Rare Plant Species Surveys for the Michigan Department of Transportation: US-12 from Bertrand/Galien township line to M-139 MDOT project No. 127449

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Cover: Left: State Threatened *Trillium recurvatum* (prairie Trillium) found along the south side of US-12 west of Dayton Lake. Right: State Endangered *Chasmanthium latifolium* (sea oats) on the north side of US-12 west of the Bakertown Drain.
All photos in this report were taken by Elizabeth Haber.

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Introduction and Methods

A summary of rare plant surveys for MDOT project area 127449 is presented in this report. Surveys for rare plant species are required for this project to ensure compliance with regulations regarding potential impacts of road improvement projects on rare species. The project area is located along US-12 in Berrien County from east of the intersection between US-12 and M-139 westward to the Bertrand/Galien Township line (Figure 1). Resurfacing of the entire project area will be carried out, including paving the 8-foot shoulders. Improvements are planned at the Bakertown Road intersection, as well as road widening at Michiana Aggregate. Guardrails will be replaced/upgraded and isolated drainage improvements will be implemented as needed.

A search of the Michigan Natural Heritage Database was performed to identify rare plant species records and high-quality natural communities found within a two-kilometer buffer of the project area. Survey search efforts focused on species that have been recently observed within the buffer of the project area (Table 1) and were also informed by the historical presence of other species in the area (Table 2) and by the presence of high-quality Natural Communities (Table 3) nearby.

Three surveys were carried out during the 2021 growing season in this project area. These corresponded as closely as possible to early, mid, and late season phenology to capture the changing plant species composition and abundance over the growing season and to maximize the chances to observe the target rare plant species. The early survey was conducted on June 21-22, the mid-season survey on July 23, and the late season survey on October 6.

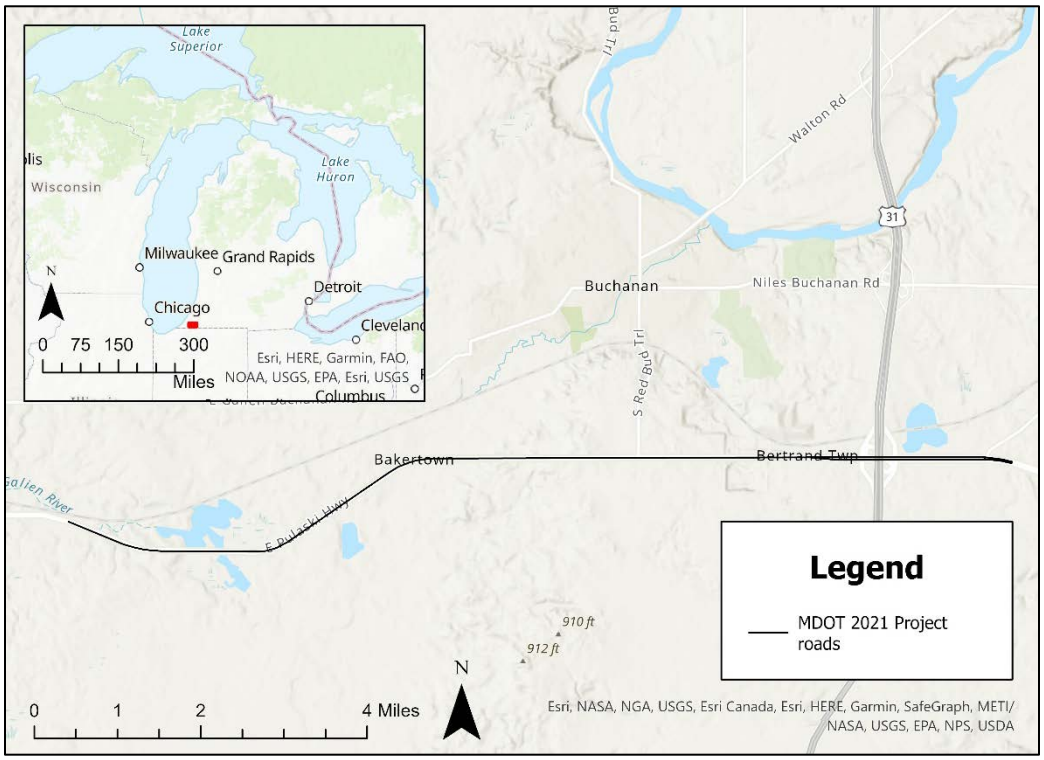

Figure 1: Overview map of MDOT project area 127449. The project area is located in Southwest Michigan in Berrien County on US-12 from M-139 westward to the Bertrand-Galien Township line (red rectangle in insert map). The roads impacted by this MDOT project are shown as black lines in the larger map.

Since this project area is large (~11.75 miles long), it was not feasible to walk the entire ROW during each survey. A targeted approach was used to focus walking survey efforts on areas which were either likely to support rare species or were likely to be disturbed during construction activities. The habitat preferences for the rare species in Tables 1 and 2 informed this targeted approach. Aerial imagery was consulted to identify locations where 1) the tree canopy was intact, and 2) creeks, lakeshores, or wetlands within the ROW were accessible, as these locations were considered more likely to provide habitat for rare species. Walking surveys were carried out in these areas of potential high-quality habitat, as well as in locations where impacts of construction activities will likely be substantial. The entire project area was surveyed either on foot or by car during each visit.

In addition to searching for rare species, several other categories of observations were collected. These include: presence and identification of non-native invasive species using the Midwest Invasive Species Information Network (MISIN) app, high-quality habitats, areas sensitive to runoff, and other notable features.

Results and Discussion

Biotics Database search results

The results of the Biotics database queries for listed plant species and Natural Community Element Occurrences found near this project area are presented in Tables 1-3.

Fifteen rare plant species have been located within two kilometers of the roads impacted by this MDOT project within the last 50 years (Table 1). Of these species, two are listed as Special Concern, eleven are Threatened, and two are Endangered. Special Concern species are tracked by MNFI; however, they do not have the legal protections that Threatened and Endangered species do.

Prior to 1970, 19 additional rare plant species have been found near this MDOT project area (Table 2). Many of the historical species occurrences have very general location information, and therefore it is not certain if these species were specifically found within the two-kilometer buffer of this MDOT project area. However, if the potential range of an historical observation intersected with the project buffer, it was included in the table. Of these 19 species, four are listed as Special Concern, 11 are Threatened, one is Endangered, and three are presumed to be extirpated from Michigan. These species were not the primary focus of search efforts, although their historical presence in the area informed searching behavior.

The majority of the rare plant species in Tables 1 and 2 occur in forested Natural Communities. Wet and mesic forests such as floodplain forests, mesic southern forests, and southern hardwood swamps are associated with many of the rare species in Tables 1 and 2, although drier forests such as oak openings, oak barrens, and dry-mesic southern forests host a fair amount of these species as well. Some of the rare species in Tables 1 and 2 also prefer prairie community types such as prairie fens and dry-mesic and mesic prairies.

Table 1: Post-1970 records of rare plant species located near the project area.			
Latin name	**Common name**	**State status**	**Target season**
Arnoglossum plantagineum	Prairie Indian-plantain	Special concern	Mid-late summer, autumn
Asclepias purpurascens	Purple milkweed	Threatened	Mid-late summer
Baptisia lactea	White false indigo	Special concern	Mid-late summer
Coreopsis palmata	Prairie Coreopsis	Threatened	Early-late summer, autumn
Cypripedium candidum	White lady-slipper	Threatened	Mid spring – mid summer
Eryngium yuccifolium	Rattlesnake master	Threatened	Mid summer – mid autumn
Panax quinquefolius	Ginseng	Threatened	Early-late summer, autumn
Phlox maculata	Wild sweet-William	Threatened	Early-mid summer
Platanthera ciliaris	Orange fringed orchid	Endangered	Mid-late summer
Polemonium reptans	Jacob's ladder	Threatened	Late spring
Primula meadia	Shooting star	Endangered	Late spring – mid summer
Silphium integrifolium	Rosinweed	Threatened	Mid-late summer, autumn
Silphium perfoliatum	Cup plant	Threatened	Mid summer – late autumn
Trillium sessile	Toadshade	Threatened	Early-late spring
Valeriana edulis var. *ciliata*	Edible Valerian	Threatened	Mid spring – mid summer

Table 1: Results of a query of the Biotics database listing occurrences of protected plant species within a two-kilometer buffer of the project area last observed since 1970

