Local Study Area LSA_{ECO} = Local Study Area for ecosystem function and services

MNRF	Ontario Ministry of Natural Resources and Forestry
MVCA	Maitland Valley Conservation Authority or Maitland Conservation
NWMO	Nuclear Waste Management Organization
Rights-holders	First Nation and Métis communities who have asserted and or hold recognized treaty and/or Indigenous rights and whose traditional territories include the project location.
RSA	Regional Study Area RSA_{ECO} = Regional Study Area for ecosystem function and services
SAR	Species at Risk
SON	Saugeen Ojibway Nation
SON-South Bruce siting area	Used to describe the broader area surrounding the defined area within which the Project may be located. The SON-South Bruce siting area is the general area surrounding the Municipality of South Bruce and includes the traditional territory of Saugeen Ojibway Nation (SON) in southwestern Ontario.
SOP	Standard Operating Procedure
SWH	Significant Wildlife Habitat; Defined in the Ontario Provincial Policy Statement, 2020 as: *Wildlife habitat* – areas where plants, animals and other organisms live, and find adequate amounts of food, water, shelter and space needed to sustain their populations. Specific wildlife habitats of concern may include areas where species concentrate at a vulnerable point in their annual life cycle; and areas which are important to migratory and non-migratory species. *Significant* – in regard to wildlife habitat, ecologically important in terms of features, functions, representation or amount, and contributing to the quality and diversity of an identifiable geographic area or natural heritage system.
SVCA	Saugeen Valley Conservation Authority or Saugeen Conservation
TEM	Terrestrial Ecosystem Mapping
The Project	The Adaptive Phased Management Project is the Deep Geological Repository and other required infrastructure for the safe, long-term management of Canada's used nuclear fuel.
TISG	Tailored Impact Statement Guidelines. 'TISG Template' refers to the Tailored Impact Statement Guidelines Template (generic version) (IAAC 2022).
TWC	Teeswater Wetland Complex
VC	Valued Component. For impact assessments of designated projects under the *Impact Assessment Act*, the Agency's Glossary of Terms defines VCs as "environmental, health, social, economic or additional elements or conditions of the natural and human environment that may be impacted by a proposed project and are of concern or value to the public, Indigenous peoples, federal authorities and interested parties. Valued components may be identified as having scientific, biological, social, health, cultural, traditional, economic, historical, archaeological and/or aesthetic importance."

1.0 ECOSYSTEM FUNCTION AND SERVICES

1.1 Introduction

All biodiversity values previously discussed in this 2023 BIS Baseline Report rely on a healthy functioning ecosystem. The current Chapter 9 (Ecosystem Function and Services) focuses on ecosystem functions and the related ecosystem services that maintain biodiversity and may benefit humans. Ecosystem functions are the physical, chemical, and biological processes within the ecosystem that maintain biodiversity. Ecosystem functions control the flux of energy, nutrients, and organic matter through an environment and provide the habitats on which biota depend for survival. Ecosystem services are the variety of benefits that nature provides to people. These services include tangible benefits (e.g., goods such as merchantable timber) and intangible benefits (e.g., carbon sequestration, spiritual practices).

A healthily functioning ecosystem is composed of various ecosystem components that work together to support biodiversity values (BVs) and benefit humans. The value of each ecosystem component can be determined based on its function, along with cultural ideals or scientific concerns. For example, wetlands (see Chapter 3) are typically recognized as valued components due to their important ecological functions and socio-economic values. Wetlands provide ecosystem services to humans, such as water retention and flood control, and so are ascribed high societal value. Wetlands also provide critical ecological functions – natural processes independent of their benefits to humans (Hanson et al. 2008) that are essential for supporting biodiversity.

The Millennium Ecosystem Assessment (MEA 2005) defines four main categories of ecosystem services:

- **Provisioning services**: Material benefits provided to people and wildlife. Examples include food (growing, collecting, hunting, harvesting), freshwater (flow and storage), raw materials (merchantable timber, biofuels, fibre), and medicinal resources (vegetation).
- **Regulating services**: Benefits (often invisible) from regulating ecosystem processes. Examples include local air quality (shading, pollutant removal), carbon sequestration and storage (greenhouse gases), moderation of extreme events (natural buffers), waste-water treatment (filter, decompose, eliminate), erosion prevention and maintenance of soil fertility, pollination (insects, birds, bats), biological control (predators and parasites), and regulation of water flow.
- **Cultural services**: Non-material benefits people obtain from ecosystems. Examples include recreation and mental and physical health; tourism; aesthetic appreciation and inspiration for culture, art, and design; and spiritual experience and sense of place.
- **Supporting services**: Supporting services are necessary to produce all other ecosystem services. Examples include nutrient cycling, soil formation, and primary production (i.e., photosynthesis).

Biodiversity loss has been directly linked to a decline in ecosystem services (MEA 2005). Ecosystem services are often included in Impact Assessments (IAs) to account for the human value of biodiversity and assess the importance of different ecosystems and their services. Ecosystem services are derived from the natural environment and are, therefore, necessarily assessed as a component of the biophysical baseline conditions. However, this Chapter of the Biodiversity Impact Studies (BIS) Baseline Report will be linked to other baseline assessments being conducted for the Adaptive Phased Management Project (hereafter, 'the Project') when considering the four pillars of sustainability (e.g., health, social, and economic assessments).

The Canadian Nuclear Safety Commission's (CNSC) *Guidance on Deep Geological Repository Site Characterization* requires that the aquatic and terrestrial environment be characterized as ecosystem components in the Area of Interest (AOI) (CNSC 2018). In addition, the Tailored Impact Statement Guidelines (TISG) Template (generic version) ('TISG Template'[1]) requires that the impact statement include detailed descriptions of baseline conditions and potential project effects on the biophysical, human health, social, and economic environments, and Indigenous peoples (IAAC 2022). Assessment of ecosystem services will require consideration of the interactions between these valued components (VCs). Further, the TISG Template indicates that the rationale for inclusion (or exclusion) of VCs must consider environmental, cultural, spiritual, historical, health, social, economic, recreational, and aesthetic considerations, and Indigenous Knowledge. The value of a component, including biodiversity, depends on both its intrinsic function in the ecosystem and the extrinsic value placed on it by local communities and Indigenous communities. Zoetica™ aims to address these types of VCs in this Chapter 9, in combination with work done on other pillars of the IA. The TISG Template also includes guidance to characterize the project's effects on riparian and wetland environments, which are relevant for ecosystem function and services. A full list of acts, regulations, and other biodiversity considerations is available in Appendix E of the *Biodiversity Impact Studies – Southwestern Ontario Region: Best Practices and Preferred Approaches* (BPPA) Report (Zoetica 2021).

1.1.1 Objectives

The objectives of Ecosystem Function and Services studies are to:

1. Identify ecosystems and ecosystem components critical to sustaining biodiversity, and thus ecosystem function, within the relevant BIS study areas (see Section 3.0, Chapter 1);
2. Identify ecosystem processes that provide regulating services (as defined in Section 1.1) which are essential for maintaining biodiversity and ecological functions and may also be important for people; the latter of which will be considered within the social and economic IA pillars; and
3. Identify ecosystems and ecosystem components that underlie the provisioning of goods and provide cultural services (as defined in Section 1.1) to people; the latter of which will be considered within the social and economic IA pillars.

The current Chapter 9 (Ecosystem Function and Services) begins to fulfill the requirements of the TISG Template required for ecosystem function and services (see Appendix C in the BPPA Report (Zoetica 2021)). Cultural services such as recreation, tourism, aesthetic appreciation, and spiritual enjoyment of nature are not part of the BIS but will be included in other IA pillars.

1.2 Methods

1.2.1 Study Area

The BIS study areas for ecosystem function and services include the AOI, a local study area (LSA_{ECO}), and a regional study area (RSA_{ECO}) that combines the largest areas covered by all biodiversity values. See Section

[1] Please see Chapter 1 for limitations of and planned updates to the TISG Template (IAAC 2022).

3.0, Chapter 1 of the 2023 BIS Baseline Report and Section 5.2.12.4 of the BPPA report (Zoetica 2021) for more details on study area descriptions.

1.2.2 Collation of Data

Zoetica began desk-based collation of data for this chapter of the 2023 BIS Baseline Report by searching existing datasets for areas known to provide ecosystem function and services, including national and provincial parks and reserves, Areas of Natural or Scientific Interest (ANSIs), conservation authority (CA) lands, county lands (e.g., county forests), municipal parks, and trails that exist within the relevant BIS study areas (see **Table 1-1**).

In future years of the baseline program, additional available databases (including regional and municipal data sources) will be investigated to identify more areas that may protect ecosystem functions or services. Additional areas, if identified, will be reported in subsequent iterations of the BIS Baseline Report. Engagement with stakeholders and rights-holders is ongoing (see Section 2.4, Chapter 1), and additional ecosystem information received will be interwoven with information collected from other sources and studies.

Zoetica identified species of forest pests and diseases relevant to ecosystem function and services that could potentially occur within the BIS study areas. Desk-based research and mapping of these species proceeded by collating existing data from government, citizen science, and other biodiversity databases. For this 2023 BIS Baseline Report, data sources for verified species and habitat records included the Ontario Ministry of Natural Resources and Forestry (MNRF), Global Biodiversity Information Facility (GBIF), and Early Detection and Distribution Mapping System (EDDMapS) Ontario. As these datasets periodically pull observations from other biodiversity-related projects and programs (e.g., iNaturalist), they were deemed to be a good starting point to investigate observations of forest pests and diseases that are found or are likely to be found in the BIS study areas. In addition, Zoetica investigated findings from previous environmental studies conducted for the Project in the Saugeen Ojibway Nation (SON)-South Bruce siting area (Tulloch Environmental 2020, 2021). **Table 1-1** summarizes the datasets, data layers, and reports investigated and analyzed for species observations and habitat data for the 2023 BIS Baseline Report. Data reported on maps were limited to observations from 1970 onward as older observations were considered historic and not as reliable. Data on desk-based observations of species of interested are presented in **Table A-2**. See Appendix A, Chapter 1 for data quality scoring.

Table 1-1. Spatial datasets and reports analyzed for information relevant to ecosystem function and services.

