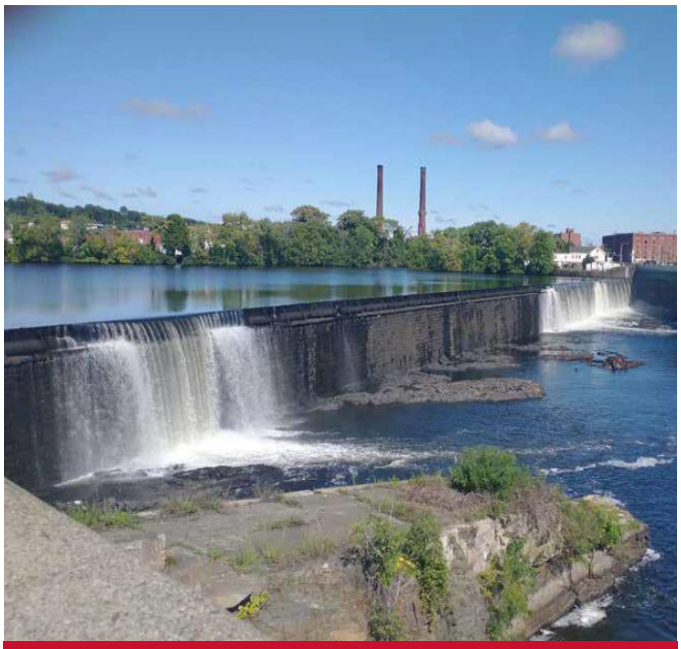

Invasive Plant Survey Report

Lawrence Hydroelectric Project

(FERC No. 2800)

April 27, 2026

Prepared by:

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List of Acronyms

CFR	Code of Federal Regulations
Essex	Essex Company, LLC
FERC	Federal Energy Regulatory Commission
GIS	Geographic Information System
GNSS	global navigation satellite system
ILP	Integrated Licensing Process
kV	kilovolt
MassWildlife	Massachusetts Division of Fisheries and Wildlife
MIPAG	Massachusetts Invasive Plant Advisory Group
MW	megawatt
NGVD29	National Geodetic Vertical Datum of 1929
PAD	Pre-Application Document
Project	Lawrence Hydroelectric Project (P-2800)
RM	river mile
SPD	Study Plan Determination
USDA Plants Database	U.S. Department of Agriculture Natural Resources Conservation Service Plants Database
USFWS	U.S. Fish and Wildlife Service

1 Introduction

Essex Company, LLC (Essex), a subsidiary of Patriot Hydro, LLC, is the Licensee, owner, and operator of the Lawrence Hydroelectric Project (P-2800) (Project or Lawrence Project). The Project was licensed by the Federal Energy Regulatory Commission (FERC or Commission) on December 4, 1978 (with an effective date of December 1, 1978), and the license expires on November 30, 2028. The Lawrence Project is located on the Merrimack River in the City of Lawrence, Essex County, Massachusetts. Essex is pursuing a new license for the Project using the Commission's Integrated Licensing Process (ILP) as defined in 18 Code of Federal Regulations (CFR) Part 5.

Massachusetts Division of Fisheries and Wildlife (MassWildlife) and the U.S. Fish and Wildlife Service (USFWS) submitted formal study requests for an Invasive Species Study. In accordance with 18 C.F.R. § 5.15, Essex has conducted studies and information-gathering activities as detailed in the Study Plan Determination (SPD) issued by the Commission on May 10, 2024 for the Project. This report describes the methods and results of the approved Invasive Plant Survey conducted in support of a new license for the Project.

1.1 Project Description and Background

The Lawrence Project is located at river mile (RM) 29 on the Merrimack River in the City of Lawrence, Essex County, Massachusetts. As licensed, the existing Lawrence Project consists of:

- The 35-foot-high by 900-foot-long gravity Essex Dam of stone masonry construction (also known as the Great Stone Dam), with a five-foot-high pneumatic crest gate system mounted on the spillway crest;
- A 9.8-mile-long impoundment having a surface area of 655 acres at a normal water elevation of 44.17 feet National Geodetic Vertical Datum of 1929 (NGVD29) at the top of the crest gates, and gross storage capacity of approximately 19,900 acre-feet;
- A powerhouse located at the end of a small forebay adjacent to the south abutment of the Essex Dam, containing two 8.4 megawatt (MW) generating units, and a tailrace channel extending into the Merrimack River channel;
- Fish passage facilities integral with the powerhouse, including a fish elevator and downstream fish bypass, and an eel ladder at the right abutment of the dam;
- The North Canal, approximately 5,300 feet long by 95 feet wide by 15 feet deep, originating at the north abutment of the dam and paralleling the Merrimack River downstream of the Essex Dam;
- The South Canal, approximately 2,750 feet long by 35 feet wide by 10 feet deep, originating the south abutment of the Essex Dam and generally paralleling the Merrimack River downstream of the Essex Dam;
- A single-circuit, underground/underwater 23.0-kilovolt (kV) transmission line; and
- Appurtenant facilities.

2 Study Goals and Objectives

The goals and objectives of this study are to:

- Provide information on invasive weed occurrences and distributions within the survey area;
- Provide maps identifying the extent/boundary of survey areas and the locations of observed invasive plants in the survey areas;
- Describe the approximate abundance (e.g., stem count, patch size, relative density) and distribution of observed invasive plant species within the survey areas; and
- Provide an assessment of any data gaps in the Project-specific invasive plant species.

3 Study Area

Pursuant to the Commission's SPD, the study area for the Invasive Plant Species Survey Study encompassed all designated focal study areas associated with the (1) three vegetation surveys of the North and South Canals, conducted as part of the Recreation Facilities, Use, and Aesthetics Study (hereinafter "Canal Vegetation Surveys"); (2) the field inventory of up to 16 sites, conducted as part of the Recreation Facilities, Use, and Aesthetics Study (hereinafter "Recreation Field Inventory Assessment"); (3) the field reconnaissance and visitor-intercept surveys, conducted as part of the Recreation Facilities, Use, and Aesthetics Study (hereinafter "Recreation Visitor Use Surveys"); and (4) the field sampling conducted as part of the Freshwater Mussel Habitat Assessment and Survey[1].

The 16 sites, conducted as part of the Recreation Field Inventory Assessment, are presented in Appendix A. Ten of the 16 sites were selected as part of the Recreation Visitor Use Surveys which are further presented in Appendix A. The selection of sites for the Recreation Field Inventory Assessment and the Recreation Visitor Use Surveys were determined in consultation with stakeholders (see the Recreation Facilities, Use, and Aesthetics Study Report filed with the Commission on April 27, 2026).

4 Methodology

4.1 Invasive Plant Species Field Surveys

4.1.1 Pre-field Literature Review

A review of publicly available spatial data on invasive plants near the Project area was conducted using two prominent online sources: iNaturalist and EDDMapS (NHESP 2025, iNaturalist 2025, EDDMapS 2025). Observations from these sources were examined to review identification accuracy, spatial patterns of invasive plant species, and relevance to the Project area, informing preparation for field surveys. The 2023 Pre-Application Document (PAD) also provides ample information pertaining to terrestrial and aquatic invasive species.

[1] In their May 10, 2024 SPD, FERC requested that Essex report the occurrence of all invasive plant species while conducting field sampling conducted as part of the Freshwater Mussel Habitat Assessment and Survey. Although invasive plant data was not collected during the 2024 Mussel Study, Essex revisited the survey locations in 2025 that had been previously established during the Freshwater Mussel Habitat Assessment and Survey.

Detailed existing information on invasive plant species in the study area is limited. No known dedicated invasive plant species surveys have been conducted in study area. The invasive plant species survey focused on plant species included on the Massachusetts Invasive Plant Advisory Group (MIPAG) annotated species list (MIPAG undated) (Appendix B). MIPAG serves as the governing body responsible for classifying non-native plants in Massachusetts as invasive, likely invasive, or potentially invasive based on their annotated criteria provided on the group's website (MIPAG undated). Species that are non-native but do not fit in either of the three categories above are classified as not currently meeting criteria but are being monitored closely for spread and aggression within the Commonwealth (MIPAG undated). Statewide, 106 plant species occur in the Commonwealth, of which 36 plant species are currently classified as invasive, 33 as likely invasive, 3 as potentially invasive, and 34 as not currently meeting the criteria (MIPAG undated; Appendix B).

"Invasive" plants are non-native species that have spread into native or minimally managed plant systems in Massachusetts. These plants cause economic or environmental harm by developing self-sustaining populations and becoming dominant and/or disruptive to those systems (MIPAG undated; available here: https://massnrc.org/MIPAG/invasive.htm).

"Likely invasive" plants are non-native species that are naturalized in Massachusetts but do not meet the full criteria that would trigger an "invasive" plant designation (MIPAG undated; available here: https://massnrc.org/MIPAG/linvasive.htm).

"Potentially invasive" plants are non-native species not currently known to be naturalized in Massachusetts, but that can be expected to become invasive within minimally managed habitats within the Commonwealth (MIPAG undated; available here: https://massnrc.org/MIPAG/pinvasive.htm.

"Evaluated plants not meeting criteria" are plants that were evaluated for invasiveness by the MIPAG but did not meet the necessary criteria to list them as invasive, likely invasive or potentially invasive at the time of evaluation (MIPAG undated; available here https://massnrc.org/MIPAG/notmeetingcriteria.htm).

Species descriptions were obtained from *A Manual of the Vascular Flora of New England and Adjacent New York* (Magee & Ahles 2007), Native Plant Trust (https://www.nativeplanttrust.org), and other web based sources and printed articles. The U.S. Department of Agriculture Natural Resources Conservation Service Plants Database (USDA Plants Database) for the region (i.e., Massachusetts) (USDA NRCS 2024) was queried for local habitat and range information. Other publications like MIPAG (2005) and MassAudubon (2023) were reviewed prior to field surveys.

4.1.2 Field Surveys

Field notes for each of the 106 listed species were maintained in a spatial geodatabase for ease of access in the field. Information such as species dimensions, identifying characteristics, growth patterns and behavior, and habitat preferences was included.

Recreation Field Inventory Assessment

One on-foot observational survey was conducted to assess invasive plant species across sixteen potential recreation areas during the Recreation Field Inventory Assessment phase of the Recreation Facilities, Use, and Aesthetics Study in October 2024. These sixteen recreation areas included: Abe Bashara Boathouse, Strazzula Reservation, Boys and Girls Club, Lawrence Heritage State Park, Campagnone Common, Merrimack River Trail, Pemberton State Park, Nunzio DiMarca

Park, Methuen Boat Ramp, Philips Academy Boathouse, Raymond J. Martin Riverside Park, Sewer Interceptor, Spicket River Greenway-Manchester Street Park, Riverfront State Park, Bay Circuit Trail, and Oxford Park.

The invasive plant species survey of the recreation areas was conducted using commonly accepted botanical survey methods to systematically locate and identify invasive plant infestations. These methods involved visually searching the study area for the presence of invasive plant species.

A species was considered invasive, likely invasive, or potentially invasive if it was listed on the MIPAG annotated species lists, respectively (MIPAG undated, Appendix B). As time allowed, Essex mapped the location of invasive plant species using an EOS Positioning Systems Arrow Gold™ global navigation satellite system (GNSS) receiver linked to an iPad™ operating Field Maps for ArcGIS™ and sketch maps during ground truthing. Mapped invasive plant species boundaries were delineated or characterized based on the dominant canopy cover or areal ground coverage of the invasive plant(s) and were categorized as localized or widespread. Areas containing only occasional invasive plant species were geolocated using a GNSS center point and radius necessary to enclose the population. In areas where invasive plant species were ubiquitous or impractical to map, surveyors characterized the population using estimates of areal coverage and percent of species present. In areas where dense stands of invasive plant species have formed, infestations were photo documented and georeferenced.