Table 2: Pre-1970 historical records of rare plant species located near the project area.			
Latin name	**Common name**	**State status**	**Target season**
Androsace occidentalis	Rock-jasmine	Endangered	Mid-late spring
Brickellia eupatorioides	False boneset	Special Concern	Mid-late summer, autumn
Carex gravida	Sedge	Extirpated	Early-mid summer
Carex oligocarpa	Eastern few-fruited sedge	Threatened	Late spring – mid summer
Carex seorsa	Sedge	Threatened	Early-mid summer
Collinsia verna	Blue-eyed Mary	Special Concern	Mid-spring – early summer
Corydalis flavula	Yellow fumewort	Threatened	Early-mid spring
Euphorbia commutata	Tinted spurge	Threatened	Mid-spring – early summer
Filipendula rubra	Queen-of-the-prairie	Threatened	Mid-late summer, autumn
Galearis spectabilis	Showy orchis	Threatened	Mid-spring – early summer
Gentiana saponaria	Soapwort gentian	Extirpated	Early-late autumn
Gentianella quinquefolia	Stiff gentian	Threatened	Early-late autumn
Hybanthus concolor	Green violet	Special concern	Mid-spring – late summer
Linum virginianum	Slender yellow flax	Threatened	Early-mid summer
Lithospermum mole	Marbleweed	Extirpated	Early-mid summer
Lycopodiella subappressa	Northern clubmoss	Special concern	Late summer – late autumn
Pycnanthemum pilosum	Hairy mountain mint	Threatened	Mid-late summer
Silene stellata	Starry campion	Threatened	Mid-late summer
Trillium recurvatum	Prairie Trillium	Threatened	Early spring – early summer

Table 2: Results of a query of the Biotics database listing historical (last seen before 1970) occurrences of protected plant species within a two-kilometer buffer of the project area.

Two MNFI Natural Community element occurrences are mapped within two kilometers of this MDOT project area (Table 3). An MNFI Natural Community is "an assemblage of interacting plants, animals, and other organisms that repeatedly occurs under similar environmental conditions across the landscape and is predominantly structured by natural processes rather than modern anthropogenic disturbances."[1] These mapped element occurrences are of a prairie fen and a wet prairie. Twelve of the rare plant species listed in Tables 1 & 2 occur in prairie fen and wet prairie habitats, so extra search effort was devoted to these species when suitable habitat was encountered.

Table 3: Natural Community Event Occurrences located near the project area

Natural Community Name	General Location	Last observed
Prairie Fen	Bakertown Fen: North of US-12, to the east of Bakertown Road north of Amtrack railroad tracks. Habitat is on both sides of McCoy Creek.	1997
Wet Prairie	Bakertown Prairie: North of US-12, at the intersection of Bakertown Road and the Amtrack railroad tracks. Habitat on north and south sides of railroad tracks west of Bakertown Road, on south side of railroad tracks east of Bakertown Road.	1981

Table 3: Results of a query of the Biotics database listing Natural Community Element Occurrences within a two-kilometer buffer of the project area.

Protected plant species observations

Two observations of rare plant species were found while surveying this project area. During the first visit, surveyors Alex Ellison and Elizabeth Haber found a population of State Threatened *Trillium recurvatum* (prairie Trillium) within the ROW boundary. During the second visit, surveyor Elizabeth Haber found a single plant of State Endangered *Chasmanthium latifolium* (wild oats) within the ROW boundary. The locations, nearby habitat descriptions, quantity and health of populations, and threats and mitigation measures for these two observations are presented below.

Chasmanthium latifolium (wild oats) observation

The observation of *Chasmanthium latifolium* is a notable find, because there is only one other known occurrence of this species in Michigan from 1981, also in Berrien County. However, after consultation with other MNFI staff, we are skeptical that this newly-found occurrence is a natural occurrence. Firstly, this species is sold as a horticultural landscape plant and may escape into nearby habitat. Second, the only known location in Michigan of this species is from Warren Woods, roughly 15 miles away from where this plant was found. Finally, the habitat surrounding this newly-found occurrence of *Chasmanthium latifolium* is of very poor quality, and does not match the floodplain forest habitat of the other known location for this species. Therefore, this report will present information about the *Chasmanthium latifolium* occurrence, but we cannot say if this occurrence is natural or spread from a cultivated plant.

Location

The *Chasmanthium latifolium* plant was found along the north side of US-12 roughly 630 meters west of the culvert at the Bakertown Drain (Figure 2; Table 4). It was found within 2 meters of the pavement, at the margin between the mowed and unmowed parts of the ROW. The plant was growing at the base of a small bank sloping down to US-12 in the front yard of a residence.

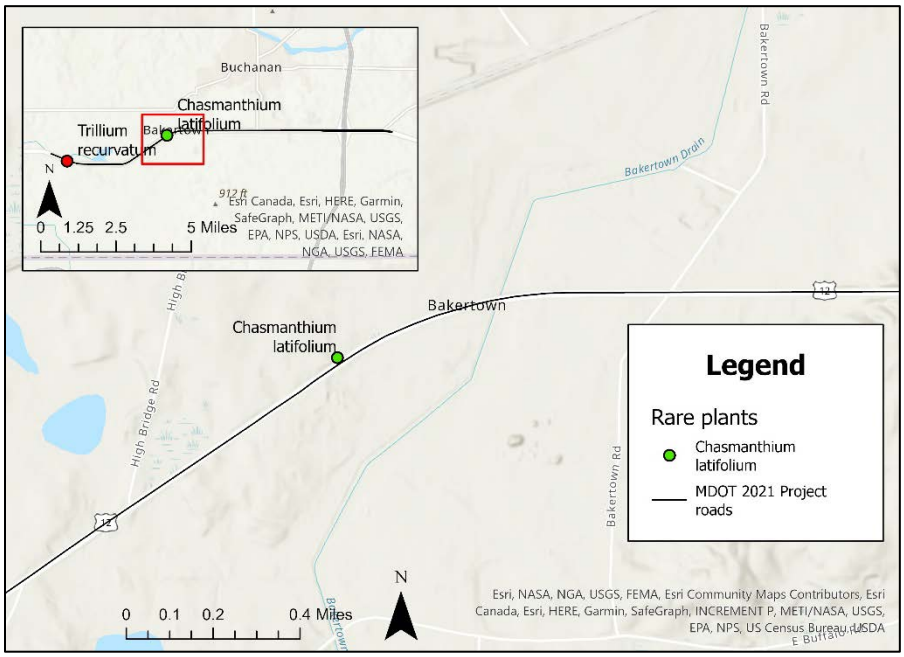

Figure 2: Map showing the location of the *Chasmanthium latifolium* plant found in this project area. The larger map corresponds to the area delineated with the red rectangle in the inset map.

Table 4: GPS coordinates for the *Chasmanthium latifolium* observation

Latin name	Common name	Latitude	Longitude
Chasmanthium latifolium	Wild oats	41.8036396	-86.4017195

Table 4: GPS coordinates for the *Chasmanthium latifolium* (wild oats) plant found in this MDOT project area.

Habitat description

A single occurrence of *Chasmanthium latifolium* has been documented from Michigan, so general habitat affinity for this species in Michigan is not available. However, the habitat where this known occurrence grows is a floodplain forest near the Galien River in the Warren Woods Natural Area. Plant associates in this habitat include: *Acer saccharinum* (silver maple), *Fraxinus pennsylvanica* (red ash), *Laportea canadensis* (wood nettle), *Symphyotrichum* sp. (aster), *Toxicodendron radicans* (poison-ivy), and *Urtica dioica* (stinging nettle)[2].

The habitat surrounding the occurrence of *Chasmanthium latifolium* found in this MDOT project area is a degraded roadside. A sparse tree canopy is present and consists of *Acer saccharum* (sugar maple), *Juglans nigra* (black walnut), and *Ulmus americana* (American elm; Figure 3). The vines *Parthenocissus quinquefolia* (Virginia creeper; Figure 3) and *Vitis riparia* (riverbank grape) were also present nearby. The invasive grass *Bromus inermis* (smooth brome; Figure 3) was found growing directly adjacent to the Endangered grass.

Figure 3: Habitat and associated plant species for the *Chamanthium latifolium* observation. *Bromus inermis* (smooth brome), *Parthenocissus quinquefolia* (Virginia creeper), and *Ulmus americana* (American elm) can be seen in this photo growing adjacent to the *Chasmanthium latifolium*.

Quantity and health of population

A single clump of this species, most likely representing one individual, was found. Because only one clump was found, this population is highly imperiled and vulnerable to disturbance. Despite the perilous existence of this plant, it seemed healthy and was producing robust foliage and ample fruits (Figure 4).