Data Source / Owner	Dataset	Data Format	Date Accessed / Received	Contains relevant[1] data?
Integrated Biodiversity Assessment Tool (IBAT)[2]	World Database on Protected Areas	Shapefile	03/2020	Y
Ontario Ministry of Natural Resources and Forestry (MNRF)	Ontario Trail Network (OTN) Trail Segment	Shapefile	12/2019	Y
	Areas of Natural and Scientific Interest	Shapefile	12/2019	Y
Ontario Ministry of the Environment, Conservation and Parks (MECP)	Conservation authority administrative area	Shapefile	01/2022	Y

County of Bruce Open Spatial Data	Bruce County Forests	Shapefile	11/2021	Y
Huron County Open Data	County Tracts	Shapefile	11/2021	Y
	Parks	Shapefile	11/2021	Y
Saugeen Conservation (SVCA)	Saugeen Conservation properties	Shapefile	01/2022	Y
Species Observations				
Tulloch Environmental *Phase 2 preliminary environmental studies for the Project*	July 2020 Site Reconnaissance (Tulloch Environmental 2020)	Report	10/2020	Y
	October 2020 Natural Heritage Features (Tulloch Environmental 2021)	Report	04/2021	Y
Ontario Ministry of Natural Resources and Forestry (MNRF)	Wildlife Activity Site	Shapefile	12/2020	N
	Wildlife Activity Area	Shapefile	12/2020	N
	Greenock Swamp ANSI Report (Johnson 1994a, 1994b)	Reports	10/2020	Y
Global Biodiversity Information Facility (GBIF)	Species Occurrences	CSV	09/2021	Y
Early Detection and Distribution Mapping System (EDDMapS) Ontario	Invasive Species Observations	Shapefile	01/2022	Y

Notes:
1. Zoetica determined dataset relevance based on geographic and temporal relevance as well as relevance to ecosystem function and services. For example, data that were not within the relevant BIS study areas, data that were too old to be considered relevant, or data that did not include information related to biodiversity, ecosystem functions, or ecosystem services were labelled “N” for not containing relevant data.
2. Data were received from IBAT, but the data were created by the UN Environment Programme World Conservation Monitoring Centre (UNEP-WCMC) and the International Union for Conservation of Nature (IUCN).

A full list of the species mentioned in this report, including common and scientific names, is available in **Table A-1** in Appendix A.

In addition, information collected as part of Tier 1 studies outlined in Section 1.2.3 may be used to infer areas of relevance for providing ecosystem functions and services. Zoetica designed Tier 1 field studies (see Section 1.2.3) that commenced in the summer of 2022. In addition, as described in the BPPA (Zoetica 2021), Tier 2 BIS studies are planned for many of the BVs reported in this BIS Baseline Report, if the SON-South Bruce siting area is selected for further study. The results of these studies will help establish baseline conditions for ecosystem function and services. For example, Ontario Wetland Evaluation System studies are planned as Tier 2 methods to evaluate wetland function (see Chapter 3). Similarly, merchantable timber will be assessed in collaboration with economic studies conducted for the Project (see Chapter 2). These studies will improve understanding of valuable ecosystem functions and services within the RSA_{ECO}.

1.2.3 Tier 1 Studies

Tier 1 studies to date focused on collating desk-based data from accessible existing data sources, desk-based habitat mapping, and one season of field studies. Field work commenced in the summer of 2022 and focused on collecting Tier 1 foundational habitat data and species detections through eDNA metabarcoding and incidental observations (see Section 2.0, Chapter 1 for information on study tiers). Detailed methods for the Tier 1 studies outlined below are available in the *Biodiversity Impact Studies – Southwestern Ontario Region: Baseline Program Design* (BPD) Report (Zoetica 2022) and associated

Standard Operating Procedures (SOPs). Data from the 2022 field season are included in this 2023 iteration of the BIS Baseline Report. Field work was not conducted in the SON-South Bruce siting area in 2023.

1.2.3.1 Terrestrial Ecosystem Mapping
Terrestrial Ecosystem Mapping (TEM) completed to date is described in Appendix B, Chapter 1. The ecosite dataset resulting from desk-based TEM was refined with field data from 2022. This included identifying ecosites that are associated with rare vegetation communities and ecosite types that are rare within the BIS study areas. Zoetica used ecosite delineations to plan Aquatic Habitat Mapping (AHM) studies (see Appendix D, Chapter 1), and determine candidate Significant Wildlife Habitat (SWH) for various BVs (see Appendix C, Chapter 1).

1.2.3.2 Identification of Candidate Significant Wildlife Habitat
Zoetica conducted desk-based work to identify candidate SWH and preliminary fieldwork was done in 2022 to evaluate candidate SWH at select TEM survey plots. SWH work completed to date is described in Appendix C, Chapter 1, and field examination of candidate SWH will be expanded to additional survey plots in subsequent years of Tier 1 data collection. SWH is ecologically important habitat within which plants, animals, and other organisms live and find adequate food, water, shelter, and space needed to sustain their populations. Areas of SWH often provide ecosystem components critical to sustaining biodiversity (see Objective 1), and thus can be considered in the ecosystem function and services BV.

1.2.3.3 Aquatic Habitat Mapping
AHM completed to date is described in Appendix D, Chapter 1. AHM studies focus on characterizing watercourses, waterbodies (ponds, lakes), and wetlands in the relevant aquatic study areas. These studies can identify potentially important habitats for fish and other aquatic and semi-aquatic wildlife. Aquatic and semi-aquatic habitats can be considered in the ecosystem function and services BV for their potential to support biodiversity.

1.2.3.4 Environmental DNA Metabarcoding
Environmental DNA (eDNA) metabarcoding studies[2] completed to date are described in Appendix E, Chapter 1. The two vertebrate primers used for eDNA studies were primarily intended to capture aquatic and semi-aquatic species such as fish, amphibians, and turtles. Invertebrate primers used for eDNA studies were targeted to capture aquatic and semi-aquatic invertebrate species (see Zoetica's BPD Report (Zoetica 2022)). eDNA metabarcoding is a powerful tool that can potentially identify biodiversity hotspots in sampled habitats within the BIS study areas. Such areas provide a relatively important ecosystem function with regard to sustaining local biodiversity and may be important to protect. eDNA surveys may also identify the presence of pests that are currently impacting the ability of the ecosystem to function, or could threaten to impact ecosystem function in the future with growth and spread.

1.2.4 Mapping Considerations
Desk-based species observations reported on maps were limited to observations from 1970 onward as older observations were considered historic and not as reliable. See Appendix A, Chapter 1 for data quality scoring. For EDDMapS data, when there were multiple entries with a count of one at the same location, Zoetica assumed the entries were all the same individual to avoid double-counting and erroneously reporting that multiple individuals were present. For simplicity, mapped species observations in **Figure**

[2] In all sections of this 2023 BIS Baseline Report, where eDNA studies and results are noted, they refer to the use of eDNA in combination with metabarcoding for multi-species identification.

A-2 present the *cumulative* number of observations and counts and do not represent the number of individuals.

Incidental observations were recorded during various Tier 1 baseline field programs and were noted on different data forms. Incidental observations varied in method of observation (audio, visual, etc.) and life history stage of organisms, and may have been recorded in transit to a site and thus not associated with habitat data. As well, expertise in species identification may have varied among field contractors working on different field programs. Thus, not all pertinent information may have been available (e.g., observation type, activity, demographics) or collected in a directly comparable manner (e.g., quantity). Data on incidental observations of species of interest are included in Appendix A (**Table A-3**).

1.3 Results

1.3.1 Ecosystems and ecosystem components critical to sustaining biodiversity

Habitats that are important for species support biodiversity and thus provide ecosystem functions. Zoetica considered areas of protected habitat for biodiversity to be important for evaluating ecosystem function.

1.3.1.1 National and Provincial Parks and Reserves

Parks and reserves support ecosystem functions by preventing development within these areas and protecting ecosystems that support biodiversity. They also support ecosystem services that can provide regulating, cultural, and supporting services for local people. According to the World Database on Protected Areas, no national or provincial parks overlap with the BIS study areas (AOI, LSA_{ECO}, and RSA_{ECO}).

1.3.1.2 Areas of Natural or Scientific Interest (ANSI)

ANSIs are areas of land and water in Ontario containing natural landscapes or features that have significant life science or earth science values on a local, regional, or provincial scale. ANSIs are considered natural heritage areas and are subject to the requirement that development and site alteration not occur on adjacent lands unless it has been demonstrated that there will be no negative impacts on the ANSI or its ecological function (see the Provincial Policy Statement (MMAH 2020) for more information). The province recommends a 120 m buffer for “adjacent lands" around Life Science ANSIs and a 50 m buffer around Earth Science ANSIs (OMNR 2010). Thirteen ANSIs exist within the BIS study areas, including five of provincial significance and eight of regional significance. No ANSIs were found within the AOI (**Figure A-1**). The Greenock Swamp Wetland Complex (GSWC) is classified as a Life Science ANSI of provincial significance, thus providing critical ecosystem function in the SON-South Bruce area. The GSWC is primarily captured within the LSA_{ECO} north of the AOI, with a small portion in the RSA_{ECO} (**Figure A-1**). Of note, the southern end of the GSWC that protrudes into the northern AOI is not considered part of the ANSI. The Turnberry Swamp, a Life Science ANSI of regional significance, partially occurs in the southern end of the LSA_{ECO} (**Figure A-1**). These Life Science ANSIs are defined by their important ecological features, and thus provide significant ecosystem functions to the SON-South Bruce area. In the RSA_{ECO}, several other Life Science ANSIs occur, including the eastern border of the Glammis Bog (provincially significant) just north of the LSA_{ECO}; the St. Helens Beech Maple Forest (regionally significant) in the southwestern RSA_{ECO};

most of the St. Augustine Bog and Swamp Forest (regionally significant) in the southwestern RSA_{ECO}; Murrays Bog (regionally significant) in the eastern RSA_{ECO}; portions of the Lakelet Lake Bog (regionally significant) close to Murray's Bog; the Bog North of Gorrie (regionally significant) in the southeastern RSA_{ECO}; and parts of the Wroxeter Swamp (regionally significant) in the southeastern RSA_{ECO} (**Figure A-1**). Earth Science ANSIs have important geological landscapes or features in their area, which might also provide unique habitats to support biodiversity and ecosystem function. Four Earth Science ANSIs also exist within the $RSA_{ECO,}$ including the Lothian-Lake Warren Shorelines (provincially significant) in the western RSA_{ECO}; the Saugeen River Section (provincially significant) in the northeastern RSA_{ECO}; the Formosa North Road Cut (provincially significant) in the eastern RSA_{ECO}; and the Elma Tavistock Tills (regionally significant) in the southern RSA_{ECO} (**Figure A-1**).

1.3.1.3 Conservation Authority Lands

The jurisdictions of two conservation authorities (CAs) partially overlap with the BIS study areas (**Figure A-1**). The AOI and the LSA_{ECO} fall within the Saugeen Valley Conservation Authority (Saugeen Conservation; SVCA) jurisdiction, except for a small portion of the western LSA_{ECO} that is in the jurisdiction of the Maitland Valley Conservation Authority (Maitland Conservation; MVCA). The RSA_{ECO} overlaps primarily with the western extent of the SVCA jurisdiction, but the southern portion of the RSA_{ECO} overlaps with the northwest extent of the MVCA jurisdiction.