Recreation Visitor Use Surveys

Essex conducted 24 on-foot observational surveys throughout the 2025 growing season to identify invasive plant species within ten recreation areas as part of the Recreation Facilities, Use, and Aesthetics Study. The ten recreational sites evaluated under this study included Abe Bashara Boathouse, Boys and Girls Club, Lawrence Heritage State Park, Campagnone Common, Merrimack River Trail, Pemberton State Park, Nunzio DiMarca Park, Spicket River Greenway–Manchester Street Park, Riverfront State Park, and Oxford Park. Appendix C summarizes the 24 survey days, including the dates on which they occurred, and the conditions observed across all ten recreation sites.

The invasive plant species surveys generally followed the methods used for the Recreation Field Inventory Assessment, with the exception of utilizing an EOS Positioning Systems Arrow Gold™ GNSS receiver and the addition of completing Invasive Plant Species Observation Documentation Forms (hereinafter “forms” or “data forms”) (Appendix D). Boundaries of mapped invasive plant species were delineated or characterized based on dominant cover type using an iPad™ or iPhone™ running Field Maps for ArcGIS™ and supplemented by sketch maps during ground-truthing. In areas where invasive plant species were widespread, impractical to map individually, or previously identified during earlier study efforts, surveyors updated population sizes using estimates of areal coverage, percent species composition, and stem counts; when practical. Dense infestations were photographically documented and mapped to show areal representation.

Biologists completed an invasive plant species data form during each park visit when a new invasive plant species was observed. Each form documented the site, species observed, vegetative density at the time of the survey using four areal coverage categories (1: 1–25 percent, 2: 26–50 percent, 3: 51–75 percent, and 4: 76–100 percent); distribution within the site (localized or widespread); stem counts, if practical, or assemblage characteristics; and notes on observed conditions, including unusual growth patterns, species location relative to the study area, and other relevant observations. One form was completed per species at each site; forms were not duplicated for species previously

documented and reobserved during subsequent visits. If a species density increased or decreased during the study period, notes on changes in spatial density were documented in a field notebook and included in the results section of this report.

Results from the Recreation Visitor Use Surveys, combined with findings from the Recreation Field Inventory Assessment, were used by Essex to develop maps identifying locations of significant invasive vegetation accumulations within all recreational site areas studied.

4.1.3 Documentation and Mapping

Essex uploaded the field-collected GNSS data to ArcGIS™ Online and imported it into ArcGIS™ desktop applications. HDR finalized invasive plant species boundaries and other data points using the field-collected GNSS data in ArcGIS Pro™ version 3.4.4.

Using the results of the initial Recreation Field Inventory Assessment Surveys, Essex developed maps identifying locations of mapped invasive plant species within the potential recreational sites areas. This data source was the foundation of the more comprehensive invasive species surveys conducted during the Recreation Visitor Use Surveys portion of the Recreation Facilities, Use, and Aesthetics Study. Results from these combined surveys were used by Essex to develop maps identifying locations of significant invasive vegetation accumulations within all of the recreational site areas studied.

Invasive plants were commonly observed growing in dense, mixed stands with other invasive species. To accurately represent their distribution within the recreation area, mapped polygons delineate the approximate extent of the dominant invasive plant species present in each localized area. Maps showing the approximate boundaries of dominant mapped invasive plant species are provided in Appendix E. The occurrence of additional invasive species conglomerates within these dominant-species polygons is documented in the site-specific tables in Appendix F.

Additional notes or data collected that were not specified in Geographic Information System (GIS) were recorded in field notebooks, photographs, and other geodatabases for data analysis and post-processing purposes.

4.2 Canal Vegetation Surveys

Essex conducted on-foot surveys of the North and South Canals to visually inspect and document vegetation within the study area. As per the SPD, three canal vegetation surveys were completed to capture conditions at different stages of the growing season between 2024 and 2025. During each survey, technicians recorded invasive vegetation species, depositional settings, detailed field notes, and photographic documentation. Vegetation growth along the historic canal wall was also mapped using a GPS Eos Positioning System Arrow 100TM GNSS receiver linked to an iPad™ Pro or compatible cellular device operating Collector for ArcGIS™ hand-held GPS unit (equipped with a data dictionary aiding in feature attribution).

The presence and extent of cover of vegetation on/along the canal walls observed at the time of the field survey were evaluated based on photographs and field observations. Geospatial vegetation data was transferred to a GIS format and used to develop both visual maps and depicting vegetation presence boundaries and vegetation polygons, vegetation points, and vegetation polylines along the canal walls as well as tabular information quantifying the abundance and distribution of dominant vegetation types within the study area. Vegetation data was analyzed to calculate the percentage represented by each species within each canal.

Vegetation polygons were used to document large, dense clusters along the canal walls, whereas vegetation polylines were used to document intermittent invasive species clusters. Vegetation points were used to document single stem and/or a single cluster of an invasive species observed. Representative photos were taken for each of the above documentation categories.

The surveys were conducted during peak growing season 2024, at the end of the growing season 2024, and at the beginning of the following year's growing season 2025 in northeastern Massachusetts. Using the results of these surveys, Essex developed maps identifying locations of significant vegetation accumulations within the North and South Canals vicinity.

4.3 Freshwater Mussel Habitat Assessment and Survey

Normandeau Associates conducted a qualitative review of terrestrial and aquatic invasive plant species within the study area. In order to document the presence of invasive species throughout the Project, a botanist revisited the survey locations that had been previously established for the Freshwater Mussel Habitat Assessment and Survey (see Freshwater Mussel Habitat Assessment and Survey Study Report filed with the Commission on April 26, 2025).

The majority of points were accessed from the mainstem of the river and were surveyed using a small, flat-bottomed boat. However, two of the survey locations were located on the power canal immediately upstream of the dam and were accessed by foot. One additional survey point was located along the Spicket River and water levels at the time of the survey were insufficient to reach by boat, and the point was surveyed by foot. If multiple survey locations were located within 100 meters of each other, only one point was surveyed and the points were assigned a combined identifier. When multiple points were combined, points with a "T" prefix and lower numbers were given priority.

At each point, the immediately adjacent shoreline was reviewed for the presence of terrestrial invasive species, and the immediate surroundings were reviewed for all submerged and floating-leaved aquatic vegetation. Terrestrial invasive species located below the top of bank were identified to the species level, if possible, and a representative shoreline photo was taken at each location. If submerged aquatic vegetation was visible from each point, vegetation was viewed through a view tube and, if necessary for identification, samples were collected and examined by hand. Voucher photographs were taken of each species found during the survey.

5 Study Results

5.1 Invasive Plant Species Field Surveys

5.1.1 Field Surveys

Recreation Field Inventory Assessment

Observation of invasive, likely invasive, and potentially invasive plant species within the sixteen potential recreation areas were performed in conjunction with the Recreation Inventory Field Survey activities on October 10, 2024.

Eighteen plant species designated as invasive or likely invasive (MIPAG undated) were observed and mapped within the approximately 87.7- acre study area as a result of the Recreation Field

Inventory Assessment (Table 5-1). 16 of these species are classified as Invasive by MIPAG (undated).

Table 5-1. Invasive or Likely Invasive Plant Species Observed as a Result of the Recreation Field Inventory Assessment.

Common Name	Genus Species	MIPAG Classification
Norway Maple	*Acer platanoides*	Invasive
Tree-of-Heaven	*Ailanthus altissima*	Invasive
Garlic Mustard	*Alliaria petiolata*	Invasive
Japanese Barberry	*Berberis thunbergii*	Invasive
Oriental Bittersweet	*Celastrus orbiculatus*	Invasive
Autumn Olive	*Elaeagnus umbellata*	Evaluated Plants Not Meeting Criteria
Winged Euonymus	*Euonymus alatus*	Invasive
Japanese Knotweed	*Fallopia japonica*	Invasive
Glossy Buckthorn	*Frangula alnus*	Invasive
Yellow Iris	*Iris pseudacorus*	Invasive
Morrow's Honeysuckle	*Lonicera morrowii*	Invasive
Purple Loosestrife	*Lythrum salicaria*	Invasive
Reed Canary-Grass	*Phalaris arundinacea*	Invasive
Phragmites	*Phragmites australis*	Invasive
Creeping Buttercup	*Ranunculus repens*	Likely Invasive
Common Buckthorn	*Rhamnus cathartica*	Invasive
Black Locust	*Robinia pseudoacacia*	Invasive
Multiflora Rose	*Rosa multiflora*	Invasive

Source: MIPAG (undated).

Invasive plant species in the potential recreation areas exhibit generally two patterns of occurrence; localized and widespread, as described below. Given that the majority of the observed Invasive plant species occurring in the recreation areas were predominantly widespread, most Invasive plant species observations were not mapped during this field effort.

- **Localized Species:** These invasive plant species were observed to generally exist as individual groups and their distribution is considered to be more restricted within the recreation areas. Some species have a propensity to occur as relatively large, dense clusters and as individual plants or as groups of thinly dispersed plants. These species include autumn olive, creeping buttercup, yellow iris, multiflora rose, and glossy buckthorn. For example, autumn olive was observed along forested edges adjacent to the Abe Bashara Boathouse occurring in relatively small, localized, dense clumps. Similarly, yellow iris was observed in scattered

dense clumps in backwater and wetland habitats between Abe Bashara Boathouse and the Merrimack River trail as well as and along the Bay Circuit Trail in wetland habitats bordering the Merrimack River.

- **Widespread Species:** These species are described by their general range of distribution within the recreation areas and are considered to be widespread invasive plant species both within the recreation areas and this region of Massachusetts. These species include oriental bittersweet, Japanese knotweed, common buckthorn, black locust, garlic mustard, Japanese barberry, Norway maple, winged euonymus, Morrow's honeysuckle, purple loosestrife, reed canary-grass, tree-of-heaven, and common reed. These invasive plant species have the propensity to occur as relatively large, dense stands and can occur as individual plants or as groups of thinly dispersed plants. The presence of these species in the recreation areas was most notable along riparian and floodplain habitats, along the edges of forested habitat, along roadways and trails, and within/adjacent to recreation areas. Oriental bittersweet was the most pervasive species being found in dense cover at some locations and in a variety of habitats. Dense growth of reed canary-grass was observed in some areas along stream courses and floodplain habitats. Relatively large stands of Japanese knotweed were observed along forested edges, access paths, and unpaved roadways/parking areas. Japanese barberry was also widely distributed throughout the recreation areas in dense patches, on river and stream banks, along the edges of wetlands, and along trails and forested edges. It also occurred as discrete smaller patches within larger, typically forested plant communities bordering the Merrimack River. Black locust trees occurred sporadically throughout forested cover types bordering Lawrence Riverfront State Park/Merrimack River Trail, Oxford Park, Nunzio DiMarca Park, Sewer Inceptor, Spicket River Greenway-Manchester Street Park, Raymond J. Martin Riverside Park, and Strazzula Reservation.

Examples of localized and widespread invasive plant species observed within the recreation areas are provided in Figure 5-1 through Figure 5-5.

Figure 5-1. Example of Yellow Iris Growing in Wetland Along Merrimack River Trail Behind Abe Bashara Boathouse (10/10/2024).

Figure 5-2. Example of Tree-of-Heaven and Oriental Bittersweet at Nunzio DiMarca Park (10/10/2024).

Figure 5-3. Example of Oriental Bittersweet and Common Buckthorn Along Merrimack River Riparian Habitat at Phillips Academy Boathouse (10/10/2024).

Figure 5-4. Example of Norway Maple and Oriental Bittersweet Growing Along Merrimack River Trail Near Abe Bashara Boathouse (10/10/2024).

Figure 5-5. Example of Phragmites (In Background) Growing along the Spicket River at Manchester Street Park (10/10/2024).