Figure 4: *Chasmanthium latifolium* (wild oats) voucher photos. a) Fruiting culm showing one of the broad leaves. b) Spikelets with developing fruits.

Threats and mitigation measures

The quantity and location of this population of *Chasmanthium latifolium* make it very vulnerable. Paved shoulders in this project area are slated to be expanded, and this expansion could destroy the single wild oats plant since it is located so close to the existing shoulder. Even if the shoulder expansion does not destroy the plant, expanded mowing margins could negatively affect its growth. If it is decided that this plant should be protected, it is recommended that the plant be moved further away from the road margin to protect it from potential harm from mowing or road shoulder expansion. Invasive grasses, such as *Bromus inermis* (smooth brome) are growing directly next to the *Chasmanthium latifolium* (Figure 3). The *Chasmanthium latifolium* plant would benefit from the removal of these invasive grasses.

Trillium recurvatum (prairie Trillium) observation

Trillium recurvatum has been recently found in only two counties in southwest Michigan: Berrien and Cass counties. This species usually grows in rich forests in Michigan, with limestone-derived soils, and can be found in the following forested natural communities: floodplain forests, dry-mesic and mesic southern forests, and southern hardwood swamps[3].

Location

The population of the State Threatened *Trillium recurvatum* found in this MDOT project area is located on the south side of US-12 roughly 950 meters east of the west terminus of the project boundary, and to the west of Dayton Road (Figure 5, Table 5). This population was found at the boundary of the mowed ROW and a high-quality mesic southern forest, and less than 40 meters to the east of a residential yard. An historical observation from 1939 of this species was located "11 miles west of Niles on US-12" in a rich forest. The habitat type and general location of the current *Trillium recurvatum* observation match this historical observation, and therefore this population may be the same population of this species as was observed in 1939. Furthermore, aerial imagery taken in 1938 suggests that the location where the current *Trillium recurvatum* occurrence was found was forested at that time[4], indicating temporal continuity of supportive habitat.

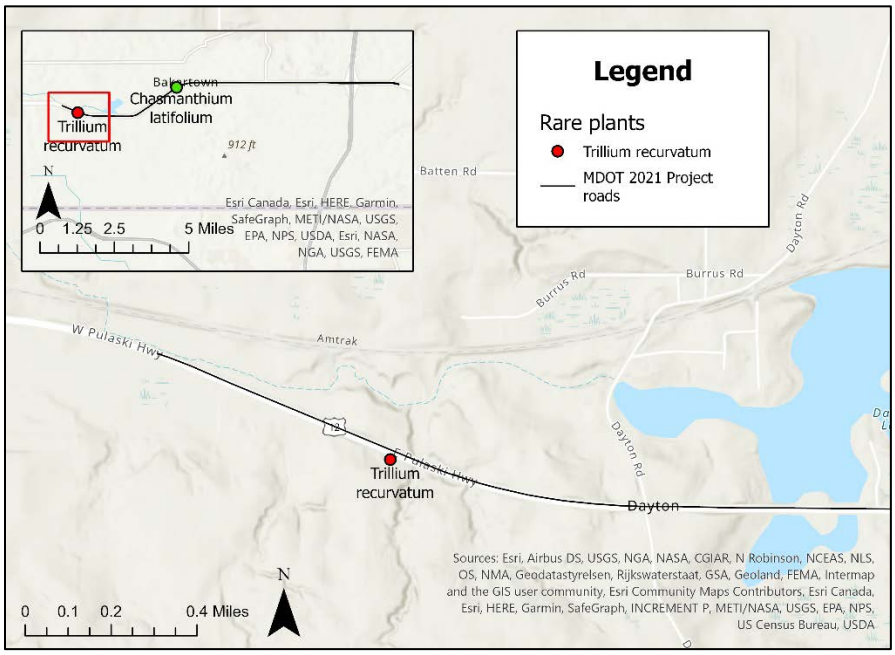

Figure 5: Map showing the location of the *Trillium recurvatum* population found in this project area. The larger map corresponds to the area delineated with the red rectangle in the inset map.

Table 5: GPS coordinates for the *Trillium recurvatum* observation

Latin name	Common name	Latitude	Longitude
Trillium recurvatum	Prairie Trillium	41.7945241	-86.4497382

Table 5: GPS coordinates for the *Trillium recurvatum* (prairie Trillium) population found in this MDOT project area.

Habitat description

The *Trillium recurvatum* plants were found at the boundary of a mowed ROW and a high-quality mesic southern forest. The mowed ROW is dominated by non-native grasses such as *Bromus inermis* (smooth brome), *Dactylis glomerata* (orchard grass), and *Phalaris arundinacea* (reed-canary grass). Other plants found in the nearby mowed ROW include *Erigeron philadelphicus* (common fleabane), *Leucanthemum vulgare* (ox-eye daisy), and *Torilis japonica* (Japanese hedge-parsley).

The mesic southern forest in this area has a canopy consisting of *Acer saccharum* (sugar maple), *Fagus grandifolia* (American beech), *Quercus rubra* (red oak), and *Tilia americana* (basswood). The subcanopy consists of *Acer saccharum* seedlings/saplings (sugar maple), *Asimina triloba* (paw paw), *Carpinus caroliniana* (musclewood), *Fraxinus* spp. seedlings/saplings (ash), *Hamamelis virginiana* (witch-hazel), *Lindera benzoin* (spicebush), and *Ostrya virginiana* (hop-hornbeam). The groundcover layer in this forest contains *Asarum canadense* (wild-ginger; Figure 6a), *Epifagus virginiana* (beech-drops), *Euonymus obovatus* (creeping strawberry-bush; Figure 6b), *Geranium maculatum* (wild geranium), *Hepatica acutiloba* (sharp-lobed Hepatica), *Impatiens* sp. (touch-me-not), *Polystichum acrostichoides* (Christmas fern; Figure 6c), and *Trillium grandiflorum* (common Trillium).

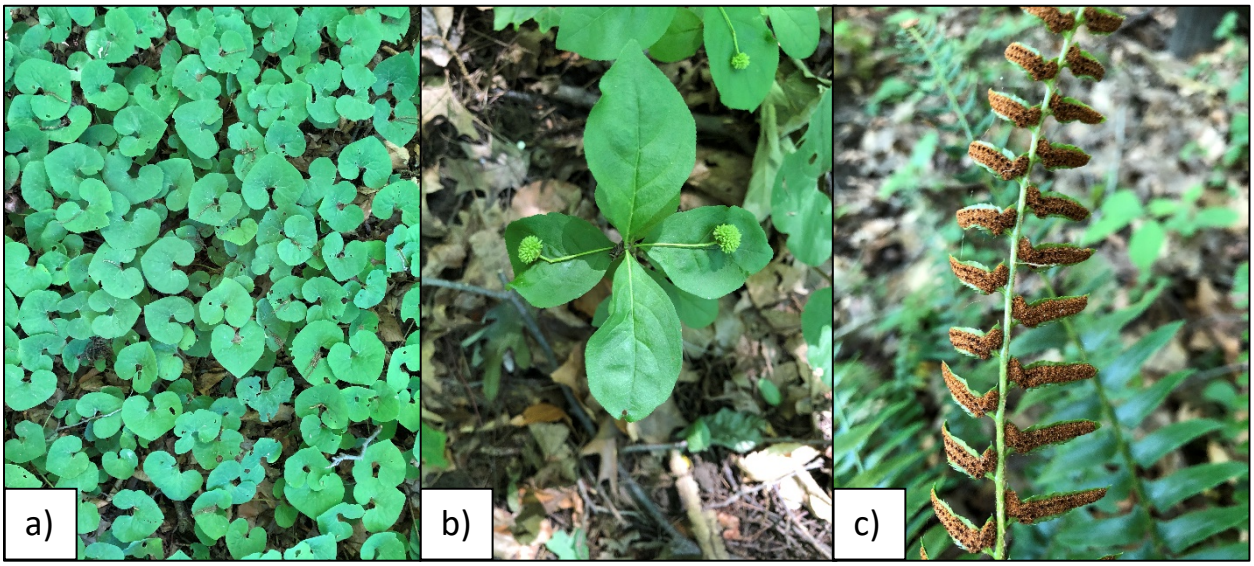

Figure 6: Groundcover flora in the mesic southern forest near where the *Trillium recurvatum* plants were found. a) *Asarum canadense* (wild-ginger), b) *Euonymus obovatus* (creeping strawberry-bush), c) *Polystichum acrostichoides* (Christmas fern).