Conservation lands, owned by either the SVCA or the MVCA, exist within the boundaries of the CA jurisdictions. No conservation lands overlap the AOI (**Figure A-1**). Within the LSA_{ECO}, the SVCA owns 35 properties in the GSWC north of the AOI and one, the Hardwood Hill Management Unit, south of the AOI (**Figure A-1**). The RSA_{ECO} contains conservation lands owned and managed by the SVCA and MVCA. In addition to those in the LSA_{ECO}, the SVCA owns 18 properties in the RSA_{ECO}, of which three occur in the northern portion of the GSWC outside of the LSA_{ECO} (**Figure A-1**). The MVCA owns 18 properties contained within the southern RSA_{ECO} (**Figure A-1**). The SVCA and MVCA manage these lands to conserve their ecosystem functions and support biodiversity.

1.3.1.4 County and Municipal Lands

Huron and Bruce County open datasets both included forest tracts, but no forest tracts occur in the AOI. Five forest tracts occur in the RSA_{ECO}, one of which (Culross Tracts) occurs within the LSA_{ECO} (**Figure A-1**). All forest tracts in the RSA_{ECO} are within the Bruce County boundary. Timber harvest, which is an ecological service of relevance to humans, may occur in these forest tracts. The forest tracts are also managed by the counties to also provide habitat for biodiversity.

Huron County datasets indicated that 11 municipal parks occur within the RSA_{ECO}, none overlapping with the AOI or LSA_{ECO} (**Figure A-1**). The parks primarily occur as a cluster south of the LSA_{ECO}, with one occurring southwest of the LSA_{ECO}, one in the far south of the RSA_{ECO} along the boundary between the Township of North Huron and the Municipality of Morris-Turnberry, and another two southeast of the LSA_{ECO}, near Wroxeter Swamp. When writing the 2023 BIS Baseline Report (September 2023), Zoetica did not have data for Bruce County to map municipal parks within this boundary and the BIS study areas. Municipal parks can provide ecosystem function via habitat for biodiversity, while also containing land types that provide less ecosystem function such as lawns, pavilions, playgrounds, and other paved or built spaces. Thus, they are heterogeneous units in terms of providing ecosystem functions and services and vary more from park to park compared to other types of protected lands.

1.3.1.5 Additional areas identified during Tier 1 studies

Tier 1 studies to date focused on determining the presence, distribution, and abundance of important habitat for BVs with an emphasis on species of conservation concern (including species at risk (SAR) and provincially rare species), species of interest and potential importance to local stakeholders and rights-holders, invasive species, and indicator species. Each BV chapter outlines existing information on important habitats within their respective study areas collated through searches of desk-based datasets and field surveys. In addition, Appendix C, Chapter 1 presents candidate SWH identified using ecosite information from TEM studies (Appendix B, Chapter 1) for these species. Appendix D, Chapter 1 includes potentially important aquatic habitats for fish and other aquatic and semi-aquatic biota. All of these important habitats identified in the previous chapters are providing key ecosystem functions to allow species to carry out life history stages within those habitats. In future iterations of the BIS Baseline Report, Zoetica will consider important areas for each BV holistically to identify any biodiversity hotspots and assess potentially important areas for sustaining high biodiversity.

1.3.2 Ecosystems and ecosystem components providing regulating services

To date, insufficient baseline information has been collected to understand ecosystems and ecosystem components providing regulating services. Tier 1 TEM and AHM studies focused on collecting information within terrestrial and aquatic habitats, including wetlands. Chapter 3 examined information from these studies to understand the areas within the AOI and LSA_{AQU} that directly contribute to the health of existing aquatic habitats. Although the complete extent of each study area has not been mapped, currently 12.7% of the AOI and 28.1% of the LSA_{ECO} were covered by wetlands. Riparian buffers of 100 m around all mapped wetlands, waterbodies, and watercourses would cover 37.8% of the AOI and 30.5% of the LSA_{ECO}. Provincially significant wetlands and their required 120 m riparian buffers constituted 24.2% of the AOI and 48.8% of the LSA_{ECO}. Mapped ecosites within riparian buffers were mostly forest (hardwood, mixedwood, and conifer), which is likely good quality riparian habitat (see Figures D-4 and D-5 in Chapter 3). If riparian habitat is prevalent and in good condition, it could provide regulating functions for aquatic habitats in these study areas. However, 64.4% of 100 m riparian buffers in the AOI, and 58.8% in the LSA_{ECO}, were unmapped anthropogenic areas (see Table C-1 in Chapter 3), which are likely poor quality riparian habitat. Additional Tier 2 studies (e.g., Ontario Wetland Evaluation System) are planned for future years if the SON-South Bruce siting area is selected for additional baseline investigations for the Project. Data from Tier 2 studies, along with data collected as part of the Environmental Media Baseline Program (EMBP) on water and sediment quality, surface water hydrology, and groundwater (CanNorth 2021), will help Zoetica to ascertain ecosystems and ecosystem components providing regulating services in the future.

1.3.3 Ecosystems and ecosystem components providing provisioning services and cultural services

Insufficient baseline information has been collected to understand ecosystems and ecosystem components providing provisioning and cultural services. Future Tier 2 studies may be conducted once more is understood from studies on other IA pillars examining which provisioning services are important to people, and which make sense to include within the BIS scope of study.

1.3.3.1 Forest Health

Community concerns regarding emerald ash borer (EAB) and Dutch elm disease (DED) and their effects on forest health and diversity were expressed during engagement (see Appendix B in the BPPA Report (Zoetica 2021)). EAB is an invasive beetle that can quickly spread among ash trees to feed on them, resulting in tree death (NRCan 2020). Since its introduction to North America around 2002, EAB has killed millions of ash trees of several species (Herms and McCullough 2014). Without control measures to manage EAB, up to 99% of all ash trees in an area die within 8-10 years of EAB arrival (NRCan 2020). Die-off of ash can have cascading impacts on forest communities, including by altering succession and increasing invasion by non-native plants (Klooster et al. 2018).

There are desk-based records of invasive spongy moth (previously called LDD moth) at one site in the far western AOI, one site in the northern AOI and a nearby site just north of the AOI in the LSA_{ECO}, and a site in the GSWC by Clam Lake within the LSA_{ECO} (**Figure A-2**; **Table A-2**). In 2022, spongy moth was detected via eDNA metabarcoding at one stream site in the east-central AOI in the summer (see Figure I-2 in Appendix E, Chapter 1). While the spongy moth is not a provincially regulated invasive species, it is a federally regulated pest under the authority of the *Plant Protection Act* and the attendant Plant Protection Regulations (CFIA 2021). All of southern and central Ontario, and the southern parts of northern Ontario (up to the Sudbury area and west to Lake Superior) have been designated as 'regulated areas' by the Canadian Food Inspection Agency[3] for spongy moth (EDDMapS Ontario 2021). This species infests mainly oak trees but will also feed on most hardwoods and sometimes spruce, causing severe and prolonged defoliation leading to tree mortality.

In 2022 TEM surveys, forest health was assessed at 33 sites within the BIS study areas. Assessments were partially based on tree health, which was rated as poor, fair, or good. All sites rated 'fair' (n = 21) and three of four sites rated 'poor' had evidence of EAB. Forest health surveys were primarily conducted in the LSA_{ECO} north of the AOI (28 of 33 sites). Thus, EAB was only detected at sites in the LSA_{ECO} north of the AOI, despite ash trees being present at two sites south of the AOI. The only site surveyed for forest health within the AOI did not contain ash trees. EAB was the most prevalent factor in determining tree health among sites. Additional surveys will help determine the full distribution of ash species and EAB within the BIS study areas. TEM forest health surveys also detected beech bark disease (BBD) at one site in the LSA_{ECO} south of the AOI. There were no records of DED in the forest health surveys. For a complete discussion of TEM forest health surveys, see Section 4.3 in Appendix B, Chapter 1.

Several forest pests and diseases were recorded as incidental observations in the 2022 field surveys (**Table 1-2**). Such records may include observations of individuals of the given species, but often were observations of damage caused by the species. Observations from TEM surveys, AHM surveys, and incidental observations are mapped in **Figure A-3** and described in **Table A-3**. Within the AOI, field contractors detected EAB at 13 sites, and BBD and spongy moth at the same site in the southeastern AOI (which also had EAB). Field contractors detected spongy moth at one site west of the AOI in the LSA_{ECO}. In the LSA_{ECO} south of the AOI, field contractors detected EAB at ten sites, mostly within the Teeswater Wetland Complex (TWC). Also in the TWC, field teams detected DED at three sites, BBD at two sites, and white pine blister rust at one site (which also had DED and spongy moth). Field contractors detected spongy moth at one site near the TWC and one near the Wingham Wetland Complex. In the LSA_{ECO} north

[3] In regulated areas, it is prohibited to move, import, or export items that could be infested with spongy moth from the area.

of the AOI, field contractors observed EAB at 48 sites, mostly within the GSWC. Field contractors recorded spongy moth at two sites in the GSWC and two in the northeastern LSA_{ECO} (including a record of eggs), DED at two sites in the northeastern GSWC, black knot disease at one site in the northeastern GSWC, ash leaf spot disease at one site just north of Oppleck Lake, BBD at four sites in the northern GSWC, and tar spot disease at three sites in the northern portion of the LSA_{ECO}.

Table 1-2. Incidental observations of forest pests and diseases during TEM field surveys within the AOI or LSA_{ECO} in 2022. Listed BVs are in addition to the Ecosystem Function and Services BV.

Common Name	BV	Status
Ash leaf spot fungi	Vegetation	-
Beech bark disease (BBD)	Vegetation, Terrestrial Invertebrate	Invasive
Black knot	Vegetation	-
Dutch elm disease (DED)	Vegetation, Terrestrial Invertebrate	Invasive
Emerald ash borer (EAB)	Terrestrial Invertebrate	Invasive
Spongy moth	Terrestrial Invertebrate	Invasive
Tar spot fungus	Vegetation	-
White pine blister rust	Vegetation	Invasive

Annual forest health monitoring conducted by the MNRF can provide additional insight into existing stressors on forest health in the SON-South Bruce siting area. A summary of invasive forest pests and other forest disturbances in the MNRF Midhurst and Guelph districts, within which the RSA_{ECO} is contained, is provided in **Table 1-3**. Where data are available, a more detailed analysis focusing on spatial data within the RSA_{ECO} will be conducted in future years of BIS baseline program.

Table 1-3. Forest disturbances identified in the MNRF Midhurst and Guelph districts between 2017 and 2021.