Recreation Visitor Use Surveys

Observation of invasive, likely invasive, potentially invasive, and evaluated plants not meeting criteria plant species within the ten recreation areas were performed in conjunction with the Recreation Visitor Use Surveys activities during 24 survey days from May 15, 2025, through September 30, 2025. Appendix C summarizes the 24 survey days, including the dates on which they occurred, and the conditions observed across all ten recreation sites.

Twenty-four plant species designated as Likely Invasive or Invasive (MIPAG undated) were observed during this part of the study covering approximately 62.2 acres (Table 5-2). Maps showing the approximate boundaries of dominant mapped invasive plant species are provided in Appendix E[2]. Nineteen of these species are classified as invasive by MIPAG (undated). Honey locust (*Gleditsia triacanthos*) was also observed during this study. Although it is not included on the MIPAG species lists, it exhibits invasive characteristics and is listed as invasive in neighboring states and has been included in Table 5-2.

Table 5-2. Invasive or Likely Invasive Plant Species Observed as a Result of the Recreation Visitor Use Surveys.

Common Name	Genus Species	MIPAG Classification
Autumn Olive	*Elaeagnus umbellata*	Evaluated Plants Not Meeting Criteria
Glossy Buckthorn	*Frangula alnus*	Invasive
Garlic Mustard	*Alliaria petiolata*	Invasive
Black Locust	*Robinia pseudoacacia*	Invasive
Black Swallow-wort	*Cynanchum louiseae*	Invasive
Bradford Pear	*Pyrus calleryana*	Likely Invasive
Coltsfoot	*Tussilago farfara*	Likely Invasive
Common Buckthorn	*Rhamnus cathartica*	Invasive
Honey Locust	*Gleditsia triacanthos*	N/A[1]
Japanese Barberry	*Berberis thunbergii*	Invasive
Japanese Honeysuckle	*Lonicera japonica*	Invasive
Japanese Knotweed	*Fallopia japonica*	Invasive
Morrow's Honeysuckle	*Lonicera morrowii*	Invasive
Multiflora Rose	*Rosa multiflora*	Invasive
Norway Maple	*Acer platanoides*	Invasive

[2] Invasive plants were commonly observed growing in dense, mixed stands with other invasive species. Mapped polygons delineate the approximate extent of the dominant invasive plant species present in each localized area. The occurrence of additional invasive species conglomerates within these dominant-species polygons is documented in the site-specific tables included as Appendix F.

Common Name	Genus Species	MIPAG Classification
Oriental Bittersweet	*Celastrus orbiculatus*	Invasive
Phragmites	*Phragmites australis*	Invasive
Winged Euonymus	*Euonymus alatus*	Invasive
Yellow Iris	*Iris pseudacorus*	Invasive
Tree-of-Heaven	*Ailanthus altissima*	Invasive
Purple Loosestrife	*Lythrum salicaria*	Invasive
Reed Canary-Grass	*Phalaris arundunacea*	Invasive
Tatarian Honeysuckle	*Lonicera tatarica*	Likely Invasive
Variable-leaved Milfoil	*Myriophyllum heterophyllum*	Invasive

Source: MIPAG (undated).

[1]Honey Locust (*Gleditsia triacanthos)* is not considered invasive, likely invasive, and potentially invasive plant species in the Commonwealth of Massachusetts according to MIPAG (undated); however, this species is largely considered invasive in this region of the United States.

Examples of localized and widespread invasive plant species observed within the recreation areas are provided in Figure 5-6 through Figure 5-10.

Figure 5-6. Example of Winged Euonymus with Conglomerates of Oriental Bittersweet, Norway Maple, Morrow's Honeysuckle, Multiflora Rose and Japanese Knotweed Growing Along Merrimack River Bank at the Merrimack River Trail (5/26/2025).

Figure 5-7. Example of Oriental Bittersweet and Tree-of-Heaven Growing Along Merrimack River Bank and Trail Fence at Pemberton State Park (6/10/2025).

Figure 5-8. Example of Widespread Japanese Knotweed, Tree-of-Heaven, Black Locust, and Garlic Mustard at Nunzio DiMarca Park (6/10/2025).

Figure 5-9. Example of Tree-of-Heaven Growing Along Spicket River at Oxford Park (8/6/2025).

Figure 5-10. Example of Japanese Barberry, Norway Maple, and Tree-of-Heaven Along Spicket River Bank at Spicket River Greenway (7/26/2025).

Recreation Site Assessments

As part of the Recreation Facilities, Use, and Aesthetics Study, invasive plant species densities were monitored at 10 recreation sites throughout the 2025 growing season. When combined with 2024 data, these observations provide a baseline for invasive plant species growth, distribution, and expansion during a typical growing season within the study area. Summaries of dominant invasive plants observed and their general location within the 10 recreation sites are provided below. Data tables that present plant species, general location, distribution (i.e., localized or widespread), and overall descriptions of each species' general occurrence and distribution within each of the 10 recreation sites are provided in Appendix F.

Abe Bashara Boathouse

The Abe Bashara Boathouse, located along the Merrimack River, encompasses a study area of approximately 1.8 acres. The site includes a large boathouse near the northern portion, with numerous boats, trailers, associated facilities along the study area boundaries, and areas of maintained lawn and open space. Several docks extend from the boathouse into the Merrimack River; however, the study primarily focused on the immediate terrestrial, riparian, and along the shoreline of the Merrimack River.

Invasive plant species were extensively documented throughout the site, with the highest concentrations occurring along the terrestrial boat parking area near the southern boundary of the study area. Twelve species were observed within the study area and are included on the MIPAG annotated species lists (MIPAG undated: 11 identified as invasive and one identified as evaluated plants not meeting criteria (autumn olive). Observed species included common buckthorn, multiflora rose, Morrow's honeysuckle, garlic mustard, tree-of-heaven, Japanese knotweed, oriental bittersweet, autumn olive, reed canary-grass, Norway maple, yellow iris, and purple loosestrife. Examples of observed species are shown in Figure 5-11 and Figure 5-12. Nine of these species (75 percent) were classified as Widespread (Appendix F).

Figure 5-11. Example of Oriental Bittersweet, Common Buckthorn, and Norway Maple Growing Between Boat Parking Area at Aba Bashara Boathouse (6/3/2025).

Figure 5-12. Example of Oriental Bittersweet, Common Buckthorn, Autumn Olive, and Tree-oh-Heaven Growing Between Fenced-In Storage Area at Abe Bashara Boathouse (6/10/2025).

Boys and Girls Club

The Boys and Girls Club, located approximately a half mile downstream of the Abe Bashara Boathouse along the left descending bank of the Merrimack River, encompasses a study area of approximately 3.2 acres. The site includes the main club building to the southeast, separated from the bank of the Merrimack River by Jordan Street. A chain link fence runs between the Merrimack River bank, with a narrow, mowed lawn strip situated between the chain link fence and Jordan Street. A relic boat launch provides access to the Merrimack River between Jordan Street and the main entrance road to the club. Large boulders, approximately 3–4 feet in width, block vehicle access to the boat ramp, preventing motorized entry to the river.

Invasive plant species were extensively documented along the perimeter of the site, with the highest concentrations occurring between the bank of the Merrimack River and fenced area. Five species were observed within the study area and are included on the MIPAG annotated species lists (MIPAG undated), all identified as invasive. Observed species included oriental bittersweet, winged euonymus, glossy buckthorn, Japanese barberry, and Norway maple. Examples of observed species are shown in Figure 5-13 and Figure 5-14. Three of these species (60 percent) were classified as Widespread (Appendix F).

Figure 5-13. Example of Thick Conglomerates of Oriental Bittersweet, Winged Euonymus, Glossy Buckthorn, Japanese Barberry, and Norway Maple Along Merrimack River at Boys and Girls Club (10/10/2024).

Figure 5-14. Example of Young Winged Euonymus at the Boys and Girls Club (6/11/2025).

Lawrence Heritage State Park

The Lawrence Heritage State Park, located on the north side of the North Canal adjacent to the Washington Mills Bridge, encompasses a study area of approximately 0.6 acre. The site includes the main museum building and a renovated urban park area with gardens and benches, connected by brick and paved sidewalks. A metal fence separates the North Canal from the sidewalk area. Canal Street, a single lane road, runs between the sidewalk and the museum building. Additional parking is available along Mill Street and Methuen Street, with a designated visitor and employee parking lot located behind the urban park and museum building.

MIPAG invasive and likely invasive (Bradford pear) plant species were less dense at this site, with only a few individual observations present throughout the study's duration. Six species were observed within the study area and are included on the MIPAG annotated species lists (MIPAG undated): five classified as invasive and one classified as likely invasive (Bradford pear). Observed species included tree-of-heaven, Japanese knotweed, Norway maple, glossy buckthorn, reed canary-grass, and Bradford pear. Examples of observed species are shown in Figure 5-15 and Figure 5-16. Only one of these species (reed canary-grass) (17 percent) was classified as Widespread (Appendix F).

Figure 5-15. Example of Glossy Buckthorn Bush Along North Canal Wall at Lawrence Heritage State Park (6/19/2025).

Figure 5-16. Example of Adult Bradford Pears Along North Canal and Canal Street Sidewalk at Lawrence Heritage State Park (6/3/2025).

Campagnone Common

The Campagnone Common, located in the center of Lawrence, encompasses approximately 17.0 acres. The site features areas of mowed grass and trees, brick and paved walking trails, benches, memorials, statues, and planted ornamentals. Parking is available along Common Street, Lawrence Street, Haverhill Street, and Jackson Street. The area resembles a typical open-concept urban park and is maintained regularly by city groundcrews and volunteer groups.

MIPAG invasive and likely invasive (coltsfoot) plant species were less abundant at this site, with only a few individual observations documented during the study's duration. Two species were observed within the study area and are included on the MIPAG annotated species lists (MIPAG undated): one classified as invasive and one classified as likely invasive. Observed species included tree-of-heaven and coltsfoot. Examples of observed species are shown in Figure 5-17. Both species were classified as Localized (Appendix F).

Figure 5-17. Example of Tree-of-Heaven Between Lawrence Street Sidewalk and Granite Shoulder at Campagnone Common (6/10/2025).

Merrimack River Trail

The Merrimack River Trail, located along the Merrimack River, encompasses an approximate distance of 0.6 miles starting from the Merrimack River inlet behind Abe Bashara Boathouse to the gated entrance to Lawrence Riverfront State Park for this study. The site features a single paved walkway along the Merrimack River with a few benches and trash receptacles along both sides of the trail. Parking is available off Eaton Street adjacent to Abe Bashara Boathouse and at Lawrence Riverfront State Park. The Merrimack River Trail is approximately 10 feet from the immediate bank of the Merrimack River and is largely upland forest on the other side of the trail.

Invasive and likely invasive (Tatarian honeysuckle) plant species were very abundant and well documented along much of the trail and were found throughout the study's duration. Fifteen species were observed within the study area and are included on the MIPAG annotated species lists (MIPAG undated): 13 classified as invasive, one classified as likely invasive (Tatarian honeysuckle), and one classified as evaluated plants not meeting criteria (autumn olive). Observed species included oriental bittersweet, yellow iris, glossy buckthorn, garlic mustard, autumn olive, black locust, tree-of-heaven, winged euonymus, Japanese barberry, multiflora rose, Tatarian honeysuckle, common buckthorn, black swallow-wort, Japanese honeysuckle, and Japanese knotweed (Figure 5-18). Eleven of these species (73 percent) were classified as Widespread (Appendix F).

Figure 5-18. Example of Multiflora Rose Between Merrimack River Bank and the Merrimack River Trail (6/10/2025).

Pemberton State Park

Pemberton State Park, located on the island between the Merrimack River and North Canal, encompasses a study area of approximately 8.8 acres. The site includes a pavilion area, gardens and benches, fenceline along the Merrimack River, a relic boat launch, and trash receptacles. Parking is available along Canal Street with access to the park via Broadway and Parker Street. Forested edges and buffers separate the predominantly mowed lawn landscape.