The immediate area where the *Trillium recurvatum* plants were found is a disturbed woodland boundary (Figure 7). No rare *Trillium* plants were found further away from the road and into the forest. A fallen tree had made a small opening in the forest-edge vegetation, and the *Trillium* plants were growing in this small opening. Nearby vegetation includes: *Acer saccharum* saplings (sugar maple), *Euonymus obovatus* (creeping strawberry-bush), *Impatiens* sp. (touch-me-not), *Sambucus racemosa* (red elderberry), and *Vitis riparia* (riverbank grape).

Figure 7: Forest edge habitat where the *Trillium recurvatum* plants were found. Species visible in this photo include: *Acer saccharum* (sugar maple), *Impatiens* sp. (touch-me-not), *Sambucus racemosa* (red elderberry), and *Vitis riparia* (riverbank grape).

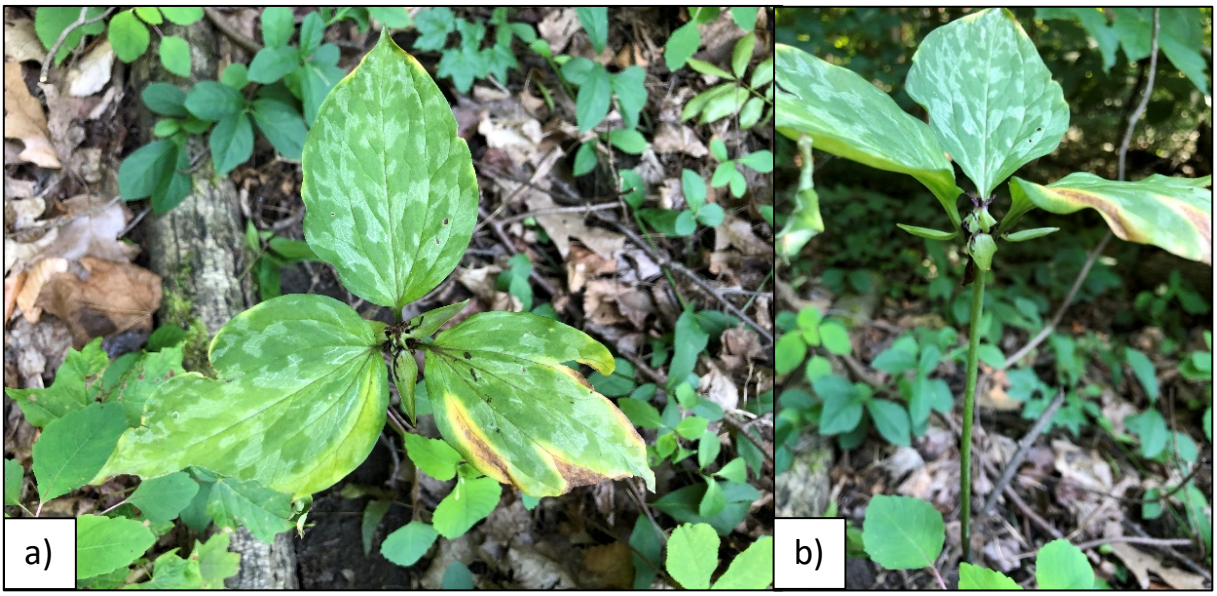

Figure 8: *Trillium recurvatum* (prairie Trillium) voucher photos. a) Top view of a senescing stem, b) side view of the same stem, showing a developing fruit.

Quantity and health of population

Despite a thorough search in nearby habitat, only two stems of *Trillium recurvatum* were found at this location. Both stems were senescing (Figure 8a), as the timing of the first survey to this project area was toward the end of the species' growing cycle. Although this population consists of very few stems, both were fruiting (Figure 8b), which indicates the population is still able to reproduce.

Threats and mitigation measures

This population of *Trillium recurvatum* is vulnerable, as it only consists of two stems. When working to expand the road shoulder, care must be taken to avoid harming the population (Figure 9). This means avoiding clearing the canopy near this population, as clearing causes disturbance which could encourage the nearby *Alliaria petiolata* (garlic-mustard) to spread. Also, evidence of deer browse was observed nearby in the mesic southern forest, and deer herbivory is a serious threat to *Trillium* species.

Figure 9: Roadside adjacent to forest boundary where the *Trillium recurvatum* plants were found.

Descriptions of plant communities by survey section

The vegetation and habitat characteristics found in this project area are summarized in the following sections that correspond with those mapped in Figure 10. These sections were chosen because they will be heavily altered by construction activities, or they contain habitat that may host rare plant species. A description of the habitat, as well a list of common and/or noteworthy plant species encountered is presented for each section. Special attention is given to sensitive species, high-quality habitats, areas that are sensitive to runoff, and invasive plant species found in these sections.

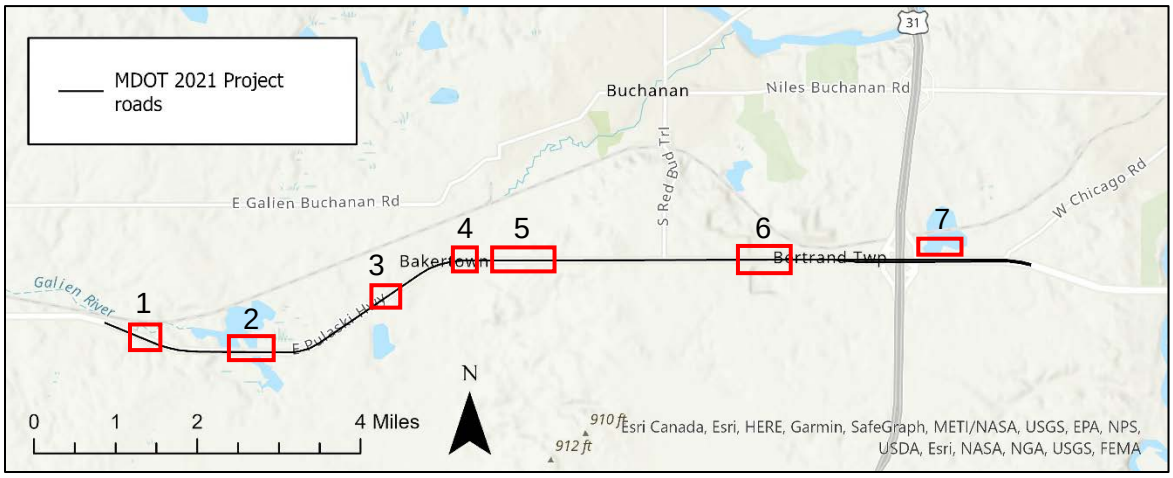

Figure 10: Map of the project area showing the locations of important survey sections.

Suitable habitat for rare plant species was found in four survey sections: sections one, two, three, and five (Figure 10). Section one contains a high-quality mesic southern forest on both sides of US-12, with mature canopy trees and a relatively intact groundcover layer. A population of the State Threatened *Trillium recurvatum* was located here. Section two encompasses the ROW adjacent to Dayton Lake, including a medium-quality submerged/emergent marsh. Section three contains two notable wetlands: a high-quality inundated shrub swamp and a medium-quality southern wet meadow. Lastly, section five contains a medium-quality mesic southern forest on both sides of US-12. This forest, although degraded in some areas, contains large canopy trees and an intact groundcover layer in some areas.

Invasive plant species occurrences and GPS coordinates were collected while surveying in this project area using the MISIN app. GPS coordinates were collected at 39 locations in this project area, representing 16 species of non-native invasive plants. The species with the most observations are: *Cirsium vulgare* (bull thistle; nine observations), *Phragmites australis* subsp. *australis* (invasive reed; ten observations), and *Torilis japonica* (Japanese hedge-parsley; five observations). A summary of invasive plant species in each survey section can be found in the following sections of this report.

Section 1: Mesic southern forest south of the Galien River

The west terminus of this project area contains habitat that could potentially host rare species. Therefore, this section was surveyed by foot during each of the three visits to the project area.