District	Forest Disturbance	Status	Level of Impact	Pest Type	Host Species
Guelph	Ash leaf spot	-	Minor	Leaf disease	Ash spp.
Midhurst	Basswood leafminer	-	Minor	Defoliator	Basswood
Midhurst, Guelph	Beech bark disease	One sp. is invasive	Major	Disease	American beech
Guelph	Beech leaf disease	-	Major	Nematode	American beech
Midhurst, Guelph	Beech scale	invasive	Minor	Sucking insect	American beech
Midhurst, Guelph	Brown spot needle blight	-	Major	Needle blight	Scots pine, eastern white pine, red pine, Austrian pine
Midhurst, Guelph	Cedar leafminer complex	-	Major	Defoliator	Eastern white cedar
Midhurst, Guelph	Fall webworm	-	Minor	Defoliator	American elm, ash spp., alder spp., cherry spp., poplar spp., black walnut, hickory spp. and white birch
Midhurst	Forest tent caterpillar	-	Major	Defoliator	Various deciduous species
Guelph	Hemlock woolly adelgid	invasive	Major	Defoliator	Eastern hemlock
Midhurst, Guelph	Spongy moth	invasive	Major	Defoliator	Most hardwood species

Midhurst	Spruce gall adelgid	-	Minor	Gall making insect	White spruce, Norway spruce
Guelph	Tar spot on maple	-	Minor	Fungal foliar disease	Maple spp.

Data on the size of the impacted areas are available for some of the forest disturbance factors listed in **Table 1-3**; trends over the period of 2017-2022 are shown in **Figure 1-1**. Cedar leafminer complex and forest tent caterpillar were not causing moderate or severe damage/defoliation from 2019 to 2021 (and forest tent caterpillar was not an issue in the Guelph District from 2017 - 2022). However, cedar leafminer complex returned to both the Midhurst and Guelph districts in 2022. As well, moderate to severe damage to pine trees from brown spot needle blight returned to both districts in 2022 after being absent in 2020 and 2021. Spongy moth infestation was increasing substantially from 2017 to 2021 in the Midhurst District, and steadily in the Guelph District, and is a primary forest health concern for both regions. In 2021, the MNRF mapped 176,264 ha and 112,978 ha of spongy moth infestation in the Midhurst and Guelph districts, respectively. With respect to the SON-South Bruce siting area, small areas of spongy moth defoliation were mapped in and around the GSWC between Glammis (County Rd 15) and Kinloss (County Rd 9) in 2021 – this area falls within the RSA_{ECO} and potentially the LSA_{ECO} (NDMNRF 2022). However, in the report on 2022 data, the MNRF noted that 2021 was the peak of an outbreak and moderate to severe defoliation declined to zero and 3,128 ha in Midhurst and Guelph, respectively (MNRF 2023). Spongy moth outbreaks are naturally cyclical (every 7-10 years), and susceptibility to pathogens and egg parasitism may have contributed to the recent decline in their populations (MNRF 2023).

Further information on major and minor forest disturbances, including locations of low-level damage or defoliation (not included in **Figure 1-1**), is available in the MNRF's *Forest Health Conditions in Ontario* reports (MNRF 2017, 2018, 2019, 2020, 2023, NDMNRF 2021, 2022). If the SON-South Bruce siting area is selected, Tier 2 studies will include additional surveys for EAB and other forest pests in all woodlands within the AOI, as these pests change the structure and canopy of woodlands.

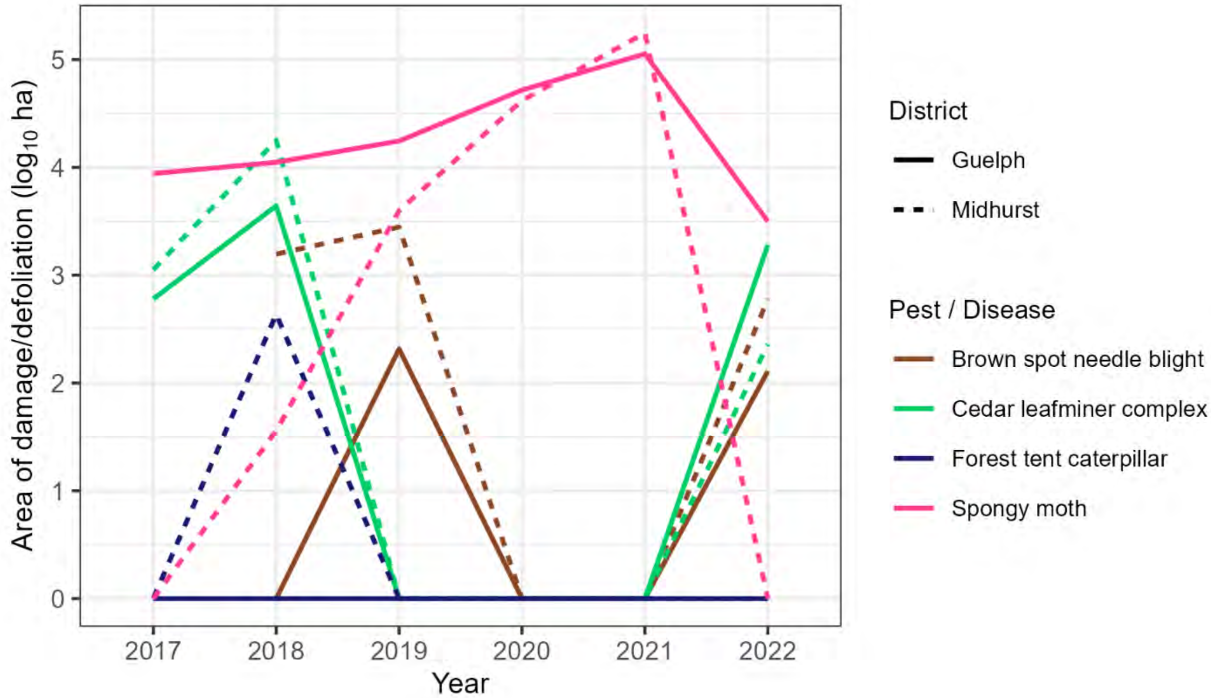

Figure 1-1. Areas of moderate to severe damage or defoliation caused by each forest disturbance type in the Midhurst and Guelph districts from 2017-2022 (MNRF 2023).

1.3.3.2 Trails

In addition to the areas listed in Section 1.3.1, the Ontario Trail Network has 28 trails within the RSA_{ECO}. Trails are managed by various trail management associations. Trails have been grouped, where appropriate, into trail networks for mapping purposes. One trail, maintained by the Huron Shores ATV Club, runs through the western part of the AOI and the southwestern part of the LSA_{ECO} (**Figure A-1**). An additional trail network (the Culross Trails) occurs in the southern LSA_{ECO} (**Figure A-1**). The remainder of the trails occur as small trail networks primarily within the southern RSA_{ECO} (south of the AOI), except for the Bruce Country Rail Trail, which runs along the eastern side of the southern RSA_{ECO}, and crosses to the western side at the town of Paisley in the northern RSA_{ECO}. In addition, the Saugeen River Trail and the Brant Tract Trails occur in the RSA_{ECO} northeast of the AOI (**Figure A-1**).

1.3.3.3 Areas of Interest to Stakeholders and Rights-Holders

During engagement conducted with stakeholders and rights-holders in the SON-South Bruce siting area, concerns about the existing state of the environment and biodiversity were raised. Individuals expressed concerns about existing water contamination (from agriculture) and aquatic health (including effects on biological diversity and abundance of fish populations, perceived to be related to the use of pesticides and insecticides), which may be addressed by water quality assessments in the EMBP. Concerns were also raised regarding the area's low amount of remaining forest and the impacts that deforestation has had on rivers, streams, wetlands, and forest diversity. Participants raised the need to preserve biological diversity, including SAR. Participants also noted the current degradation of ecosystem function and services, especially provisioning services (e.g., agriculture and livestock, drinking water wells and aquifers, and species such as maple trees for syrup harvesting) and regulating services (e.g., wetlands and ecosystem features that act as water regulating services to prevent flooding). In addition, the influence of climate change was brought up as a concern as it relates to water management, including the increasing seasonal risk of drought and floods, and the spread of zoonotic diseases (e.g., Lyme disease).

Future engagement may include questions about land and resource use; types and locations of food, medicine, water, and other resources that are hunted, collected, or grown; culturally or spiritually important sites; the interconnectedness between ecosystems; types and locations of recreation; and locations of commercial use (including tourism). Many of the issues and concerns expressed during engagement will be relevant to considerations for ecosystem function and services within the BIS, and close collaboration across the IA pillars is necessary.

1.4 Discussion

The current Chapter 9 of the 2023 BIS Baseline Report focused on a desk-based analysis of available information, along with observations of forest pests from 2022 field survey results. This Chapter examined ecosystems and ecosystem components critical to sustaining biodiversity within relevant BV study areas, and components that provide regulating, provisioning, or cultural services. Tier 1 and proposed Tier 2 BIS studies, additional studies in the EMBP (CanNorth 2021), and information on other sustainability pillars (i.e., social, economic, health) will ultimately feed into determining the baseline conditions for ecosystem function and services. When data from these studies are received, relevant information will be incorporated into this chapter.

To date, Zoetica has compiled a list of ANSIs, CA lands, county and municipal lands, and trail networks within the RSA_{ECO}. This information points to areas important for sustaining biodiversity and providing cultural services. Zoetica conducted a preliminary analysis of regional forest health conditions and trends, as forest disturbances may impact provisioning services (e.g., merchantable timber) and supporting services (e.g., habitat for biodiversity). Additional Tier 1 studies aimed at collating important habitat information for various BVs and mapping foundational habitat information within relevant BIS study areas (see Section 3.0, Chapter 1) are presented in BV-specific chapters. Additional field-based Tier 1 data and future BV-specific Tier 2 studies will confirm locations of important habitats, which may be highlighted in this chapter if certain BIS study areas are more suited for supporting biodiversity than other areas.

TEM and AHM results to date indicate that riparian buffers in mapped areas of the AOI and LSA_{ECO} are predominately forested, with lesser representation by meadows, plantations, and shrublands (see Figures D-4 and D-5 in Chapter 3). Approximately half of the riparian buffers were unmapped anthropogenic areas. This suggests that many wetlands, watercourses, and waterbodies in the BIS study areas have some good quality and some poorer quality riparian habitat. When healthy, wetlands can promote ecosystem functioning that may support biodiversity and provide ecosystem services like water retention and flood control.