Invasive plant species were very abundant and well documented within the park and were found throughout the study's duration. Eight species were observed within the study area and are included on the MIPAG annotated species lists (MIPAG undated), all classified as invasive. Observed species included Japanese knotweed, Norway maple, black swallow-wort, tree-of-heaven, oriental bittersweet, Japanese barberry, glossy buckthorn, and black locust. Examples of observed species are shown in Figure 5-19 and Figure 5-20. Six of these species (75 percent) were classified as Widespread (Appendix F).

Figure 5-19. Example of Black Swallow-Wort Near Amesbury Street Terrestrial Edge at Pemberton State Park (6/19/2025).

Figure 5-20. Example of Tree-of-Heaven Sapling in Terrestrial Interior Island at Pemberton State Park (6/11/2025).

Nunzio DiMarca Park

Nunzio DiMarca Park, located on the island between the North Canal and Merrimack River, encompasses a study area of approximately 3.7 acres. The site includes a pavilion area, gardens and benches, a helical walking trail, and direct access to the North Canal and Merrimack River. Parking is available at an adjacent apartment building / indoor squash gymnasium. Interior forested islands and mowed lawns are the dominant vegetated landscape of the park.

Invasive plant species were very abundant and well documented within the park and were found throughout the study's duration. Nine species were observed within the study area and are included on the MIPAG annotated species lists (MIPAG undated): seven classified as invasive, one classified as likely invasive (Bradford pear), and one classified as evaluated plants not meeting criteria (autumn olive). Observed species included oriental bittersweet, Japanese knotweed, tree-of-heaven, Japanese barberry, garlic mustard, reed canary-grass, multiflora rose, Bradford pear, and autumn olive. Examples of observed species are shown in Figure 5-21 through Figure 5-24. Six of these species (67 percent) were classified as Widespread (Appendix F).

Figure 5-21. Example of Reed Canary-Glass Growing Along Terrestrial Hillside of North Canal at Nunzio DiMarca Park. Notice Worker Trimming Stand (6/10/2025).

Figure 5-22. Example of Trimmed Reed Canary-Grass Alongside Terrestrial Hillside of North Canal at Nunzio DiMarca Park (6/11/2025).

Figure 5-23. Example of Vegetated Hill with Tree-of-Heaven, Garlic Mustard, Black Locust, and Oriental Bittersweet at Nunzio DiMarca Park. Notice Hillside Dominated by Invasive Plant Species (6/10/2025).

Figure 5-24. Example of Trimmed Hill at Nunzio DiMarca Park. Notice Hillside Once Dominated by Tree-of-Heaven, Garlic Mustard Black Locust, and Oriental Bittersweet; Now Barren and Grasslands (6/19/2025).

Spicket River Greenway – Manchester Street Park

The Spicket River Greenway and Manchester Street Park are in northern Lawerence near the town boundary with Methuen, Massachusetts. The Spicket River Greenway is an approximately 3.5-mile-long paved trail that follows the banks of the Spicket River, a tributary to the Merrimack River. For the purpose of this study, Spicket River Greenway was surveyed from its trailhead at Manchester Street Park and at segments that run through Oxford Park and Nunzio DiMarca Park, located near downtown.

Manchester Street Park encompasses a study area of approximately 3.0 acres in total; however, due to safety concerns, the study area for this assessment was limited to approximately 0.7 acre as discussed in the formal Recreation Facilities, Use, and Aesthetics Study Report. The site includes a pavilion area, gardens and benches, children's playground, trash receptacles, and other appurtenant facilities. Parking is available at an adjacent lot to the park. The park is broadly characterized as a mowed lawn to the north and an outdoor playground area to the south.

Invasive plant species were very abundant and well documented within the park and were found throughout the study's duration. Eighteen species were observed within the study area and are included on the MIPAG annotated species lists (MIPAG undated): 16 classified as invasive, one classified as evaluated plants not meeting criteria (autumn olive), and one classified on likely invasive (Tatarian honeysuckle). Observed species included oriental bittersweet, autumn olive, black swallow-wort, black locust, garlic mustard, winged euonymus, reed canary-grass, Japanese knotweed, Norway maple, Japanese barberry, multiflora rose, Morrow's honeysuckle, phragmites, tree-of-heaven, Tatarian honeysuckle, glossy buckthorn, variable leaved milfoil, honey locust, and purple loosestrife. Examples of observed species are shown in Figure 5-25 and Figure 5-26. Fourteen of these species (74 percent) were classified as Widespread (Appendix F).

Honey locust was also observed during this study. Although it is not included on the MIPAG species list, it exhibits invasive characteristics and is listed as invasive in neighboring states. This species was added to Appendix F for reference purposes only.

Figure 5-25. Example of Variable Leaved Milfoil in Spicket River Near Manchester Street Park Pavilion/Spicket River Greenway (8/5/2025) (two photographs).

Figure 5-26. Example of Phragmites in Spicket River and Wetland Margins Near Manchester Street Park / Spicket River Greenway (8/5/2025).

Lawrence Riverfront State Park

Lawrence Riverfront State Park is located on the south banks of the Merrimack River near Abe Bashara Boathouse and within portions of the Merrimack River Trail. The Lawrence Riverfront State Park study area is approximately 21.4 acres with overlaps between the two recreation sites previously noted. The site includes a pavilion area, gardens and benches, boat launch, children's playground, trash receptacles, sports courts, and other appurtenant facilities. Parking is available at Lawrence Riverfront State Park or along Everett Street. The park's landscape is broadly characterized as forested lands, mowed grass fields, and paved grounds.

Invasive plant species were very abundant and well documented within the park and were found throughout the study's duration. Eleven species were observed within the study area and are included on the MIPAG annotated species lists (MIPAG undated): nine classified as invasive, one classified as evaluated plants not meeting criteria (autumn olive), and one classified on likely invasive (Tatarian honeysuckle). Observed species included Japanese knotweed, oriental bittersweet, Norway maple, Morrow's honeysuckle, tree-of-heaven, Tatarian honeysuckle, autumn olive, Japanese barberry, glossy buckthorn, Japanese honeysuckle, and yellow iris. Examples of observed species are shown in Figure 5-27 and Figure 5-28. Ten of these species (91 percent) were classified as Widespread (Appendix F).

Figure 5-27. Example of Japanese Honeysuckle Amongst Other Invasive Plants at Lawrence Riverfront State Park (6/11/2025).

Figure 5-28. Example of Japanese Knotweed Growing Behind Trailered-Boat Parking Area at Lawrence Riverfront State Park (7/26/2025).

Oxford Park

Oxford Park is located near the confluence of the Spicket River and the Merrimack River in downtown Lawrence. The Oxford Park study area is approximately 2.6 acres and includes parts of the Spicket River Greenway trail, garden beds, and a mowed lawn interior area. Parking is available at Oxford Park directly off Canal Street. The park's landscape is broadly characterized as mowed lawns and garden beds.

Invasive plant species were very abundant and well documented within the park and were found throughout the study's duration. Eight species were observed within the study area and are included on the MIPAG annotated species lists (MIPAG undated), all classified as invasive. Observed species included tree-of-heaven, black swallow-wort, black locust, garlic mustard, oriental bittersweet, glossy buckthorn, reed canary-grass, and multiflora rose. Examples of observed species are shown in Figure 5-29 and Figure 5-30. Five of these species (63 percent) were classified as Widespread (Appendix F).

Figure 5-29. Example of Multiflora Rose Growing Amongst Other Invasive Plants in the Garden Beds at Oxford Park (5/31/2025).

Figure 5-30. Example of Tree-of-Heaven Near Spicket River Greenway Trail Entrance to Oxford Park (5/31/2025).

5.1.2 Documentation and Mapping

Maps delineating approximate boundaries of the dominant mapped invasive plant species are provided in Appendix E.

5.2 Canal Vegetation Surveys

Pursuant to the approved study plan, terrestrial vegetation along the Project's canal system was identified and documented for the North and South Canals. Biologists mapped terrestrial likely invasive and potentially invasive vegetation in and around the canal walls on foot. Biologists identified species and categorized species using vegetation polygons, vegetation lines, and vegetation points. Any identified species were characterized by dominant species within the survey area and additional notes were collected for non-dominant species within a vegetation polygon and vegetation polyline. Vegetation points were used to characterize small groupings of single-stemmed or multi-stemmed clumps of the same species.

The North Canal was surveyed in spring 2024 and fall 2025. Biologists identified 35 species of invasive or potentially invasive vegetation within the North Canal. The South Canal was surveyed in early summer 2024 and spring 2025. Biologists identified 18 species growing in and along the South Canal wall. Identified species in the North Canal are presented in Table 5-3 and identified species in the South Canal are presented in Table 5-4 below.

Table 5-3. Invasive Species Observations in the North Canal.

Species Identified		Date Observed	
Common Name	**Scientific Name**	**Fall 2024**	**Spring 2025**
Norway Maple	*Acer plantoidies*	-	**X**
Tree-of-heaven	*Ailanthus altissima*	X	X
Common mugwort	*Artemisia vulgaris*	X	X
Common wintercress	*Barbarea vulgaris*	-	X
Hoary alyssum	*Berteroa incana*	-	X
Narrowleaf bittercress	*Cardamine impatiens L*	-	X
Oriental bittersweet	*Celastrus orbiculatus*	X	X
Spotted knapweed	*Centaurea stoebe*	-	X
Japanese knotweed	*Fallopia japonica (Houtt.) Dcne.*	X	X
Glossy buckthorn	*Frangula alnus*	-	X
St. Johns-wort	*Hypericum perforatum*	-	X
Yellow flag Iris	*Iris pseudacorus L.*	X	-
Yellow toadflax	*Linaria vulgaris*	-	X
Morrow's honeysuckle	*Lonicera morrowii A.Gray*	-	X
Purple loosestrife	*Lythrum salicaria L.*	X	X
Crabapple	*Malus spp.*	-	X
Japanese creeper	*Parthenocissus tricuspidata*	-	X
Virginia creeper	*Parthenocissus quinquefolia*	-	X
Reed canary grass	*Phalaris arundinacea L.*	X	X
Phragmites	*Phragmites australis (Cav.)*	-	X
Silver cinquefoil	*Potentilla argentea*	-	X
Spring cinquefoil	*Potentilla neumanniana*	-	X
Bradford pear	*Pyrus calleryana*	-	X
Buckthorn	*Rhamnus cathartica L.*	X	X
Black locust	*Robinia pseudoacacia L.*	X	X
Multiflora rose	*Rosa multiflora*	X	X

Species Identified		Date Observed	
Common Name	Scientific Name	Fall 2024	Spring 2025
Cutleaf blackberry	*Rubus laciniatus*	-	X
Sheep sorrel	*Rumex acetosella*	-	X
Bladder campion	*Silene vulgaris*	-	X
Early goldenrod	*Solidago juncea*	-	X
Bittersweet nightshade	*Solanum dulcamara*	-	X
Bouncing bet	*Saponaria officinalis*	-	X
Poison ivy	*Toxicodendron radicans*	-	X
Yellow salsify	*Trapopogon dubius*	-	X
Black swallow-wort	*Vincetoxicum nigrum*	-	X

Table 5-4. Invasive Species Observations in the South Canal.