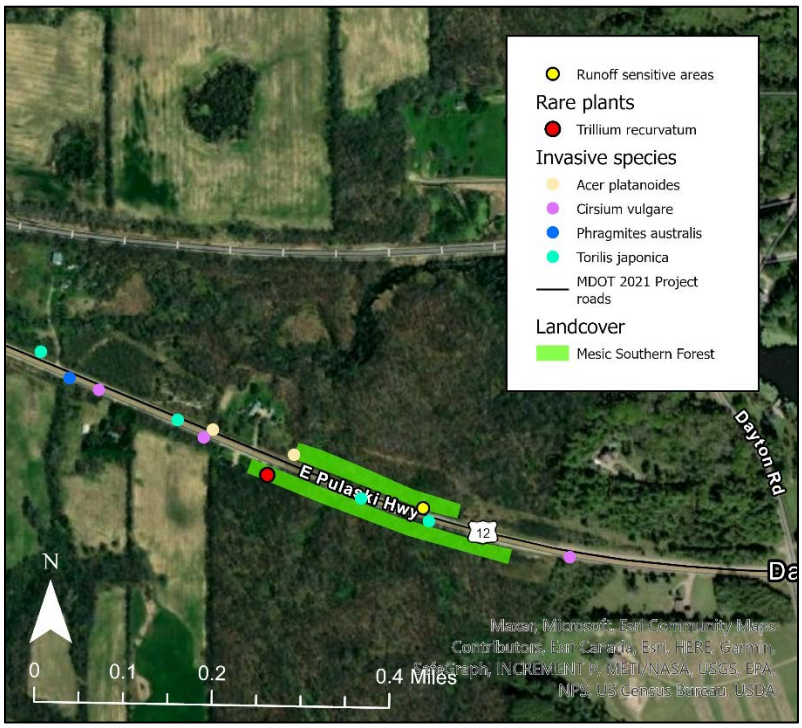

Figure 11: Map of survey section one, including a location that is sensitive to runoff, a location where a rare plant species was found, locations of non-native invasive plant species occurrences collected with the MISIN app, and the extent of high-quality habitat within the ROW.

A high-quality mesic southern forest was encountered on both sides of US-12 to the west of Dayton Road and roughly 950 meters east of the west terminus of this project area (Figure 11, green polygons). Two stems of the State Threatened *Trillium recurvatum* (prairie Trillium) were located in this mesic southern forest on the south side of US-12 (Figure 11 red dot; Figure 5; Table 5). The habitat description of the forest on the south side of the road is presented on pages 8-11 of this report in the section titled "*Trillium recurvatum* (prairie Trillium) observation".

The mesic southern forest on the north side of US-12, across from the forest where the *Trillium recurvatum* was found, is also of high quality and could potentially host rare plant species, although none were found during the surveys. The canopy and understory are of similar composition to the forest on the south side of the road, with the exception of the area adjacent to a small stream paralleling US-12 and flowing northward into the Galien River. This area is sensitive to runoff and should be protected from sediment input during construction activities.

Ten observations of four non-native invasive plant species were collected using the MISIN app in this survey section. *Torilis japonica* (Japanese hedge-parsley; Figure 11, green-blue dots) was encountered at four locations along this survey section. This species can be spread by its hooked seeds attaching to animal fur, or by mowing equipment. Control measures should be taken to remove this species where it grows adjacent to the high-quality southern mesic forest. The second-most frequently encountered non-native invasive species in this survey section was *Cirsium vulgare* (bull thistle; Figure 11, purple dots). This species is frequently found in open, mowed ROWs in this project area and is less of a threat to the high-quality mesic southern forest since it does not grow under a closed canopy. A population of the aggressive non-native *Phragmites australis* (reed; Figure 11, dark blue dot) was documented toward the west terminus of the project area. This population is adjacent to a small drainage channel that leads into the Galien River and should be removed to avoid this species spreading into the sensitive habitat along the Galien River.

Section 2: Dayton Lake

The ROW near Dayton Lake (Figure 12) contains a mosaic of landcovers, including residential/commercial properties, degraded graminoid-dominated wetlands, upland and lowland wooded thickets, and submerged/emergent marshland. Because this section of the project area has a large component of wetland landcover, and because so many of the rare species in Tables 1 and 2 occur in wetland habitats, this survey section was inspected by foot during each of the three visits to the project area. No rare plant species were found in this section; however, the submerged/ emergent marsh habitat where Dayton Lake flows under US-12 (Figure 13a-b) is of high enough quality to potentially host rare species.

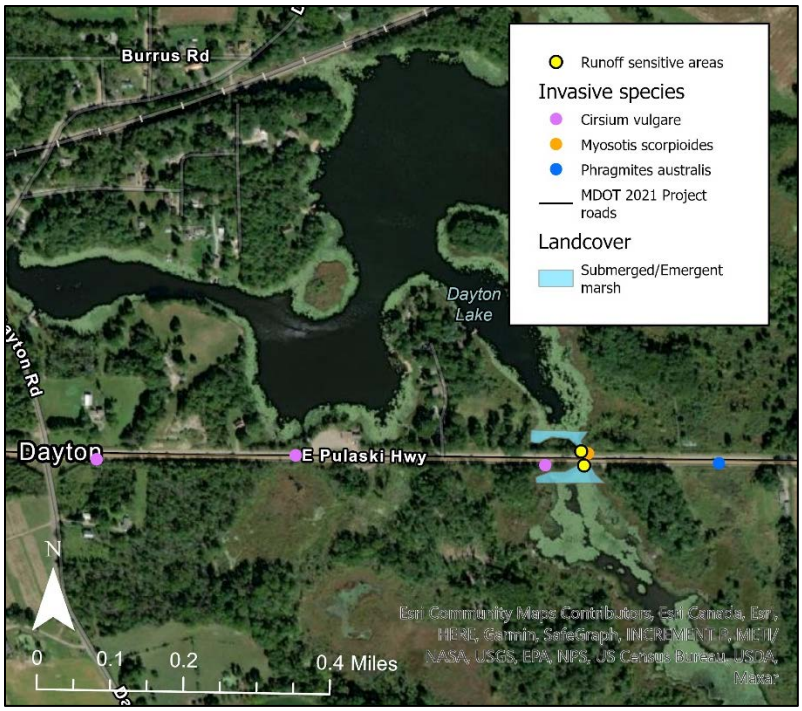

Figure 12: Map of survey section two, including locations that are sensitive to runoff, locations of non-native invasive plant species occurrences collected with the MISIN app, and the extent of medium-quality habitat within the ROW.

The plant community in the submerged/emergent marsh habitat consists of a mixture of native and non-native species, but the overall integrity of the habitat is good, despite its proximity to US-12. Aquatic plant species present in this habitat include: *Ceratophyllum demersum* (coontail), *Elodea canadensis* (common waterweed), *Nymphaea odorata* (sweet-scented waterlily), *Potamogeon crispus* (curly-leaf pondweed, an invasive aquatic plant species), *P. richardsonii* (Richardson's pondweed), *P. pusillus* (small pondweed), and *Utricularia vulgaris* (common bladderwort). Herbaceous emergent and wetland plant species found in these habitats include: *Agrimonia parviflora* (swamp agrimony), *Asclepias incarnata* (swamp milkweed), *Cuscuta* sp. (likely *C. gronovii*, swamp dodder), *Eupatorium perfoliatum* (boneset), *Eutrochium maculatum* (Joe-Pye weed), *Hydrocotyle umbellata* (water-pennywort; Figure 13c), *Leersia oryzoides* (cut grass), *Lythrum salicaria* (purple loosestrife), *Pontederia cordata* (pickerel-weed; Figure 13d), *Sagittaria* sp. (arrowhead), *Sium suave* (water-parsnip), and *Typha* x *glauca* (hybrid cattail). Shrub species present along the edges of this habitat include *Cephalanthus occidentalis* (button bush; Figure 13e), *Decodon verticillatus* (whorled loosestrife), *Frangula alnus* (glossy buckthorn), *Rosa palustris* (swamp rose), *Salix* spp. (willows), and *Sambucus canadensis* (elderberry).

Five observations of three invasive plant species were mapped in this section of the project area using the MISIN app. Three of these observations are of *Cirsium vulgare* (bull thistle; Figure 12, purple dots), which is a frequently encountered species in open, upland habitats within the ROW

of this project area. Concerningly, there is a patch of invasive *Phragmites australis* (reed; Figure 12, blue dot) in one of the wetland habitats in this section. Because there is ample suitable habitat for this invasive species near Dayton Lake, it is recommended that this population of invasive reed be treated to prevent it from spreading. Finally, a small patch of *Myosotis scorpioides* (forget-me-not; Figure 12, orange dot) was located in the emergent marsh habitat on the north side of US-12. This species is an aggressive invader of wetland habitats; therefore, this small patch should be removed before it becomes a larger infestation.