Of the forest pests and diseases detected in desk- and field-based data thus far, spongy moth and EAB may be the greatest causes for forest health concerns. Data from Ontario's annual forest health monitoring program showed that spongy moth defoliation is a major forest disturbance factor in the Midhurst District and could be impacting merchantable timber and other ecosystem functions and services within the BIS study areas (see Section 1.3.3.1). Spongy moth was also detected within the AOI in eDNA samples from summer 2022, and individuals or evidence of individuals were incidentally observed during 2022 field surveys. Evidence of EAB was incidentally observed in 2022 field surveys and detected during forest health surveys (see Appendix B, Chapter 1). In forest health surveys, EAB was noted as the primary pest or disease associated with sites with fair or poor tree health (as opposed to 'good' tree health). The need for targeted baseline studies and ground-based monitoring of spongy moth and EAB will be determined after more information is gathered about potential project impacts and stakeholder and rights-holder concerns.

The objectives outlined in Section 1.1.1 can provide a framework for integrating data and information from different IA pillars to examine impacts on ecosystem function and services related to biodiversity in the biodiversity IA. Relevant information from other environmental studies (i.e., conducted under the EMBP) and through the socio-economic pillar will be used alongside biodiversity information to identify ecosystems and ecosystem components that are critical for sustaining biodiversity and for providing regulatory and provisioning services related to biodiversity. In addition, biodiversity information presented in the BIS Baseline Report may be used by other pillars (e.g., socioeconomic) to identify regulating, cultural, and provisioning services important for people.

Objective 1, to identify ecosystems and ecosystem components critical to sustaining biodiversity, will largely be informed by the desk-based research and various field programs of the BIS. Protected and conserved lands and parks often provide ecosystem functions and important habitat for supporting biodiversity. For example, ANSIs are lands deemed significant on the provincial or reginal landscape, and thus provide key ecosystem functions that may not occur in many nearby areas. TEM work will highlight areas with rare ecosites on the landscape, which are likely to house different species compositions. TEM surveys also examine habitat features for wildlife, such as coarse woody debris and tree attributes like bark retention, which can support animal biodiversity. TEM and AHM surveys both examine vegetation species diversity across sites, and thus can highlight biodiversity hotspots within the BIS study areas. eDNA metabarcoding studies provide a vast amount of information on species diversity across sites and across several taxa, which will further contribute to identifying biodiversity hotspots. Identification of SWH will highlight areas that contribute to the quality and diversity of the region, supporting additional or important biodiversity. These can include seasonal concentration areas, rare vegetation communities, specialized habitat for wildlife, habitat for species of conservation concern, and animal movement corridors. TEM forest health surveys may also reveal unhealthy areas where biodiversity is likely poor, due to disturbances such as logging, various human activities, and forest diseases and pests. Desk-based work will continue to draw on publicly available databases of species observations and occurrences, which have and may continue to reveal the presence of species of conservation concern that require protection. TEM, AHM, and eDNA surveys have also indicated the presence of species of conservation concern, along with invasive species that may be negatively impacting biodiversity in an area if they are taking over the landscape and outcompeting a variety of native species. Future engagement will better inform Zoetica's analysis of species of importance to stakeholders and rights-holders, which will also be considered when evaluating biodiversity in the context of ecosystem services. After all Tier 1 data are collected, these biodiversity data will be mapped in layers (e.g., species of interest observations, SWH locations, forest health disturbances, amount and diversity of eDNA species detections) to show areas that are providing greater ecological functioning than others, which may be prioritized for protection. If the SON-South Bruce site is selected, additional Tier 2 studies will build upon the identification of ecosystems and ecosystem components critical to sustaining biodiversity and may incorporate information collected as part of the EMBP (e.g., bathymetry data for determining important fish habitat).

Objective 2, to identify ecosystem processes that provide regulating services for sustaining biodiversity and ecological function, will be informed by a combination of data from the BIS and EMBP data collection programs. The EMBP includes data collection on several regulating services: air quality, light and noise, water quality, water flow, and soil quality (CanNorth 2021). The BIS includes data collection on species presence, which may include pollinators, biological control agents for invasive species, species that benefit soil fertility, and vegetation species that sequester carbon. All of these species can provide or improve regulating services (see Section 1.1.1). The BIS program will continue to examine the habitats within riparian buffers around wetlands, which can increase ecosystem functioning, protect against erosion and sediment runoff, and moderate impacts from extreme weather events. Ecosite classification may also highlight habitats with greater or lesser potential to store carbon. TEM surveys include collecting data on soil conditions like texture and moisture, which are important for considering mitigation aimed at preventing or minimizing erosion and sedimentation, and in maintaining soil fertility. As an example, wetlands have great potential to provide regulating services for other aquatic habitats and provide a buffer between aquatic and upland habitat. Zoetica may integrate information on hydrology and groundwater from the EMBP with information on wetland and riparian function, habitat quality, and aquatic biodiversity from the BIS datasets to assess regulating services for sustaining biodiversity and ecological function. In future years, Zoetica may map these various components that are involved in regulating services (e.g., air quality, water quality, soil quality and conditions, observations of species that may provide regulating services, riparian buffers, ecosites) in layers to potentially reveal areas that may be more important for regulating services than others, which may be prioritized for protection.

Objective 3, to identify ecosystems and ecosystem components that underlie the provisioning of goods and provide cultural services, will require information from both the BIS and EMBP, and may be used within the socio-economic pillar. Identifying ecosystems and ecosystem components that underlie the provisioning of certain goods may require information collected as part of the BIS (e.g., identifying key species and ecosystems, mature forests that may provide merchantable timber), but will likely be assessed for their importance as provisioning services in the socioeconomic pillar. The EMBP will collect data on tissue chemistry including contaminants of potential concern, and a traditional foods dietary survey to learn of the quantity, type, and harvest locations of traditional foods by local stakeholders and rights-holders. The various water chemistry and planktonic / aquatic invertebrate sampling programs of the EMBP will inform the health of aquatic environments which can provide extensive cultural services to people. The EMBP also includes a drinking water quality program (CanNorth 2021). Within the BIS, AHM and eDNA surveys will provide data on fish and other aquatic species diversity, which can impact cultural services and provisioning of goods such as fish for food. AHM surveys specifically include identifying potentially important fish habitat. The TEM forest health surveys will inform cultural services as disturbances to the environment can impact human health, use of the space, and appreciation. The forest health surveys will also inform provisioning of goods such as timber. Species observations from various BIS desk- and field-based data, along with identification of SWH for deer and other prey, can allow for the examination of the provisioning of hunted and / or gathered foods within the area.

In addition, future Tier 2 studies specific to ecosystem function and services (see Zoetica's BPPA Report (Zoetica 2021)), are anticipated to be conducted after site selection. These studies will help determine ecosystems' ecological function and importance for maintaining biodiversity. A more complete discussion of ecosystem accounting is presented in Section 5.2.12.6 of Zoetica's BPPA Report (Zoetica 2021b).

A more complete discussion of ecosystem function and services will be included in future iterations of the BIS Baseline Report after Tier 1 field data collection has been completed and analyzed. Tier 2 studies will be completed if the SON-South Bruce siting area is selected for additional baseline investigations for the Project.

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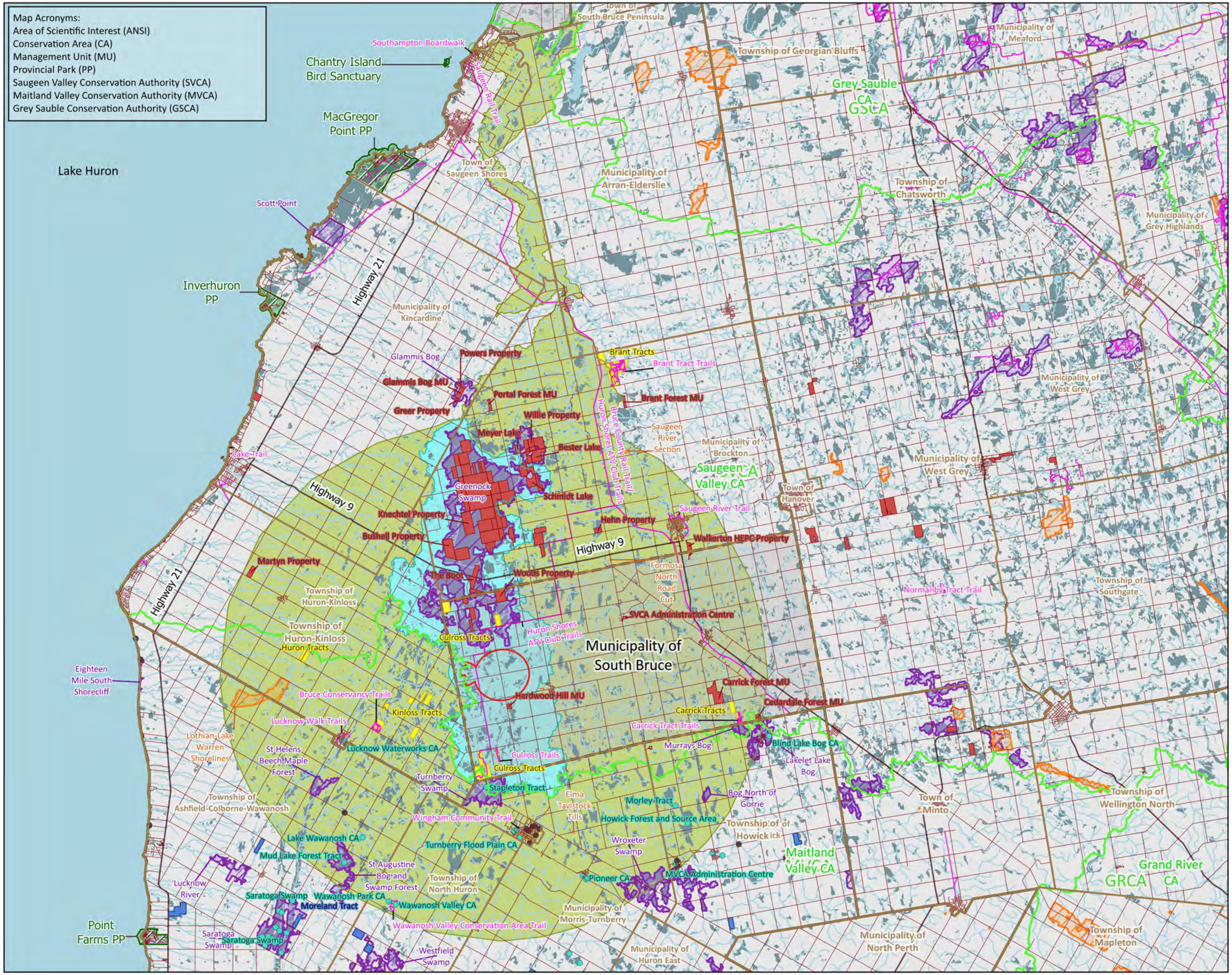
APPENDIX A – SUPPORTING INFORMATION FOR ECOSYSTEM FUNCTION & SERVICES

Table A-1. Common and scientific names for species mentioned in this report. Species names follow the NHIC's Ontario species lists (current to March 1, 2023) or NatureServe Explorer if the species does not exist in the NHIC dataset.