Species Identified		Date Observed	
Common Name	Scientific Name	Fall 2024	Spring 2025
Yarrow	*Achillea Millefolium*	-	X
Tree-of-heaven	*Ailanthus altissima*	-	X
Common ragweed	*Ambrosia artemisiifolia*	-	X
Mugwort	*Artemisia vulgaris*	X	X
Oriental bittersweet	*Celastrus orbiculatus*	X	X
Spotted knapweed	*Centaurea stoebe DC.*	X	X
Japanese knotweed	*Fallopia japonica (Houtt.) Dcne.*	-	X
Alder buckthorn / Glossy buckthorn	*Frangula alnus*	-	X
Purple loosestrife	*Lythrum salicaria L.*	X	X
Mulberry	*Morus spp.*	-	X
Multiflora rose	*Rosa multiflora*	X	-
Boston ivy	*Parthenocissus tricuspidata*	-	X
Black locust	*Robinia pseudoacacia L.*	X	X

Species Identified		Date Observed	
Common Name	Scientific Name	Fall 2024	Spring 2025
Bittersweet nightshade	*Solanum dulcamara*	-	X
Giant goldenrod / Late goldenrod	*Solidago gigantea*	-	X
Meadow-rue	*Thalictrum spp*	-	X
American elm	*Ulmus americana*	-	X
Black swallow-wort	*Vincetoxicum nigrum*	-	X

5.2.1 North Canal

Essex mapped areas within the North Canal system that it owns or manages where invasive vegetation may pose a potential concern. The methods used for this study followed those outlined in the approved study plan issued by the Commission. The North Canal was surveyed on October 30, 2024, and May 20, 2025.

The North Canal is approximately 5,300 feet long, 95 feet wide, and 15 feet deep, lined by a concrete wall, and encompasses an area of approximately 11.55 acres. Any observed invasive vegetation was mapped using vegetation polygons, vegetation polylines, and vegetation points.

Vegetation polygons were used to document large, dense patches of invasive vegetation along the concrete canal wall. A total of 68 vegetation polygons were identified and mapped, representing 21 invasive species. Vegetation polygons along the North Canal wall totaled 1.066 acres, accounting for 9.22 percent of the North Canal survey area. An inventory of vegetation polygons identified in the North Canal is presented in Table G-1 in Appendix G. Maps corresponding to each vegetation polygon referenced in Table G-1 are provided in Appendix G, and representative photographs are included in Appendix H.

Vegetation polylines were collected on October 10, 2024, and May 20, 2025, to document long, narrow stretches of clumped invasive vegetation. Biologists mapped these polylines on foot along the North Canal wall. A total of 16 vegetation polylines were recorded along the North Canal, representing 14 invasive species. A complete vegetation polyline inventory for North Canal species, along with additional field notes, is presented in Table G-2 in Appendix G. Maps corresponding to each vegetation polyline referenced in Table G-2 are provided in Appendix G, and representative photographs are included in Appendix H.

In addition to vegetation polygons and polylines, vegetation points were used to identify small single-stem or clumped multi-stem invasive species along the North Canal wall. Vegetation points were collected on October 10, 2024, and May 20, 2025. A total of 278 vegetation points were documented during the multi-season survey, consisting primarily of oriental bittersweet, tree-of-heaven, Japanese knotweed, and black locust. The complete vegetation point inventory is presented in Table G-3 in Appendix G. Maps corresponding to each vegetation point referenced in Table G-3 are provided in Appendix G, and representative photographs are included in Appendix H.

5.2.2 South Canal

Essex mapped areas within the South Canal system that it owns or manages where invasive vegetation may pose a potential concern. The methods used for this study followed those outlined in the approved study plan issued by the Commission. The South Canal was surveyed on June 27 - 28, 2024, and May 19- 20, 2025.

The South Canal originates at the south abutment of Essex Dam, adjacent to the entrance of the intake canal. The canal is approximately 35 feet wide and 10 feet deep, extending parallel to the Merrimack River for roughly 2,750 feet (FERC 1978), encompassing an area of approximately 2.21 acres. Flows within the South Canal are regulated by the South Canal Gatehouse located near the canal entrance.

Vegetation polygons were used to document large, dense patches of invasive vegetation along the concrete canal wall. A total of 45 vegetation polygons were identified and mapped, representing eight invasive species. The dominant species included spotted knapweed, black locust, Japanese knotweed, and oriental bittersweet. Vegetation polygons along the South Canal wall totaled 0.197 acres, representing 8.91 percent of the South Canal survey area. An inventory of vegetation polygons and associated field observations for the South Canal is presented in Table I-1 in Appendix I. Maps corresponding to each vegetation polygon referenced in Table I-1 are provided in Appendix I, and representative photographs are included in Appendix H.

A complete vegetation polyline inventory for species identified within the South Canal, along with additional field observations, is provided in Table I-2. Maps corresponding to each polyline referenced in Table I-2 are included in Appendix I, and representative photographs are provided in Appendix H.

In addition to vegetation polygons and vegetation polylines, vegetation points were used to identify small single-stem or clumped multi-stem invasive species along the South Canal wall. Vegetation points were collected during two field efforts: June 27–28, 2024, and May 19–20, 2025. A total of 462 vegetation points were documented during the multi-season survey, consisting primarily of black locust, oriental bittersweet, tree-of-heaven, and spotted knapweed. The complete vegetation point inventory and associated field observations are presented in Table I-3. Maps showing each identified point referenced in Table I-3 are provided in Appendix I, and representative photographs are included in Appendix H.

5.3 Freshwater Mussel Habitat Assessment and Survey

A total of 11 terrestrial invasive species were identified throughout the Project (Table 5-5) as part of the Freshwater Mussel Habitat Assessment and Survey. The most common of these were black locust (13 locations), purple loosestrife (11 locations), and Japanese knotweed (8 locations). Black locust was widespread, but rarely dominant along the bank above the ordinary high water mark. Purple loosestrife was present in low densities along the shoreline, typically at the ordinary high water mark. In contrast, several observations of Japanese knotweed consisted of dense monoculture colonies running landward along the bank from the ordinary high water mark. Other species identified during the study were: oriental bittersweet (7 locations), glossy buckthorn (4 locations), common buckthorn (4 locations), honeysuckle (2 locations), multiflora rose (1 location), reed canary-grass (1 location), Japanese barberry (1 location), and tree-of-heaven (1 location).

The majority of the aquatic vegetation observed was native; only one invasive (or potentially invasive) species of aquatic vegetation was observed at the study locations: curly pondweed

(*Potamogeton crispus,* Invasive), which was located at site T3/Q20-24. This site is located directly downstream of the north abutment of the Union Street Bridge, i.e., downstream of the Project Dam and outside of the Project boundary. The bridge abutment may shelter the curly pondweed population from scour that occurs elsewhere in this riverine section of the Project.

Three additional aquatic invasive species were observed incidentally away from transects at the mouth of a backwater: water caltrop (*Trapa natans*), brittle naiad (*Najas minor*), and variable water-milfoil (*Myriophyllum heterophyllum*). A GPS point was collected to identify this location. These three species are associated with slow moving water and the adjacent backwater is likely the source of this population.

In addition to the invasive species, 9 native aquatic species were observed while conducting the survey. The most common of these were tapegrass (*Vallisinera americana*, 21 locations) and free-flowered waterweed (*Elodea nutallii,* 13 locations). Other native species observed included ribbon-leaved pondweed (*Potamogeton epihydrus,* 7 locations), coontail (*Ceratophyllum demersum,* 6 locations), multiple species of naiad (*Najas gracillima* and *guadalupensis,* 4 locations), a water moss (*Fontanalis* sp., 1 location), and perfoliate pondweed (*Potamogeton perfoliatus,* 1 location).

Maps of survey locations and results are provided in Appendix J, and representative photographs of invasive species are provided in Appendix K.

Table 5-5. Native and Invasive Plant Species Observed at the Freshwater Mussel Survey Locations (Scientific name—Common Name).

Location (Appendix J)	Native Aquatic Species	Invasive Aquatic Species	Riverbank Invasive Species
T1	*Vallisneria americana* — American eelgrass (wild celery)	--	*Lythrum salicaria* — Purple loosestrife
T2	--	--	*Reynoutria japonica* — Japanese knotweed *Celatrus orbiculatus* — Oriental bittersweet
T3/Q20-24	*Potamogeton epihydrus* — Ribbonleaf pondweed *Vallisneria americana* — American eelgrass (wild celery)	*Potamogeton crispus* — Curly-leaf pondweed	*Lythrum salicaria* — Purple loosestrife *Robinia pseudoacacia* — Black locust
T4	*Ceratophyllyum demersum* — Coontail	--	*Lythrum salicaria* — Purple loosestrife *Phalaris arundinacea* — Reed canary grass *Robinia pseudoacacia* — Black locust
T5/Q3/Q4	*Vallisneria americana* — American eelgrass (wild celery)	--	
T6	*Vallisneria americana* — American eelgrass (wild celery) *Ceratophyllum demersum* — Coontail	--	*Robinia pseudoacacia* — Black locust

Location (Appendix J)	Native Aquatic Species	Invasive Aquatic Species	Riverbank Invasive Species
T7/Q1	*Vallisneria americana* — American eelgrass (wild celery), *Nymphea odorata* — American white waterlily *Elodea nuttallii* — Nuttall's waterweed	--	*Berberis thunbergii* — Japanese barberry *Celastrus orbiculatus* — Oriental bittersweet *Robinia pseudoacacia* — Black locust *Reynoutria japonica* — Japanese knotweed *Lonicera cf. morrowii* — Morrow's honeysuckle
T8	*Elodea nuttallii* — Nuttall's waterweed *Najas guadelupensis* — Guppy grass *Vallisneria americana* — American eelgrass (wild celery)	--	*Robinia pseudoacacia* — Black locust
T9	*Ceratophyllum demersum* — Coontail	--	*Robinia pseudoacacia* — Black locust
T10	*Najas cf. guadelupensis* — Guppy grass (cf.)	--	*Rhamnus cathartica* — Common buckthorn
T11	--	--	*Reynoutria japonica* — Japanese knotweed, *Rhamnus cathartica* — Common buckthorn, *Lonicera cf. morrow* — Morrow's honeysuckle *Celastrus orbiculatus* — Oriental bittersweet
T12	*Elodea nuttallii* — Nuttall's waterweed	--	*Rhamnus cathartica* — Common buckthorn
T13	--	--	*Frangula alnus* — Glossy buckthorn *Celastrus orbiculatus* — Oriental bittersweet
T14	*Ceratophyllum demersum* — Coontail *Vallisneria americana* — American eelgrass (wild celery) *Elodea nuttalli* — Nuttall's waterweed	--	
T15	*Fontinalis sp* — water moss (unknown) *Elodea nuttallii* — Nuttall's waterweed, *Ceratophyllum demersum* — Coontail	--	*Robinia pseudoacacia* — Black locust

Location (Appendix J)	Native Aquatic Species	Invasive Aquatic Species	Riverbank Invasive Species
T16	*Potamogeton perfoliatus* — Perfoliate pondweed, *Elodea nuttallii* — Nuttall's waterweed, *Potamogeton epihydrus* — Ribbonleaf pondweed, *Vallisneria americana* — American eelgrass (wild celery)	--	*Reynoutria japonica* — Japanese knotweed *Lythrum salicaria* — Purple loosestrife
T17	*Vallisneria americana* — American eelgrass (wild celery) *Elodea nuttallii* — Nuttall's waterweed *Najas cf. gracillima* — Slender naiad (cf.)	--	*Celastrus orbiculatus* — Oriental bittersweet *Rosa multiflora* — Multiflora rose
T18	--	--	*Robinia pseudoacacia* — Black locust
T19	*Potamogeton epihydrus* — Ribbonleaf pondweed *Vallisneria americana* — American eelgrass (wild celery)	--	*Lythrum salicaria* — Purple loosestrife *Robinia pseudoacacia* — Black locust *Celastrus orbiculatus* — Oriental bittersweet
T20	--	--	*Robinia pseudoacacia* — Black locust
T21	--	--	*Reynoutria japonica* — Japanese knotweed *Celatrus orbiculatus* — Oriental bittersweet *Rhamnus cathartica* — Common buckthorn
T22	--	--	--
T23	--	--	--
T24	--	--	*Frangula alnus* — Glossy buckthorn
T25	*Vallisneria americana* — American eelgrass (wild celery)	--	*Frangula alnus* — Glossy buckthorn
T26	*Vallisneria americana* — American eelgrass (wild celery) *Ceratophyllum demersum* — Coontail *Elodea nuttallii* — Nuttall's waterweed	--	*Robinia pseudoacacia* — Black locust