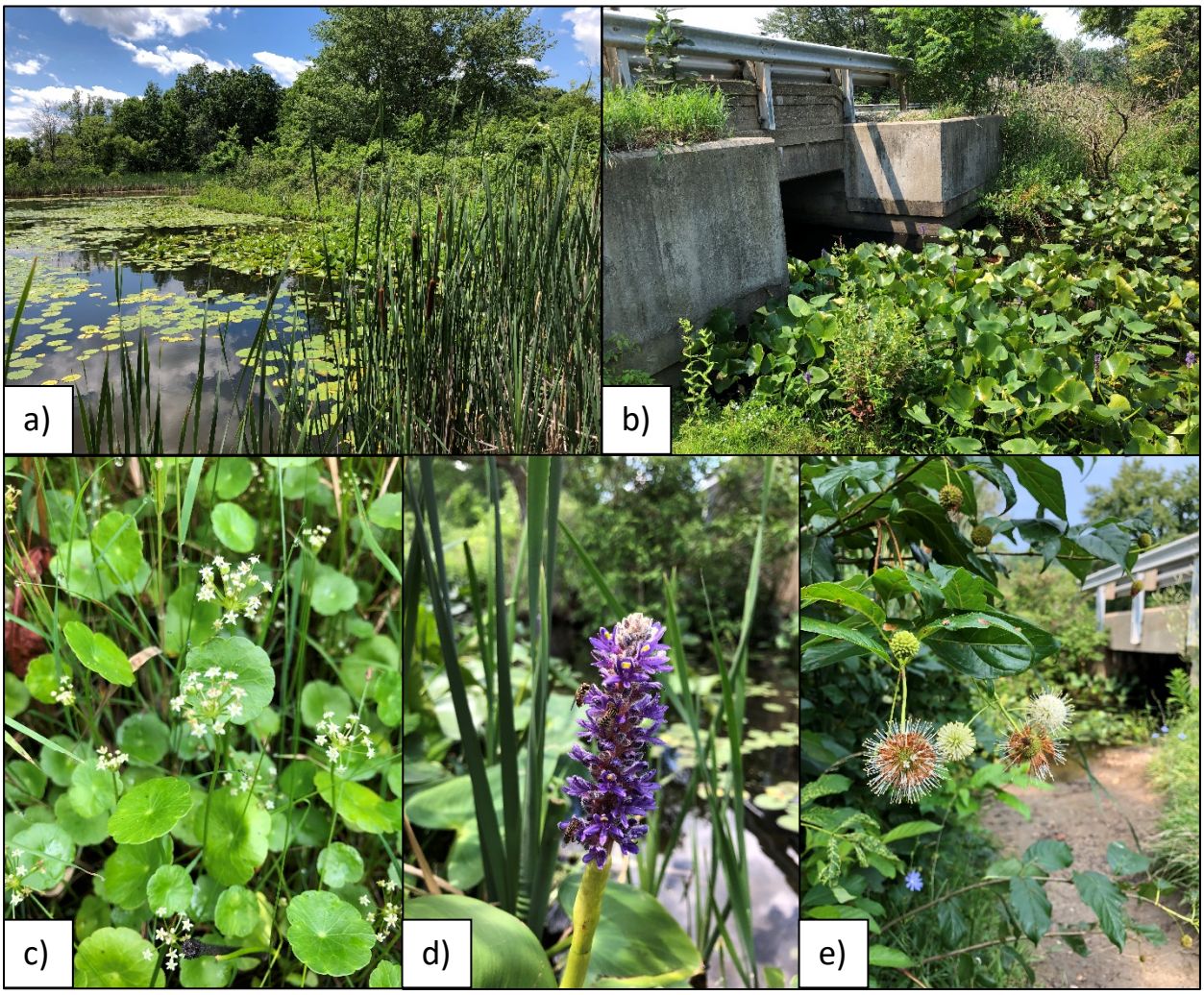

Figure 13: Habitat and vegetation near the US-12 bridge over Dayton Lake. Submerged and emergent marsh natural communities exist on both the a) south side of US-12, and b) the north side of US-12. Plant species in these communities include c) *Hydrocotyle umbellata* (marsh-pennywort), d) *Pontederia cordata* (pickerel-weed), and e) *Cephalanthus occidentalis* (button bush).

Section 3: Wetlands near High Bridge Road

Two noteworthy wetlands were surveyed near the intersection between US-12 and High Bridge Road (Figure 14). These wetlands are between 650 and 700 meters away from the Bakertown Drain, which connects to outstanding natural communities, so the likelihood of finding rare plants in these wetlands was high. Foot surveys during the first visit to this project area covered most of the southern wet meadow and some parts of the inundated shrub swamp which were outside of the ROW. Foot surveys during the second and third visits to this project area only surveyed area which was within the ROW. Despite search effort, no rare species were found in either of these wetlands; however, these two wetlands are of high enough quality to potentially host rare species.

Figure 14: Map of survey section three, including a location that is sensitive to runoff, a location of a non-native invasive plant species occurrence collected with the MISIN app, and the extent of high and medium-quality habitat within the ROW.

The inundated shrub swamp (Figure 14, orange polygon; Figure 15a) consists of a shallow moat along US-12 which separates a vegetated floating mat with an area of open water in the center from the firm ground in the ROW. The terrain quickly slopes downward from the edge of the pavement toward the wetland. Plant species in the ROW consist of a mixture of weedy upland

Figure 15: Overview photos of wetlands near High Bridge Road. a) Inundated shrub swamp with open water in the center, b) Southern wet meadow.

species and wetland species. Non-native invasive roadside weeds near the inundated shrub swamp include *Bromus inermis* (smooth brome), *Cirsium arvense* (Canada thistle), *Dactylis glomerata* (orchard grass), and *Dipsacus fullonum* (wild teasel). The shrub component of the inundated shrub swamp consists of *Cephalanthus occidentalis* (button bush), *Decodon verticillatus* (whorled loosestrife), *Rosa palustris* (swamp rose), *Salix petiolaris* (slender willow), and *Sambucus canadensis* (elderberry). Native herbaceous plant species in the inundated shrub swamp include *Asclepias incarnata* (swamp milkweed), *Cirsium muticum* (swamp thistle), *Impatiens* sp. (touch-me-not), *Lysimachia terrestris* (swamp-candles; Figure 16a), *Nuphar advena* (yellow pond-lily; Figure 16b), *Onoclea sensibilis* (sensitive fern), *Peltandra virginica* (arrow-arum), *Rumex verticillatus* (water dock; Figure 16c), and *Thelypteris palustris* (marsh fern). Although this wetland is of high quality, it contains a few worrisome invasive plant species, namely: *Lythrum salicaria* (purple loosestrife), *Phalaris arundinacea* (reed-canary grass), and *Typha* x *glauca* (hybrid cattail).