Common Name	Scientific Name	Notes
Forest pests and diseases		
Ash leaf spot fungi	*Mycosphaerella effigurata*	
Basswood leafminer	*Baliosus nervosus*	
Beech bark disease	*Neonectria faginata; N. ditissima*	BBD
Beech scale	*Cryptococcus fagisuga*	
Beech leaf disease	*Litylenchus crenatae* ssp. *mccannii*	
Black knot	*Apiosporina morbosa*	
Brown spot needle blight	*Lecanosticta acicola*	
Cedar leafminer complex	*Argyresthia aureoargentella; A. canadensis; A. thuiella; Coletechnites thujaella*	
Dutch elm disease	*Ophiostoma ulmi*	DED
Elm bark beetles	*Hylurogopinus rufipes*; *Scolytus multistriatus*	
Emerald ash borer	*Agrilus planipennis*	EAB
Fall webworm	*Hyphantria cunea*	
Forest tent caterpillar	*Malacosoma disstria*	
Hemlock woolly adelgid	*Adelges tsugae*	
Spruce gall adelgid	*Adelges* sp.	
Spongy moth	*Lymantria dispar dispar*	Previously called LDD / gypsy moth
Tar spot fungus	*Rhytisma acerinum; R. americanum*	
White pine blister rust	*Cronartium ribicola*	
Other species (trees)		
Ash	*Fraxinus* spp.	
Alder	*Alnus* spp.	
American beech	*Fagus grandifolia*	
American elm / white elm	*Ulmus americana*	
Austrian pine	*Pinus nigra*	
Basswood	*Tilia americana*	
Black walnut	*Juglans nigra*	
Cherry	*Prunus* spp.	
Eastern hemlock	*Tsuga canadensis*	
Eastern white cedar	*Thuja occidentalis*	
Eastern white pine	*Pinus strobus*	
Hickory	*Carya* spp.	
Maple	*Acer* spp.	
Norway spruce	*Picea abies*	
Oak	*Quercus* spp.	
Poplar	*Populus* spp.	
Red pine	*Pinus resinosa*	
Scots pine	*Pinus sylvestris*	
Spruce	*Picea* spp.	
White birch / paper birch	*Betula papyrifera*	
White spruce	*Picea glauca*	



NWMO Biodiversity Impact Studies

Protected and Recreation Areas

Figure A-1

- Area of Interest (AOI)
- Local Study Area (LSA_{ECO})
- Regional Study Area (RSA_{ECO})
- Conservation Authority Boundary
- ANSI, Earth Science
- ANSI, Life Science
- Protected Areas or Provincial Park (PP)
- Trail
- Highway
- Local Road
- Watercourse
- Lake
- Wetland
- South Bruce Boundary
- Other Municipal Boundary
- County Boundary
- Saugeen No. 29
- SVCA Properties
- MVCA Properties or Conservation Area (CA)
- Municipal Park in Huron County
- Huron County Forest Tract
- Bruce County Forest Tract

Only areas of relevence to the project have been labeled. No data was available at the time of mapping for municipal parks in Bruce County.

1:325,000

0 4 8 km

ZOETICA

Data received from:
Ontario GeoHub — Areas of Natural and Scientific Interest (NDMNRF); Conservation authority administrative area (MECP); Indian Reserve (NDMNRF); OHN Waterbody (NDMNRF); OHN Watercourse (NDMNRF); ORN Road Segment (NDMNRF); OTN Trail Segment (NDMNRF); Municipal Boundary - Lower and Upper Tier (MMAH); Wetlands (NDMNRF)
NWMO — AOI; SVCA Properties (SVCA)
IBAT — World Database on Protected Areas (UNEP-WCMC and IUCN)
Bruce County Open Spatial Data — Bruce County Forests
Huron County Open Data — County Tracts; Parks

Project CRS: NAD83 / UTM zone 17N

Author: DM	Reviewed by: RC	Approved by: HB
October 06, 2023	Map ID: NWMO_BIS_D110	

Table A-2. Desk-based observations of species of interest relevant to Ecosystem Function and Services within the BIS study areas.

Grid	Source	Species	Count	Coordinates	AOI	LSA_{ECO}
6579	EDDMapS	Spongy Moth	U	465949, 4879865	0	1
6973	EDDMapS	Spongy Moth	U	469602, 4873715	1	1
7275	EDDMapS	Spongy Moth	U	472878, 4875398	0	1
7375	EDDMapS	Spongy Moth	U	473082, 4875161	1	1

Notes:
Refer to **Figure A-2** for the grid locations.
For the purposes of this table, the indicated study area includes overlap with other study area(s) that may be encompassed within its boundaries. 1 = detected, 0 = not detected.
Count of 'U' = unspecified.

Table A-3. Field-based incidental observations of species of interest relevant to Ecosystem Function and Services within the BIS study areas in 2022.

Grid	Species	Observation Type	Count	Source Type	Coordinates	AOI	LSA_{ECO}
6872	Spongy Moth	Visual	>1	TEM	468168, 4872973	0	1
6890	Emerald Ash Borer	Visual	1	TEM	468509, 4890278	0	1
6981	Emerald Ash Borer	Visual	high density	TEM	469926, 4881546	0	1
6983	Emerald Ash Borer	Visual	>1	TEM	469644, 4883714	0	1
6990	Emerald Ash Borer	Visual	1	TEM	469040, 4890199	0	1
6991	Emerald Ash Borer	Visual	1	TEM	469914, 4891483	0	1
6992	Emerald Ash Borer	Visual	1	TEM	469005, 4892285	0	1
6992	Beech Bark disease	Visual	1	TEM	469005, 4892285	0	1
6993	Emerald Ash Borer	Visual	>1	TEM	469610, 4893465	0	1
7064	Emerald Ash Borer	Visual	1	TEM	470496, 4864902	0	1
7065	Dutch Elm disease	Visual	>1	TEM	470695, 4865814	0	1
7071	Emerald Ash Borer	Visual	1	TEM	470868, 4871879	1	1
7073	Emerald Ash Borer	Visual	1	TEM	470454, 4873877	0	1
7077	Emerald Ash Borer	Visual	1	TEM	470203, 4877034	0	1
7077	Emerald Ash Borer	Visual	1	TEM	470163, 4877001	0	1
7077	Emerald Ash Borer	Visual	1	Incidental	470059, 4877776	0	1

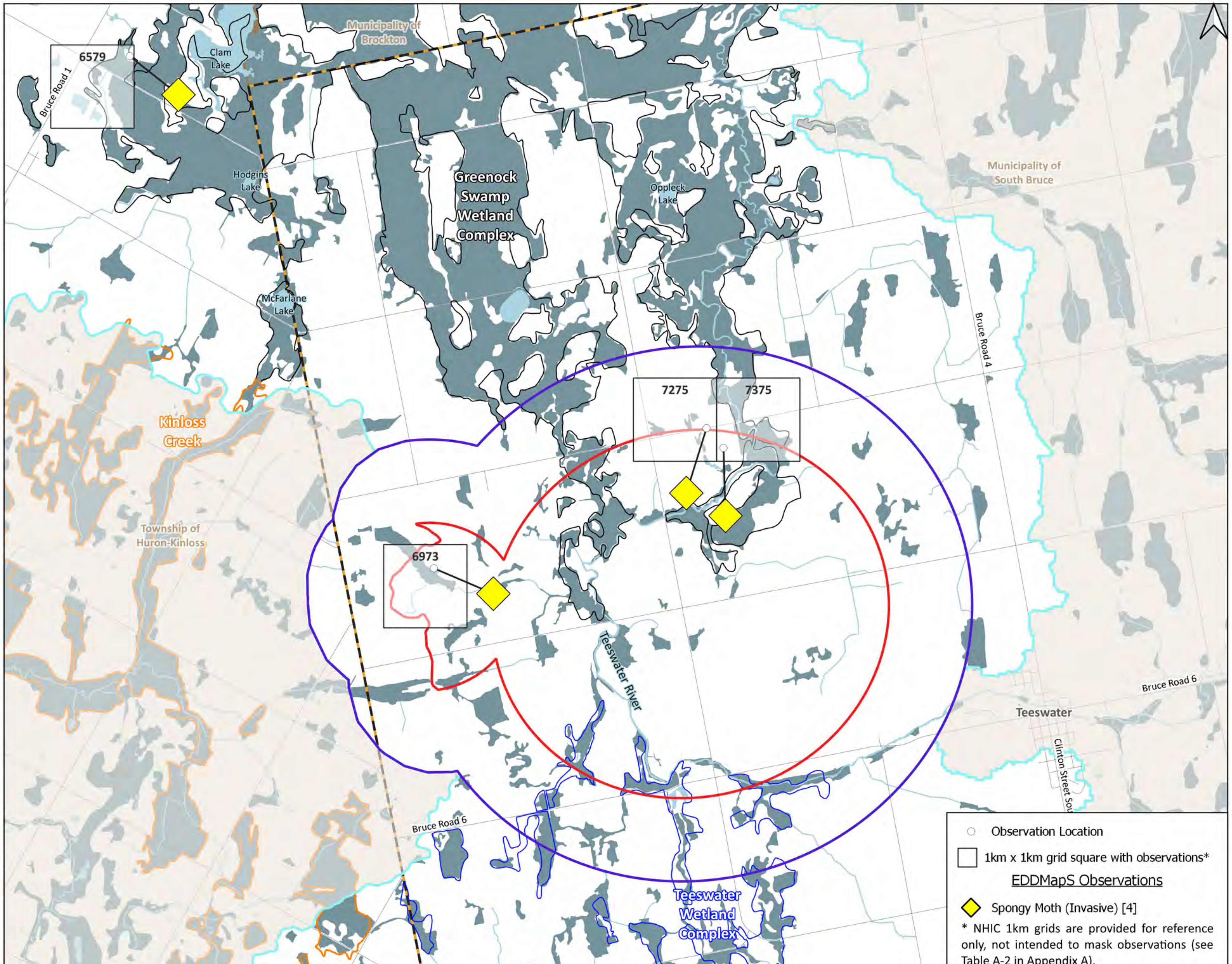
Grid	Species	Observation Type	Count	Source Type	Coordinates	AOI	LSA_{ECO}
7077	Emerald Ash Borer	Visual	1	Incidental	470215, 4877033	0	1
7078	Emerald Ash Borer	Visual	high density	TEM	470242, 4878937	0	1
7081	Emerald Ash Borer	Visual	high density	TEM	470560, 4881851	0	1
7081	Emerald Ash Borer	Visual	high density	TEM	470273, 4881965	0	1
7082	Emerald Ash Borer	Visual	high density	TEM	470384, 4882224	0	1
7082	Emerald Ash Borer	Visual	high density	TEM	470384, 4882224	0	1
7088	Emerald Ash Borer	Visual	>1	TEM	470055, 4888021	0	1
7088	Beech Bark disease	Visual	1	TEM	470352, 4888328	0	1
7088	Beech Bark disease	Visual	1	TEM	470973, 4888214	0	1
7090	Emerald Ash Borer	Visual	high density	TEM	470798, 4890789	0	1
7163	Spongy Moth	Visual	>1	TEM	471864, 4863279	0	1
7164	Emerald Ash Borer	Visual	1	TEM	471321, 4864762	0	1
7164	Emerald Ash Borer	Visual	high density	TEM	471230, 4864510	0	1
7165	Emerald Ash Borer	Visual	high density	TEM	471101, 4865542	0	1
7165	Dutch Elm disease	Visual	>1	TEM	471101, 4865542	0	1
7167	Emerald Ash Borer	Visual	>1	TEM	471136, 4867893	0	1
7167	Beech Bark disease	Visual	1	TEM	471406, 4867938	0	1
7167	Beech Bark disease	Visual	1	TEM	471406, 4867938	0	1
7167	Beech Bark disease	Visual	1	TEM	471406, 4867938	0	1
7169	Emerald Ash Borer	Visual	1	TEM	471630, 4869782	0	1
7172	Emerald Ash Borer	Visual	1	TEM	471221, 4872051	1	1
7172	Emerald Ash Borer	Visual	>1	TEM	471524, 4872315	1	1
7173	Emerald Ash Borer	Visual	1	TEM	471268, 4873472	1	1
7173	Emerald Ash Borer	Visual	high density	TEM	471136, 4873834	1	1
7173	Emerald Ash Borer	Visual	1	Incidental	471177, 4873673	1	1
7174	Emerald Ash Borer	Visual	1	TEM	471606, 4874431	1	1
7186	Emerald Ash Borer	Visual	>1	TEM	471585, 4886653	0	1
7187	Emerald Ash Borer	Visual	>1	TEM	471336, 4887743	0	1
7188	Emerald Ash Borer	Visual	1	TEM	471079, 4888946	0	1
7188	Beech Bark disease	Visual	1	TEM	471105, 4888386	0	1