Location (Appendix J)	Native Aquatic Species	Invasive Aquatic Species	Riverbank Invasive Species
T27	*Elodea nuttallii* — Nuttall's waterweed	--	*Frangula alnus* — Glossy buckthorn *Lythrum salicaria* — Purple loosestrife
T28	*Vallisneria americana* — American eelgrass (wild celery) *Elodea nuttallii* — Nuttall's waterweed	--	*Robinia pseudoacacia* — Black locust
T29	*Vallisneria americana* — American eelgrass (wild celery)	--	*Lythrum salicaria* — Purple loosestrife
T30	*Vallisneria americana* — American eelgrass (wild celery)	--	--
T31	*Vallisneria americana* — American eelgrass (wild celery)	--	*Robinia pseudoacacia* — Black locust *Reynoutria japonica* — Japanese knotweed *Lythrum salicaria* — Purple loosestrife
Q2/Q31-33	*Potamogeton epihydrus* — Ribbonleaf pondweed *Elodea nuttallii* — Nuttall's waterweed *Vallisneria americana* — American eelgrass (wild celery)	--	*Reynoutria japonica* — Japanese knotweed
Q5-9	*Vallisneria americana* — American eelgrass (wild celery) *Potamogeton epihydrus* — Ribbonleaf pondweed *Najas guadalupensis* — Common Waternymph	--	*Lythrum salicaria* — Purple loosestrife
Q10-14	*Vallisneria americana* — American eelgrass (wild celery) *Potamogeton epihydrus* — Ribbonleaf pondweed	--	*Lythrum salicaria* — Purple loosestrife *Ailanthus altissima* — Tree-of-heaven
Q15-19	*Vallisneria americana* — American eelgrass (wild celery) *Elodea nuttallii* — Nuttall's waterweed	--	*Lythrum salicaria* — Purple loosestrife
Q25-30	*Vallisneria americana* — American eelgrass (wild celery)	--	--

Location (Appendix J)	Native Aquatic Species	Invasive Aquatic Species	Riverbank Invasive Species
Q34-36	*Elodea nuttallii* — Nuttall's waterweed *Potamogeton epihydrus* — Ribbonleaf pondweed	--	--
Q37-39	*Elodea nuttallii* — Nuttall's waterweed *Vallisneria americana* — American eelgrass (wild celery) *Ceratophyllum demersum* — Coontail	--	*Reynoutria japonica* — Japanese knotweed

6 Discussion

The comprehensive existing information provided in the PAD, the MIPAG annotated species lists, as well as the extensive multi-season field efforts documented in this report (including recreation area surveys, canal vegetation mapping, and freshwater mussel assessment surveys), consistently demonstrate that invasive plant species are deeply entrenched and widespread throughout the City of Lawrence. Surveys conducted across 2024 and 2025 confirmed the presence of numerous terrestrial invasive species (e.g., Japanese knotweed, tree-of-heaven, Oriental bittersweet, multiflora rose, glossy buckthorn, common buckthorn, reed canary-grass, Phragmites, black swallow-wort, Japanese barberry), along with several aquatic invasive species (e.g., variable-leaved milfoil, curly-leaf pondweed, water caltrop, brittle naiad). These species occur across nearly every surveyed habitat type, including uplands, riverbanks, canal walls, landscaped parks, and disturbed urban corridors, which illustrates the pervasive and persistent nature of invasive plants species.

The majority of the invasive, likely invasive, and potentially invasive plants found during the study match those included in the MIPAG list. Collectively, these observations reflect a larger, well-documented regional pattern established by the MIPAG: urban environments across Massachusetts and the eastern United States universally suffer from invasive plant overgrowth. In the City of Lawrence, like other large cities, fragmented land ownership, vacant properties, roadways, rail and utility corridors, and historically disturbed soils create ideal conditions for invasive plant establishment. Once present, these species spread rapidly and aggressively, aided by prolific seed production, vegetative fragmentation, and the movement of soil, equipment, vehicles, and foot traffic between sites. For example, improper handling and disposal of invasive vegetation during maintenance activities from site to site increases the risk of spreading viable seeds and plant fragments between recreation areas. Past and present land use activities in and around the study area have contributed, and will continue to contribute, to the degraded, weedy habitats that occur there today. The patterns observed in Lawrence mirror the behaviors described by MIPAG for the species it tracks across the state.

The North and South Canals are the only structures surveyed that are within Essex's ownership. For Project and public safety reasons, Essex actively maintains the North and South Canals through

routine cutting, mowing, and removal of invasive vegetation. Biologists observed new plant growth on several occasions in areas where cutting and mowing had occurred. Despite these efforts, the proximity of the canals to adjacent lands not managed for invasive species results in frequent reintroduction and reestablishment of previously controlled populations. During field assessments, biologists observed that the invasive species present within the canal system were also widespread in neighboring unmanaged areas and throughout the study area. The SPD requested an "assessment of any data gaps in the Project-specific invasive plant species." There are no "Project-specific species" identified as part of this study and therefore no data gaps—all species identified as part of this study were widespread and pervasive beyond the Project and have no nexus to the Project.

The majority of the locations and sites surveyed as part of this study (e.g. the Recreation Field Inventory Assessment and the Recreation Visitor Use Surveys) are outside of the Project Boundary and are not owned or managed by Essex. Essex does not have any control over invasive plant management strategies employed by other parties throughout the City of Lawrence. This level of distribution underscores the reinvasion pressure on the study area and highlights the need for coordinated multi-property management not associated with Project operations.

7 Variances from FERC-Approved Study Plan

The Invasive Plant Survey was performed in accordance with the SPD, with the following variance:

- In their May 10, 2024 SPD, FERC requested that Essex report the occurrence of all invasive plant species while conducting field sampling conducted as part of the Freshwater Mussel Habitat Assessment and Survey. Although invasive plant data was not collected during the 2024 Mussel Study, Essex revisited the survey locations in 2025 that had been previously established during the Freshwater Mussel Habitat Assessment and Survey. This approach was discussed at the ISR Meetings in May 2025. FERC did not opine on this approach in their August 25, 2025 Study Determination given that it was not a formally requested modification. In their June 26, 2025 comment letter, MassWildlife noted they would support a variance in timing, allowing Essex to collect the required data during the 2025 season, provided the scope and locations remain consistent with those outlined in the approved Study Plan. The scope and locations remained consistent with those from the Freshwater Mussel Habitat Assessment and Survey.

8 References

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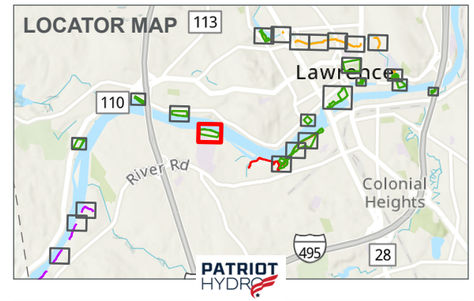
Appendix A

Invasive Plant Species Study Area Maps

LAWRENCE HYDROELECTRIC PROJECT
FERC NO. 2800
INVASIVE PLANT SPECIES SURVEY
APPROXIMATE INVASIVE SPECIES SURVEY AREA

STRAZZULA RESERVATION

Invasive Species Survey Area



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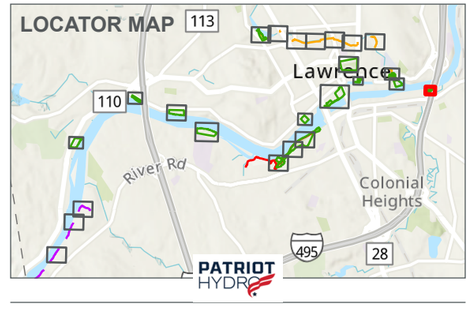
LAWRENCE HYDROELECTRIC PROJECT
FERC NO. 2800
INVASIVE PLANT SPECIES SURVEY
APPROXIMATE INVASIVE SPECIES SURVEY AREA

SEWER INTERCEPTOR

Invasive Species Survey Area



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LAWRENCE HYDROELECTRIC PROJECT
FERC NO. 2800
INVASIVE PLANT SPECIES SURVEY
APPROXIMATE INVASIVE SPECIES SURVEY AREA

RAYMOND J. MARTIN RIVERSIDE PARK

Invasive Species Survey Area

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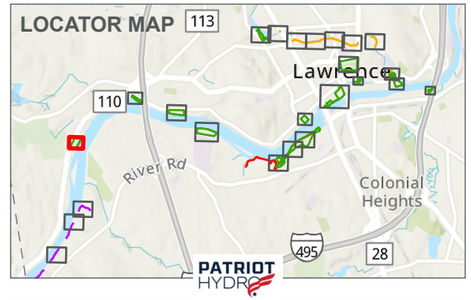
LAWRENCE HYDROELECTRIC PROJECT
FERC NO. 2800
INVASIVE PLANT SPECIES SURVEY
APPROXIMATE INVASIVE SPECIES SURVEY AREA

PHILLIPS ACADEMY BOAT HOUSE

Invasive Species Survey Area



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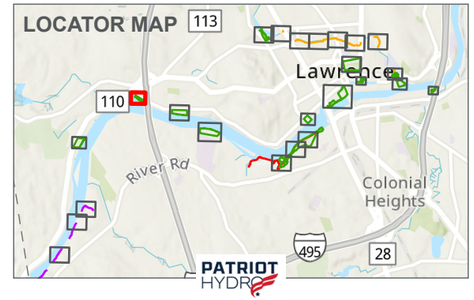
LAWRENCE HYDROELECTRIC PROJECT
FERC NO. 2800
INVASIVE PLANT SPECIES SURVEY
APPROXIMATE INVASIVE SPECIES SURVEY AREA

METHUEN BOAT RAMP

Invasive Species Survey Area



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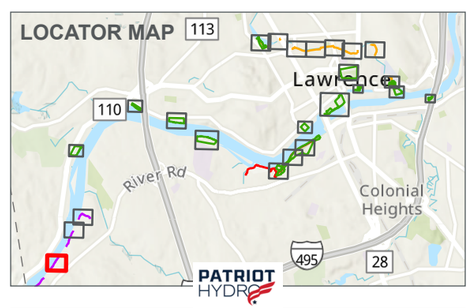
LAWRENCE HYDROELECTRIC PROJECT
FERC NO. 2800
INVASIVE PLANT SPECIES SURVEY
APPROXIMATE INVASIVE SPECIES SURVEY AREA

BAY CIRCUIT TRAIL

Invasive Species Survey Area

Trail

Bay Circuit Trail



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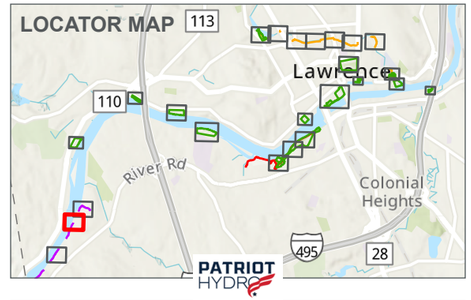
LAWRENCE HYDROELECTRIC PROJECT
FERC NO. 2800
INVASIVE PLANT SPECIES SURVEY
APPROXIMATE INVASIVE SPECIES SURVEY AREA