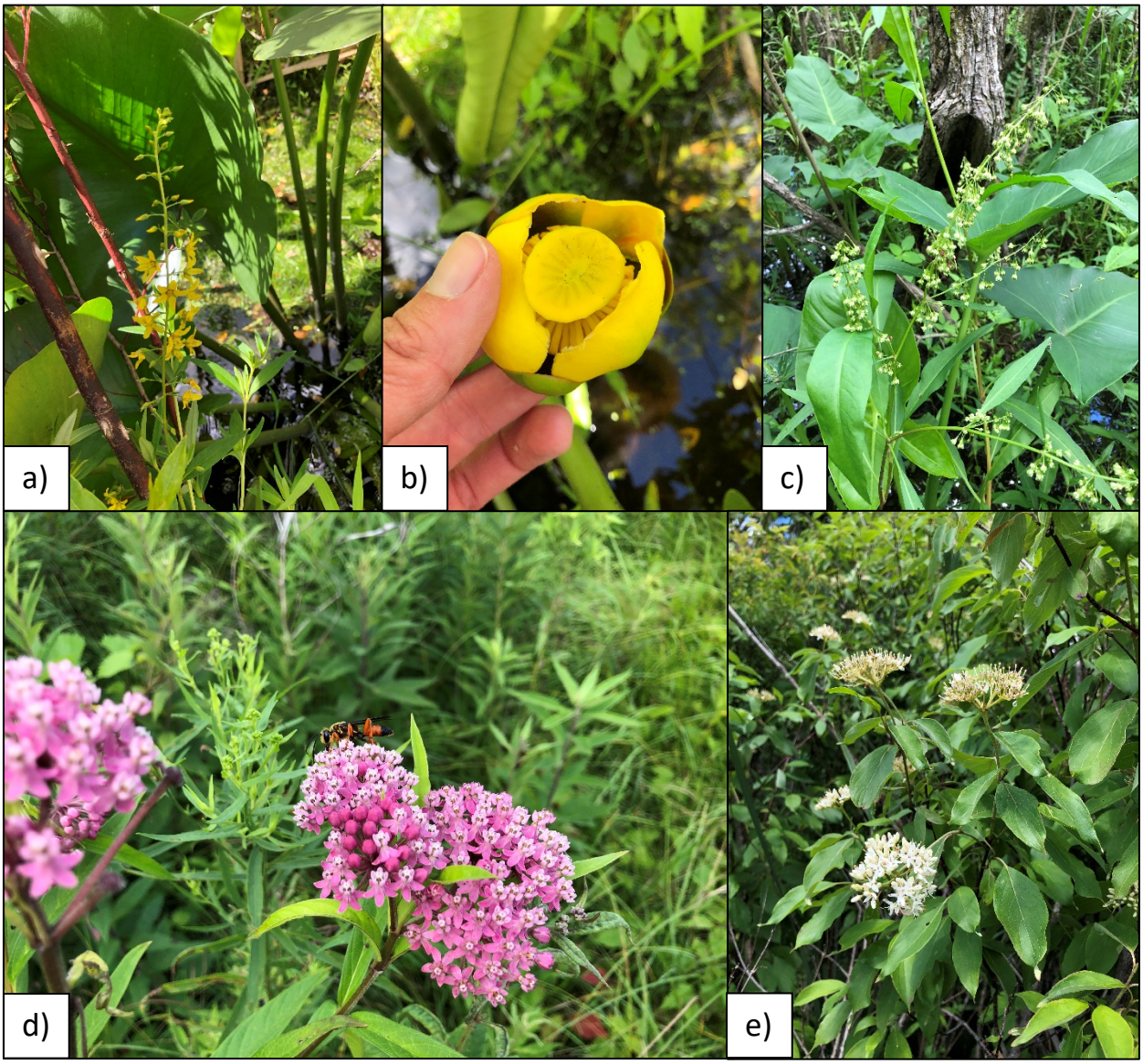

Figure 16: Plant species found in the inundated shrub swamp (a-c) and southern wet meadow (d-e) near High Bridge Road. a) *Lysimachia terrestris* (swamp-candles), b) *Nuphar advena* (yellow pond-lily), c) *Rumex verticillatus* (water dock), d) *Asclepias incarnata* (swamp milkweed) with a digger wasp (*Sphex* sp.), d) *Cornus foemina* (gray dogwood).

The southern wet meadow habitat on the south side of US-12 (Figure 14, pink polygon; Figure 15b) is degraded within the ROW and is of higher quality further away from the road. This pattern of degradation indicates that roadside disturbances are detrimental to the health of this wetland. Within the ROW, the habitat contains dense *Phalaris arundinacea* (reed-canary grass) and *Typha* x *glauca* (hybrid cattail). Further away from the road, the habitat begins to grade into a higher-quality southern wet meadow. Native species in the wet meadow habitat include: *Asclepias incarnata* (swamp milkweed; Figure 16d), *Calamagrostis canadensis* (Canada blue-joint), *Campanula aparinoides* (marsh bellflower), *Carex pellita* (woolly sedge), *Cirsium muticum* (swamp thistle), *Cornus foemina* (gray dogwood; Figure 16e) along the margins, *Eupatorium perfoliatum* (boneset), *Eutrochium maulatum* (Joe-Pye weed), *Iris virginica* (southern blue flag), *Lysimachia terrestris* (swamp-candles), *Onoclea sensibilis* (sensitive fern), *Schoenoplectus tabernaemontani* (softstem bulrush), *Scirpus atrovirens* (bulrush), *Symplocarpus foetidus* (skunk-cabbage), and *Thelypteris palustris* (marsh fern).

Section 4: Bakertown Drain

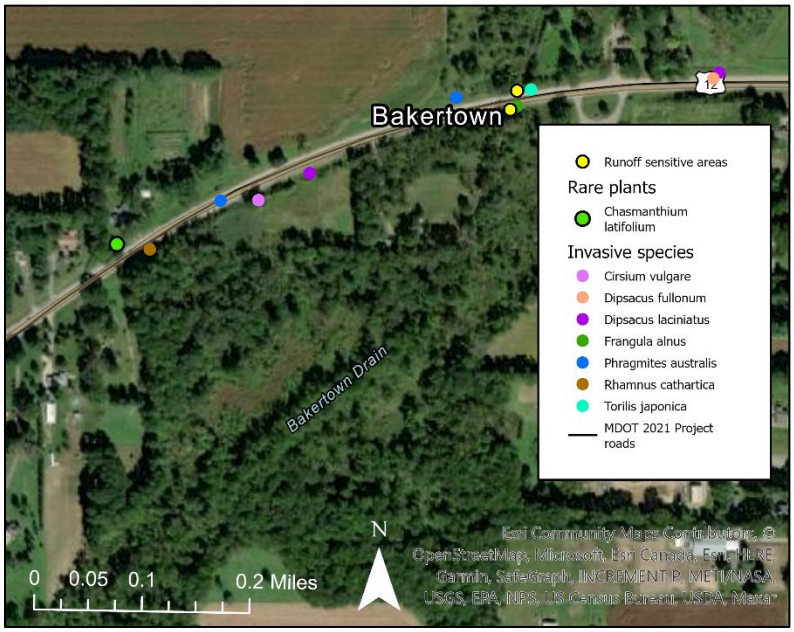

Figure 17: Map of survey section four, including locations that are sensitive to runoff, locations where a rare plant species was found, and locations of non-native invasive plant species occurrences collected with the MISIN app.

The Bakertown Drain was a focal point for surveys in this project area because it is directly connected to two high-quality natural communities (Table 3). The intersection between US-12 and the Bakertown Drain is 1600 meters from these two high-quality natural communities, so there was a strong likelihood of finding rare species in this area if suitable habitat exists. Therefore, this survey section was inspected by foot during each of the three visits to the project area. Despite concerted survey effort in this area, no rare species were found. The ROW where the Bakertown Drain flows under US-12 is degraded and is unlikely to host rare plant species, although the habitat quality increases slightly to the south of US-12. Since the Bakertown Drain connects to high-quality habitat, care should be taken near the bridge over the Bakertown Drain to avoid disturbing the ground and introducing sediment runoff into the waterbody.

On the north side of US-12 at the intersection with the Bakertown Drain, the habitat consists of disturbed shrub thicket along the banks of the waterbody (Figure 18). The shrub and tree species on this side of US-12 consist of mostly weedy and invasive species: *Juglans nigra* (black walnut), *Ligustrum vulgare* (common privet), non-native *Lonicera* spp. (honeysuckles), *Morus alba* (white mulberry), *Salix* spp. (willows), and *Viburnum opulus* (European highbush-cranberry). A concerningly large patch of *Lonicera japonica* (Japanese honeysuckle) was found

near the east bank of the Bakertown Drain; this species, along with non-native *Vinca minor* (periwinkle), carpet a significant part of the ROW here.

Figure 18: Bakertown Drain north of US-12. a) Shrubs along the banks of the waterbody. b) The Bakertown Drain as it flows out from under US-12.

The habitat near the Bakertown Drain on the south side of US-12 is more open than that on the north side of US-12 and contains a slightly higher quality wetland plant community (Figure 19). Invasive species are still prevalent here, with *Cirsium arvense* (Canada thistle), *Frangula alnus* (glossy buckthorn; Figure 17, dark green dot), non-native *Lonicera* spp. (honeysuckles), and *Rosa multiflora* (multiflora rose) present. However, a native wetland community persists here and includes *Alisma* sp. (water-plantain), *Angelica atropurpurea* (purplestem angelica; Figure 19a), *Carex vulpinoidea* (fox sedge), *Impatiens* sp. (touch-me-not), *Eupatorium perfoiatum* (boneset), *Eutrochium maculatum* (Joe-Pye weed), *Onoclea sensibilis* (sensitive fern), *Quercus palustris* (pin oak), *Scirpus atrovirens* (bulrush), and *Ulmus americana* (American elm).

Several clumps invasive *Phragmites australis* (reed) were observed to the west of the Bakertown Drain (Figure 17, blue dots). This species is an aggressive invader of wetland habitats and should be removed before it can spread downstream into the high-quality natural communities to the north.

A single plant of State Endangered *Chasmanthium latifolium* (wild oats) was found in this section of the project area in a degraded roadside habitat (Figure 17, medium green dot). See the section of this report titled "*Chasmanthium latifolium* (wild oats) observation" on pages 4-7 for more information about the habitat in the area where this plant was found.