Grid	Species	Observation Type	Count	Source Type	Coordinates	AOI	LSA_{ECO}
7188	Emerald Ash Borer	Visual	high density	Incidental	471564, 4888373	0	1
7189	Emerald Ash Borer	Visual	1	TEM	471696, 4889357	0	1
7265	Emerald Ash Borer	Visual	1	TEM	472499, 4865789	0	1
7265	Beech Bark disease	Visual	1	TEM	472499, 4865789	0	1
7266	Emerald Ash Borer	Visual	1	TEM	472296, 4866083	0	1
7266	Spongy Moth	Visual	high density	TEM	472269, 4866419	0	1
7266	Dutch Elm disease	Visual	high density	TEM	472269, 4866419	0	1
7266	White Pine Blister Rust	Visual	high density	TEM	472269, 4866419	0	1
7269	Emerald Ash Borer	Visual	1	TEM	472760, 4869877	0	1
7271	Emerald Ash Borer	Visual	1	TEM	472045, 4871484	1	1
7271	Emerald Ash Borer	Visual	high density	TEM	472074, 4871571	1	1
7272	Emerald Ash Borer	Visual	1	TEM	472997, 4872352	1	1
7273	Emerald Ash Borer	Visual	high density	TEM	472906, 4873888	1	1
7277	Emerald Ash Borer	Visual	1	TEM	472189, 4877948	0	1
7279	Ash Leaf Spot disease	Visual	>1	TEM	472763, 4879905	0	1
7279	Ash Leaf Spot disease	Visual	1	TEM	472763, 4879905	0	1
7280	Emerald Ash Borer	Visual	1	Incidental	472710, 4880128	0	1
7284	Emerald Ash Borer	Visual	>1	TEM	472596, 4884989	0	1
7284	Emerald Ash Borer	Visual	1	TEM	472077, 4884985	0	1
7285	Emerald Ash Borer	Visual	>1	TEM	472249, 4885296	0	1
7285	Emerald Ash Borer	Visual	high density	SWH	472249, 4885296	0	1
7285	Spongy Moth	Visual	>1	TEM	472022, 4885059	0	1
7286	Emerald Ash Borer	Visual	high density	SWH	472445, 4886583	0	1
7286	Emerald Ash Borer	Visual	1	Incidental	472443, 4886583	0	1
7287	Emerald Ash Borer	Visual	1	TEM	472041, 4887722	0	1
7287	Emerald Ash Borer	Visual	1	TEM	472095, 4887464	0	1
7287	Spongy Moth	Visual	>1	TEM	472293, 4887424	0	1
7373	Emerald Ash Borer	Visual	>1	TEM	473379, 4873989	1	1
7385	Emerald Ash Borer	Visual	med density	Incidental	473618, 4885341	0	1
7385	Emerald Ash Borer	Visual	1	Incidental	473522, 4885581	0	1

Grid	Species	Observation Type	Count	Source Type	Coordinates	AOI	LSA_{ECO}
7388	Emerald Ash Borer	Visual	>1	TEM	473168, 4888250	0	1
7388	Emerald Ash Borer	Visual	1	TEM	473571, 4888507	0	1
7388	Dutch Elm disease	Visual	>1	TEM	473020, 4888498	0	1
7388	Black Knot disease	Visual	1	TEM	473422, 4888746	0	1
7391	Emerald Ash Borer	Visual	>1	TEM	473673, 4891967	0	1
7391	Emerald Ash Borer	Visual	>1	TEM	473861, 4891906	0	1
7391	Emerald Ash Borer	Visual	>1	TEM	473861, 4891906	0	1
7391	Tar Spot disease	Visual	low density	TEM	473673, 4891967	0	1
7391	Tar Spot disease	Visual	1	TEM	473673, 4891967	0	1
7391	Tar Spot disease	Visual	med density	TEM	473861, 4891906	0	1
7392	Emerald Ash Borer	Visual	1	TEM	473887, 4892177	0	1
7392	Emerald Ash Borer	Visual	>1	TEM	473595, 4892133	0	1
7392	Emerald Ash Borer	Visual	high density	TEM	473887, 4892177	0	1
7392	Spongy Moth	Eggs	>1	TEM	473887, 4892177	0	1
7392	Tar Spot disease	Visual	low density	TEM	473595, 4892133	0	1
7392	Tar Spot disease	Visual	low density	TEM	473595, 4892133	0	1
7392	Spongy Moth	Visual	>1	TEM	473595, 4892133	0	1
7392	Spongy Moth	Visual	>1	TEM	473887, 4892177	0	1
7472	Emerald Ash Borer	Visual	>1	TEM	474211, 4872353	1	1
7472	Spongy Moth	Visual	>1	TEM	474211, 4872353	1	1
7472	Beech Bark disease	Visual	1	TEM	474211, 4872353	1	1
7477	Emerald Ash Borer	Visual	>1	TEM	474826, 4877263	0	1
7490	Emerald Ash Borer	Visual	>1	TEM	474680, 4890892	0	1
7490	Emerald Ash Borer	Visual	>1	TEM	474848, 4890232	0	1
7490	Emerald Ash Borer	Visual	high density	TEM	474916, 4890735	0	1
7490	Emerald Ash Borer	Visual	>1	TEM	474485, 4890531	0	1
7490	Dutch Elm disease	Visual	>1	TEM	474680, 4890892	0	1
7491	Emerald Ash Borer	Visual	>1	TEM	474257, 4891158	0	1
7576	Emerald Ash Borer	Visual	1	TEM	475156, 4876902	0	1
7577	Emerald Ash Borer	Visual	>1	TEM	475102, 4877116	0	1

Grid	Species	Observation Type	Count	Source Type	Coordinates	AOI	LSA_{ECO}
7666	Emerald Ash Borer	Visual	high density	TEM	476918, 4866522	0	1

Notes:
See **Figure A-3** for Grid locations of observations.
For the purposes of this table, the indicated study area includes overlap with other study area(s) that may be encompassed within its boundaries. 1 = detected, 0 = not detected.



NWMO Biodiversity Impact Studies

Desk-based Observations: Ecosystem Function and Services

Figure A-2

- Area of Interest (AOI)
- Local Study Area (LSA_{ECO})
- Lake
- Wetland
- Watercourse
- Highway
- Local Road
- South Bruce Boundary
- Municipal Boundary

Of all wetlands shown, only Provincially Significant Wetlands (PSWs) are labelled. The colour of the outline surrounding PSWs matches the colour of the respective PSW label.

PSW boundaries may not match wetland boundaries due to changes in aquatic habitat coverage since their creation compared to 2022.