BAY CIRCUIT TRAIL

Invasive Species Survey Area

Trail

Bay Circuit Trail



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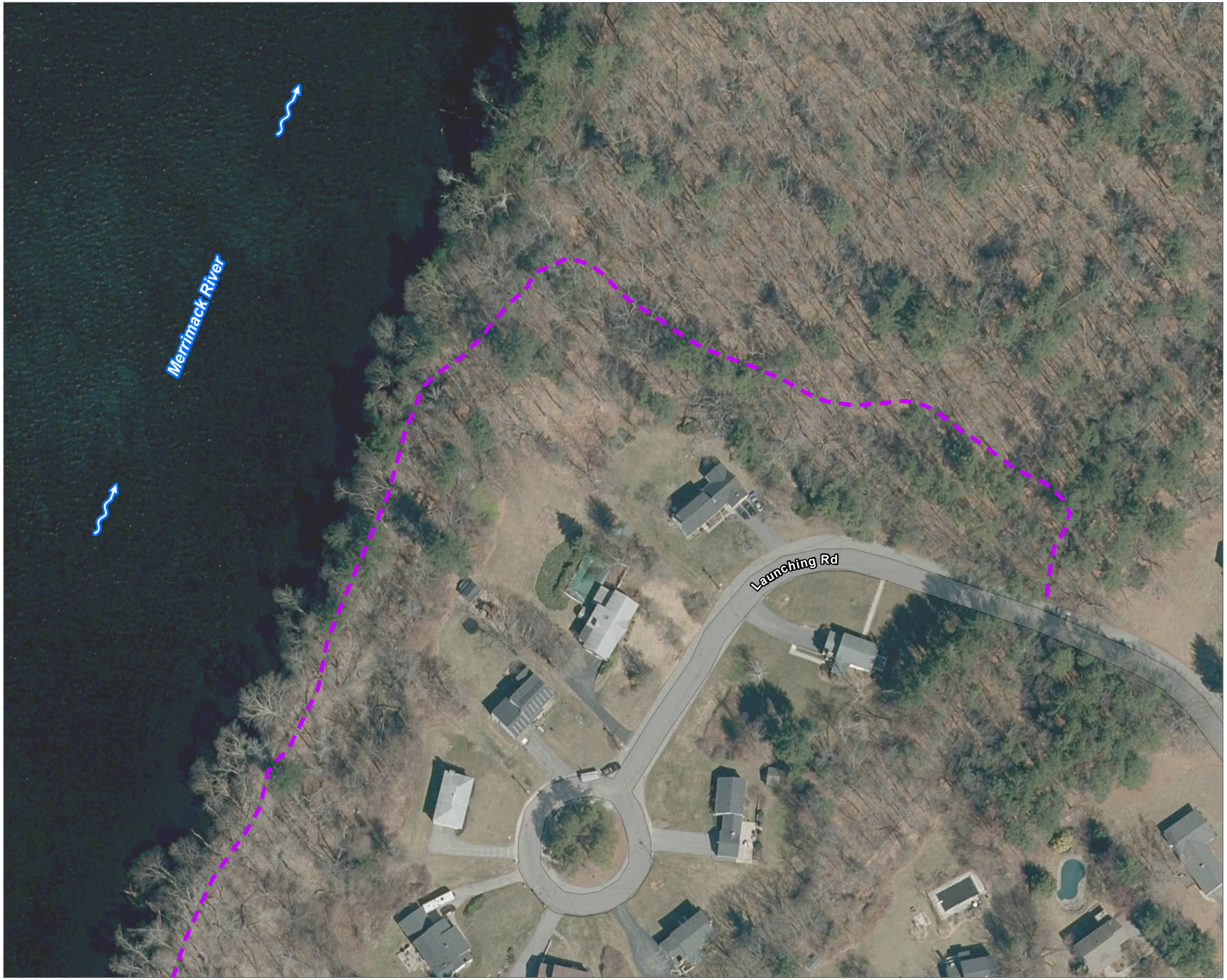
LAWRENCE HYDROELECTRIC PROJECT
FERC NO. 2800
INVASIVE PLANT SPECIES SURVEY
APPROXIMATE INVASIVE SPECIES SURVEY AREA

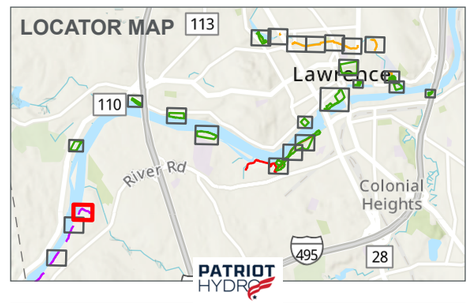
BAY CIRCUIT TRAIL



Invasive Species Survey Area

Trail

Bay Circuit Trail



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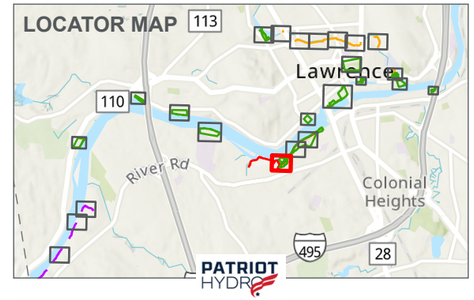
LAWRENCE HYDROELECTRIC PROJECT
FERC NO. 2800
INVASIVE PLANT SPECIES SURVEY
APPROXIMATE INVASIVE SPECIES SURVEY AREA

ABE BASHARA BOATHOUSE & LAWRENCE RIVERFRONT STATE PARK
PAGE 1 OF 3

Invasive Species Survey Area

Trail

Merrimack River Trail



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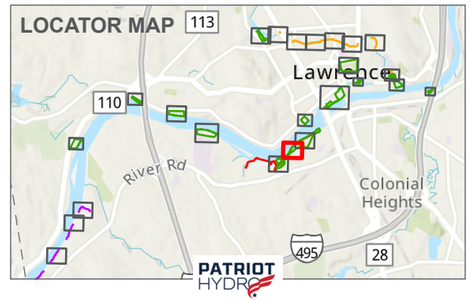
LAWRENCE HYDROELECTRIC PROJECT
FERC NO. 2800
INVASIVE PLANT SPECIES SURVEY
APPROXIMATE INVASIVE SPECIES SURVEY AREA

LAWRENCE RIVERFRONT STATE PARK

Invasive Species Survey Area

Trail

Merrimack River Trail



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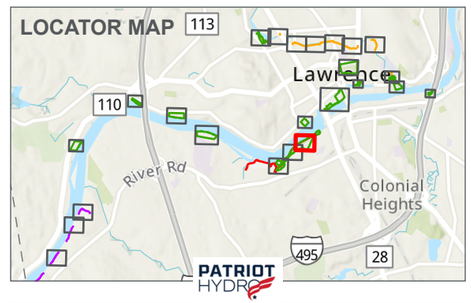
LAWRENCE HYDROELECTRIC PROJECT
FERC NO. 2800
INVASIVE PLANT SPECIES SURVEY
APPROXIMATE INVASIVE SPECIES SURVEY AREA

LAWRENCE RIVERFRONT STATE PARK

Invasive Species Survey Area

Trail

Merrimack River Trail



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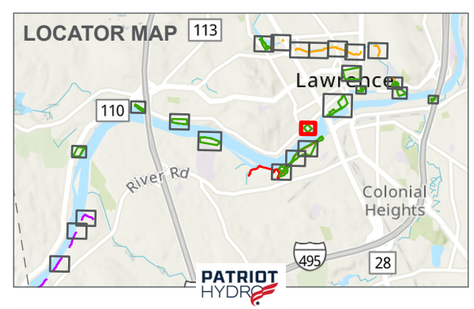
LAWRENCE HYDROELECTRIC PROJECT
FERC NO. 2800
INVASIVE PLANT SPECIES SURVEY
APPROXIMATE INVASIVE SPECIES SURVEY AREA

BOYS AND GIRLS CLUB

Invasive Species Survey Area



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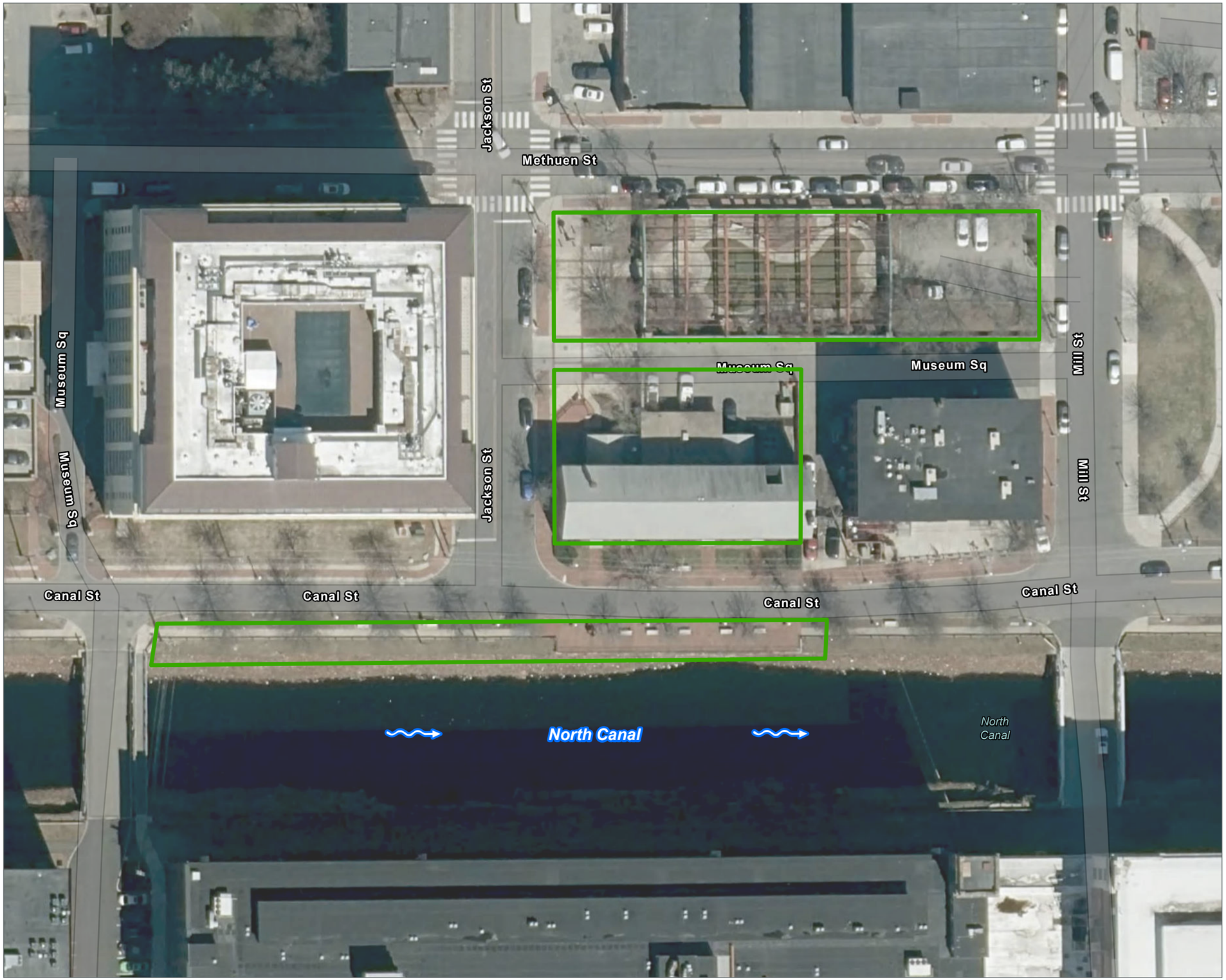
LAWRENCE HYDROELECTRIC PROJECT
FERC NO. 2800
INVASIVE PLANT SPECIES SURVEY
APPROXIMATE INVASIVE SPECIES SURVEY AREA