Figure 19: Bakertown Drain to the south of US-12. a) Open habitat along the west (left) bank of the stream and shrubby habitat along the east (right) bank. *Angelica atropurpurea* (purplestem angelica) can be seen along the west bank of the stream. b) Waterflow northward under the US-12 bridge.

Section 5: Bakertown Road intersection and woodlands to the east

Figure 10: Map of survey section five, including a point that is sensitive to runoff, a location of a non-native invasive plant species occurrence collected with the MISIN app, and the extent of medium-quality habitat within the ROW.

Figure 11: Commercial property at the intersection of Bakertown Road and US-12.

The intersection of US-12 and Bakertown Road (Figure 20, west side of section map) will be altered during the planned construction activities; therefore, this section was surveyed by foot during each of the three visits to the project area. The landcover adjacent to this intersection consists of mowed yards in front of residential and commercial buildings (Figure 21). No suitable habitat for rare species occurs at this intersection.

A medium-quality mesic southern forest habitat occurs roughly 650 meters to the east of the Bakertown Road/US-12 intersection (Figure 20, green polygons). This habitat occurs on both the north and south sides of US-12 and extends eastward for nearly 500 meters on the north side of the road and 800 meters on the south side of the road. This habitat not as high of quality as the mesic southern forest in survey section one of this project area (see page 13). However, this forest contains large native mesic southern forest canopy tree species and a relatively intact shrub and understory layer (Figure 22a). This forest has the potential to host rare species, although none were found during the visits to this project area.

The canopy of this mesic southern forest includes *Acer saccharum* (sugar maple), *Carya cordiformis* (bitternut hickory), *Fagus grandifolia* (American beech), *Juglans nigra* (black walnut), *Platanus occidentalis* (sycamore), *Quercus rubra* (red oak), *Tilia americana* (basswood), and *Ulmus americana*

(American elm). The shrub layer includes *Asimina triloba* (paw paw), *Fraxinus americana* saplings (white ash), *Lindera benzoin* (spicebush), and *Sassafras albidum* (sassafras). The understory contains *Arisaema triphyllum* (Jack-in-the-pulpit), *Elymus hystrix* (bottlebrush grass), *Solidago flexicaulis* (zig-zag goldenrod), *Symphyotrichum shortii* (Short's aster), and *Thalictrum dioicum* (early meadow-rue). Several non-native species were found while surveying along the roadside adjacent to the mesic southern forest habitat: *Alliaria petiolata* (garlic-mustard; Figure 20, grey dot), *Elymus repens* (quack grass), and *Rosa multiflora* (multiflora rose).

Figure 12: Mesic southern forest habitat to the east of Bakertown Road. a) Photo showing the general structure of the forest, b) *Symphyotrichum shortii* (Short's aster).

Section 6: Michiana Aggregate

Figure 13: Map of survey section six, showing locations of non-native invasive plant species occurrences collected with the MISIN app.

The section of US-12 near Michiana Aggregate (Figure 23) is slated for widening in this project. Therefore, the roadsides near the quarry were surveyed by foot to check for rare species and/or rare species habitat. Neither rare species nor rare species habitat was found in the ROWs near Michiana Aggregate.

The ROW on the north side of US-12 near Michiana Aggregate consists of a mowed lawn adjacent to the driveway leading to the quarry (Figure 24a), degraded

woodland habitat, and a ditch to the east of the driveway dominated by invasive *Phragmites australis* subsp. *australis* (reed). The ROW on the south side of US-12 in this survey section consists of a thin strip of degraded wooded thicket which slopes sharply downward to the quarry (Figure 24b).

Several additional invasive plant species were observed in this section of the project area. On the north side of US-12, a clump of *Conium maculatum* (poison-hemlock) was observed to the west of the quarry driveway (Figure 23, light green dot; Figure 24c). Continuing westward on the north side of US-12, *Dipsacus fullonum* (wild teasel) and *Frangula alnus* (glossy buckthorn) were also observed. Additionally, several species of invasive honeysuckles were observed in the woodland to the east of the quarry driveway, on the north side of US-12, including a large patch of *Lonicera japonica* (Japanese honeysuckle; Figure 23, light blue dot, Figure 24d). Along the guardrail on the south side of US-12, the invasive shrubs *Elaeagnus umbellata* (autumn-olive) and *Rosa multiflora* (multiflora rose) were observed.

Figure 14: Habitat and invasive species observed near Michiana Aggregate. a) Mowed ROW on the north side of US-12, b) steeply sloping wooded thicket on the south side of US-12, c) *Conium maculatum* (poison-hemlock), and d) *Lonicera japonica* (Japanese honeysuckle).

Section 7: Northeast quadrant of US-31/US-12 interchange

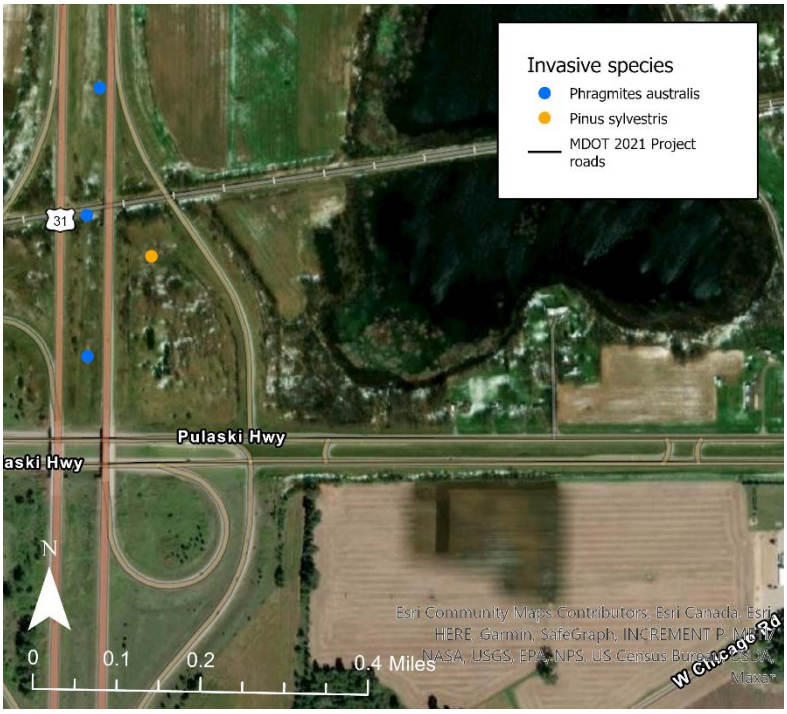

Figure 15: Map of survey section seven, showing locations of non-native invasive plant species occurrences collected with the MISIN app.

The intersection between US-12 and US-31 was surveyed by foot because a recent (Table 1) record of *Baptisia lactea* (white false indigo) is known from near Topinabee Lake Preserve, on the northeast corner of the lake in the northeast quadrant of the US-12/US-31 interchange. The habitat on the south end of this lake within the ROW was surveyed with the nearby rare species occurrence in mind; however, this area contains a degraded lowland forest and no rare species were found. The canopy of the forest includes of *Acer saccharinum* (silver maple), *Carya laciniata* (shellbark hickory), *Populus deltoides* (cottonwood), and *Quercus bicolor* (swamp white oak). The shrub layer is dominated by non-native shrub species including *Elaeagnus umbellata* (autumn-olive), non-native honeysuckles (*Lonicera* spp.), *Rosa multiflora* (multiflora rose), and *Viburnum opulus* (European highbush-cranberry). A few native *Cephalanthus occidentalis* (buttonbush) shrubs were found. The herbaceous layer consists of weedy upland species near US-12 and native and non-native wetland-adapted species in the forest understory.

The median between the onramp to northbound US-31 and northbound US-31, and the median between the northbound and southbound US-31 lanes were surveyed by foot as well. Plant communities containing wetland species were located in several areas of these medians; however, no rare species were found and no suitable habitat for rare species was observed. In the median between northbound and southbound US-31, three patches of *Phragmites australis* (common reed) were found in areas where water accumulates (Figure 25, blue dots). Other wetland invasive species, including *Lythrum salicaria* (purple loosestrife) and *Typha x glauca* (hybrid cattail) were also found near the *Phragmites australis* patches. A few *Pinus sylvestris* (Scots pine) trees were found in the median between northbound US-31 and the onramp to northbound US-31 (Figure 25, orange dot).

Acknowledgements

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