1:45,000

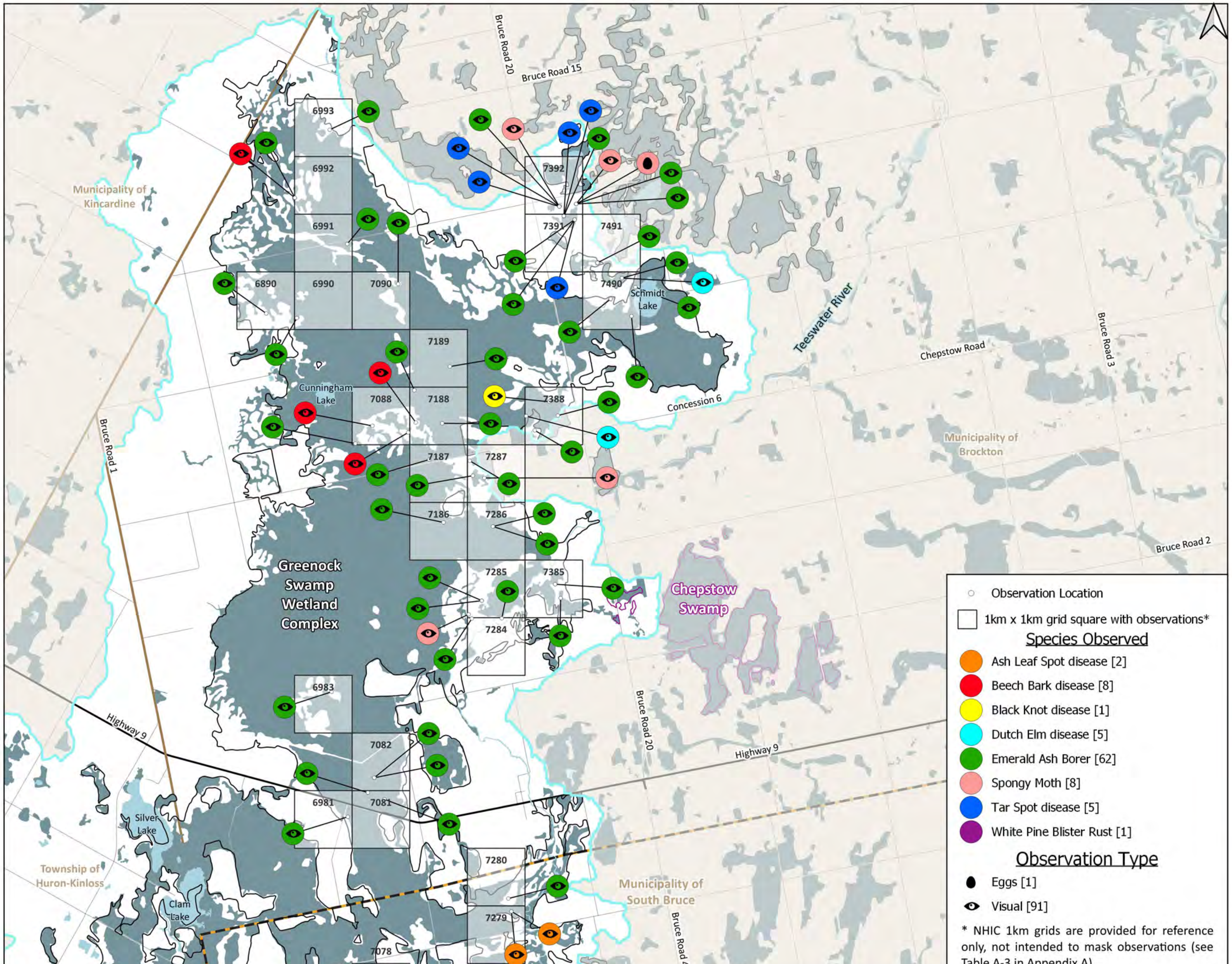
0 1 2 km

ZOETICA

Data received from:
Ontario GeoHub — OHN Waterbody (MNRF); OHN Watercourse (MNRF); MNRF Road Segments (MNRF); Municipal Boundary - Lower and Single Tier (MMAH); Wetlands (MNRF)
NWMO — AOI
EDDMapS Ontario — Invasive Species Observations - Accessed Jan.12, 2022
Wetlands and water features are mapped using ecosite data within the LSA_{ECO} and data available from Ontario GeoHub outside the LSA_{ECO}.

Project CRS: NAD83 / UTM zone 17N

Author: AH	Reviewed by: RC	Approved by: HB
December 13, 2023	Map ID: NWMO_BIS_A122	



NWMO Biodiversity Impact Studies

Field Observations: Ecosystem Function and Services - North LSA_{ECO}

Figure A-3a

- Area of Interest (AOI)
- Local Study Area (LSA_{ECO})
- Lake
- Wetland
- Watercourse
- Highway
- Local Road
- South Bruce Boundary
- Municipal Boundary

Of all wetlands shown, only Provincially Significant Wetlands (PSWs) are labelled. The colour of the outline surrounding PSWs matches the colour of the respective PSW label.

PSW boundaries may not match wetland boundaries due to changes in aquatic habitat coverage since their creation compared to 2022.

1:65,000

0 1 2 km

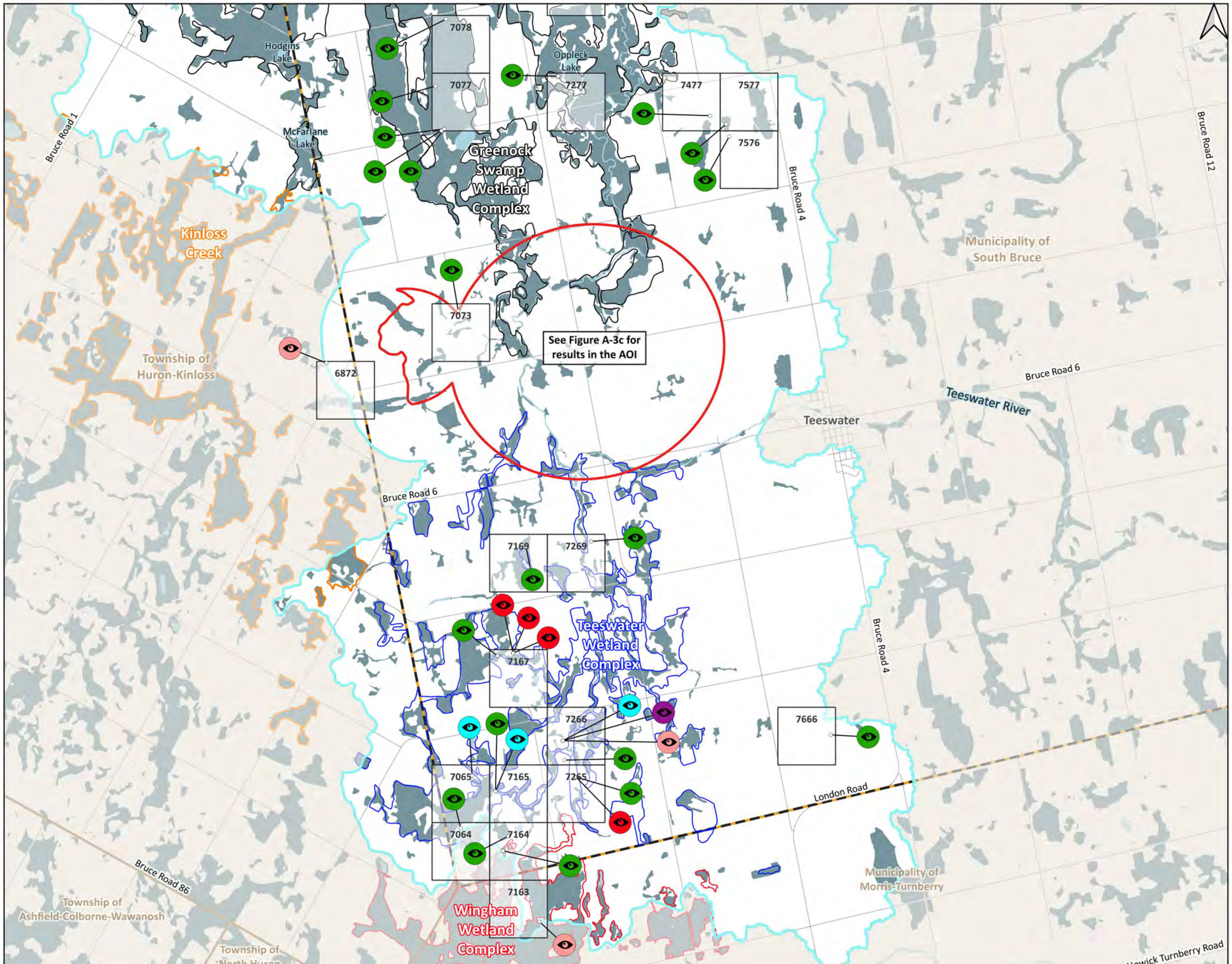
ZOETICA

Data received from:
Ontario GeoHub — OHN Waterbody (MNRF); OHN Watercourse (MNRF); MNRF Road Segments (MNRF); Municipal Boundary - Lower and Single Tier (MMAH); Wetlands (MNRF)
NWMO — AOI; NWMO Purchased or Optioned Land; 2022 SB TEM Ecosite Data Export V4 (Tulloch)
Wetlands and water features are mapped using ecosite data within the LSA_{ECO} and data available from Ontario GeoHub outside the LSA_{ECO}.

Project CRS: NAD83 / UTM zone 17N

Author: AH	Reviewed by: CC/RC	Approved by: HB

December 13, 2023	Map ID: NWMO_BIS_A120a



NWMO Biodiversity Impact Studies

Field Observations: Ecosystem Function and Services - South LSA_{ECO}

Figure A-3b

- Area of Interest (AOI)
- Local Study Area (LSA_{ECO})
- Lake
- Wetland
- Watercourse
- Highway
- Local Road
- South Bruce Boundary
- Municipal Boundary

See Figure A-3a for Full Legend

Of all wetlands shown, only Provincially Significant Wetlands (PSWs) are labelled. The colour of the outline surrounding PSWs matches the colour of the respective PSW label.

PSW boundaries may not match wetland boundaries due to changes in aquatic habitat coverage since their creation compared to 2022.

1:65,000

0 1 2 km

ZOETICA

Data received from:
Ontario GeoHub — OHN Waterbody (MNRF); OHN Watercourse (MNRF); MNRF Road Segments (MNRF); Municipal Boundary - Lower and Single Tier (MMAH); Wetlands (MNRF)
NWMO — AOI; NWMO Purchased or Optioned Land; 2022 SB TEM Ecosite Data Export V4 (Tulloch)
Wetlands and water features are mapped using ecosite data within the LSA_{ECO} and data available from Ontario GeoHub outside the LSA_{ECO}.

Project CRS: NAD83 / UTM zone 17N		
Author: AH	Reviewed by: CC/RC	Approved by: HB
December 13, 2023	Map ID: NWMO_BIS_A120b	

NWMO Biodiversity Impact Studies

Field Observations: Ecosystem Function and Services - AOI

Figure A-3c

- Area of Interest (AOI)
- Local Study Area (LSA_{ECO})
- Lake
- Wetland
- Watercourse
- Highway
- Local Road
- South Bruce Boundary
- Municipal Boundary
- NWMO Purchased or Optioned Land

See Figure A-3a for Full Legend

Of all wetlands shown, only Provincially Significant Wetlands (PSWs) are labelled. The colour of the outline surrounding PSWs matches the colour of the respective PSW label.

PSW boundaries may not match wetland boundaries due to changes in aquatic habitat coverage since their creation compared to 2022.

1:20,000

0 0.5 1 km

Data received from:
Ontario GeoHub — OHN Waterbody (MNRF); OHN Watercourse (MNRF); MNRF Road Segments (MNRF); Municipal Boundary - Lower and Single Tier (MMAH); Wetlands (MNRF)
NWMO — AOI; NWMO Purchased or Optioned Land; 2022 SB TEM Ecosite Data Export V4 (Tulloch)
Wetlands and water features are mapped using ecosite data within the LSA_{ECO} and data available from Ontario GeoHub outside the LSA_{ECO}.

Project CRS: NAD83 / UTM zone 17N		
Author: AH	Reviewed by: CC/RC	Approved by: HB
December 13, 2023	Map ID: NWMO_BIS_A120c	