LAWRENCE HERTIAGE STATE PARK & CANAL ACCESS



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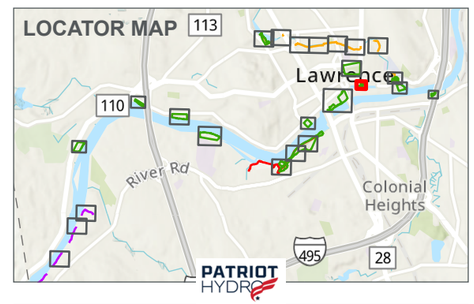

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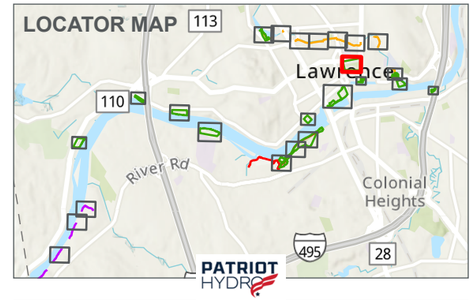
LAWRENCE HYDROELECTRIC PROJECT
FERC NO. 2800
INVASIVE PLANT SPECIES SURVEY
APPROXIMATE INVASIVE SPECIES SURVEY AREA

CAMPAGNONE COMMON

Invasive Species Survey Area



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LAWRENCE HYDROELECTRIC PROJECT
FERC NO. 2800
INVASIVE PLANT SPECIES SURVEY
APPROXIMATE INVASIVE SPECIES SURVEY AREA

PEMBERTON STATE PARK

Invasive Species Survey Area

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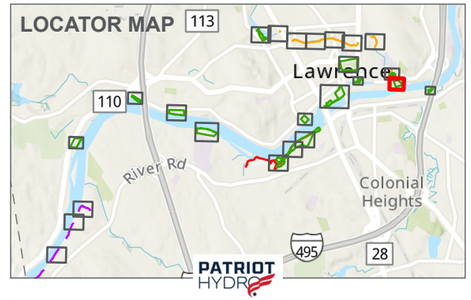
LAWRENCE HYDROELECTRIC PROJECT
FERC NO. 2800
INVASIVE PLANT SPECIES SURVEY
APPROXIMATE INVASIVE SPECIES SURVEY AREA

NUNZIO DIMARCA PARK

Invasive Species Survey Area

Trail

Spicket River Greenway



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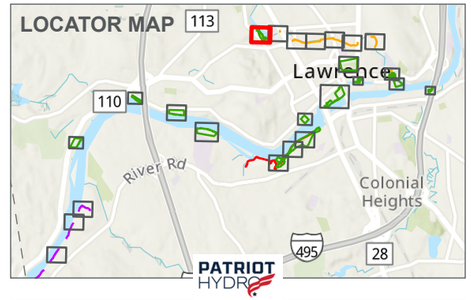
LAWRENCE HYDROELECTRIC PROJECT
FERC NO. 2800
INVASIVE PLANT SPECIES SURVEY
APPROXIMATE INVASIVE SPECIES SURVEY AREA

SPICKET RIVER GREENWAY-
MACHESTER STREET PARK
PAGE 1 OF 7

Invasive Species Survey Area

Trail

Spicket River Greenway



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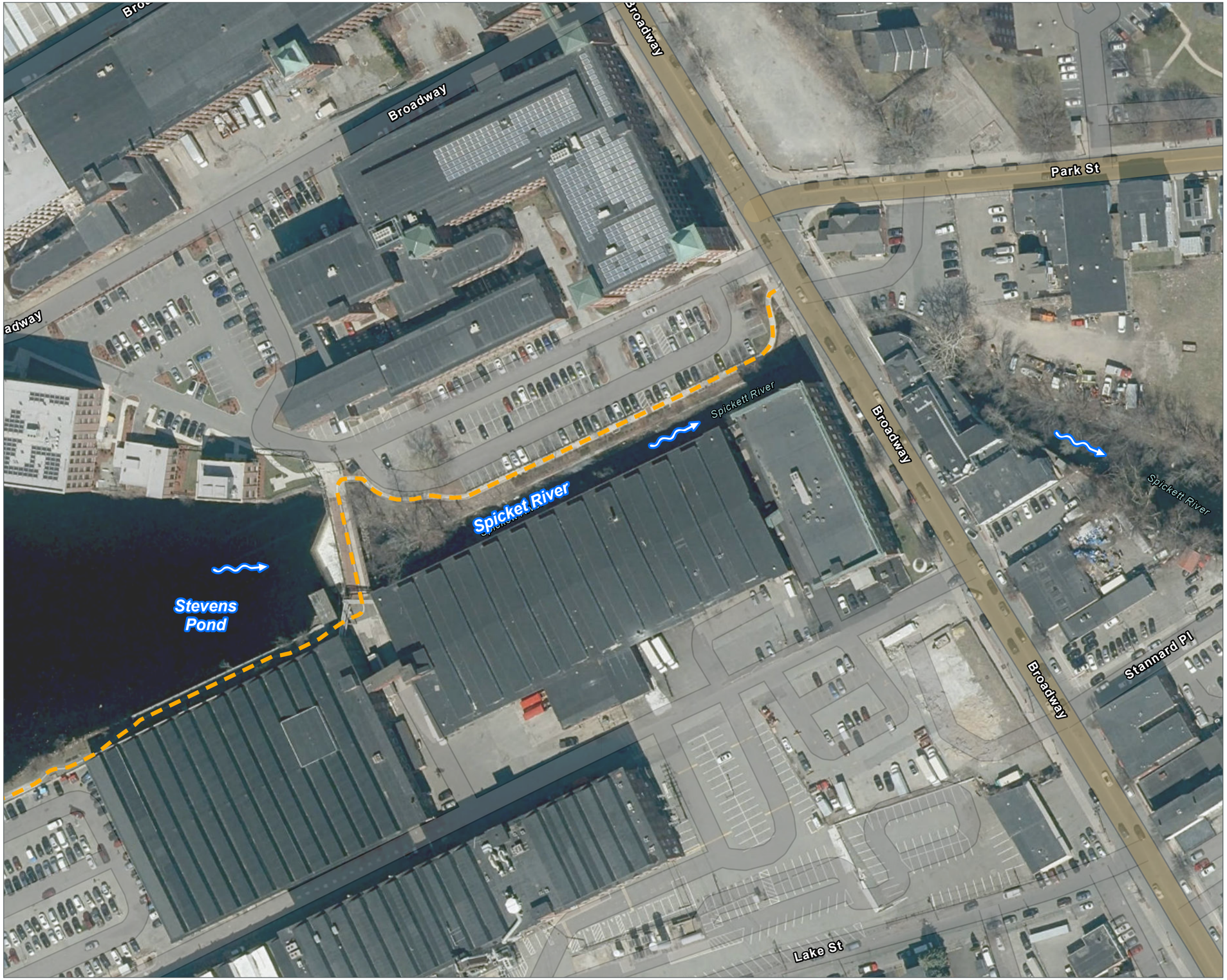
LAWRENCE HYDROELECTRIC PROJECT
FERC NO. 2800
INVASIVE PLANT SPECIES SURVEY
APPROXIMATE INVASIVE SPECIES SURVEY AREA

SPICKET RIVER GREENWAY-
MACHESTER STREET PARK
PAGE 2 OF 7

Invasive Species Survey Area

Trail

Spicket River Greenway



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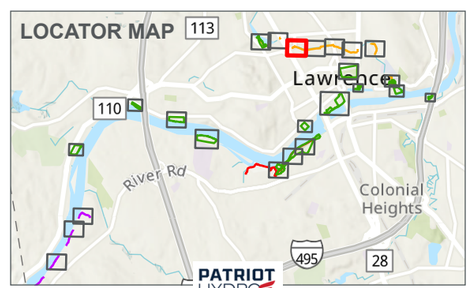
LAWRENCE HYDROELECTRIC PROJECT
FERC NO. 2800
INVASIVE PLANT SPECIES SURVEY
APPROXIMATE INVASIVE SPECIES SURVEY AREA

SPICKET RIVER GREENWAY-
MACHESTER STREET PARK
PAGE 3 OF 7

Invasive Species Survey Area

Trail

Spicket River Greenway



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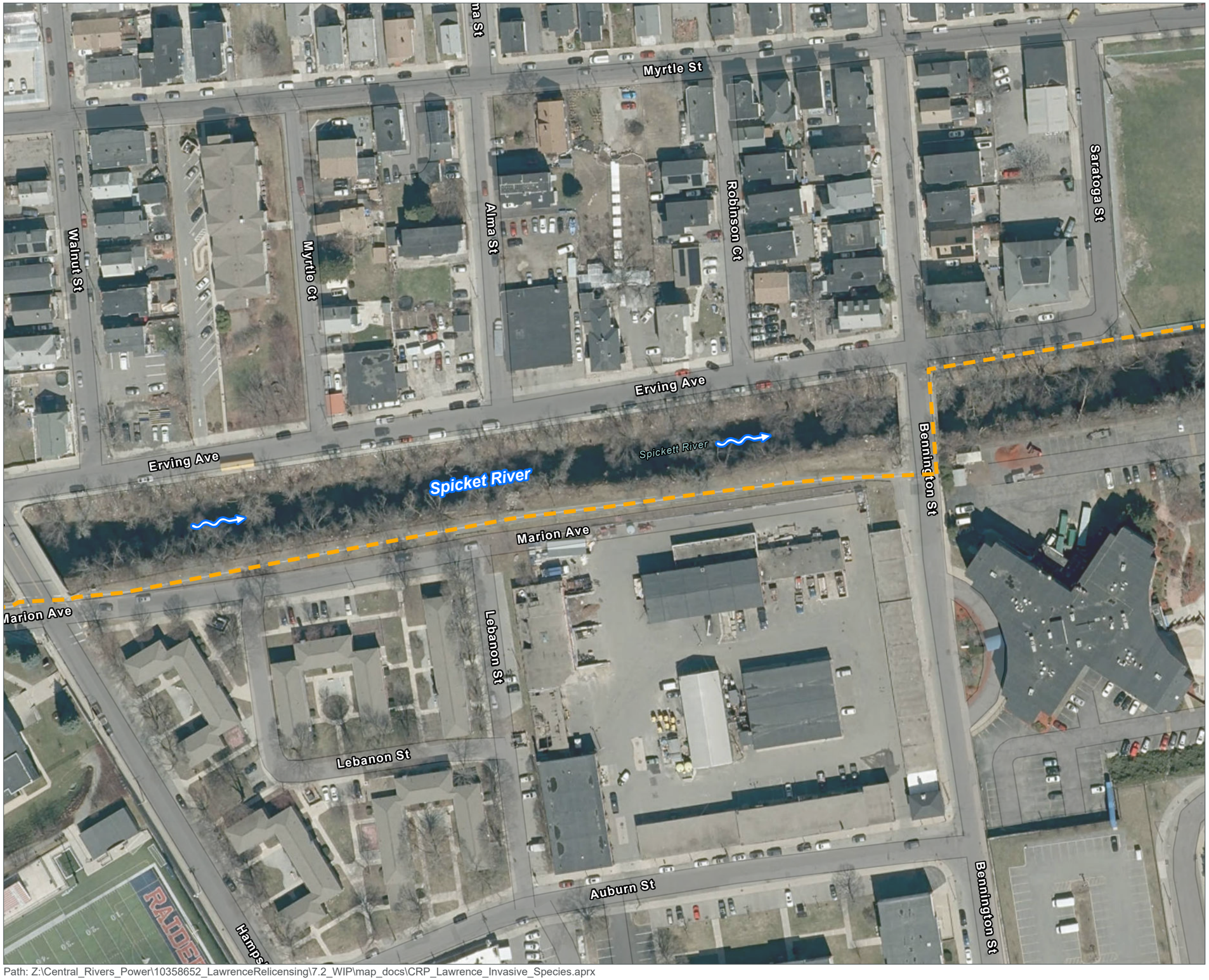
LAWRENCE HYDROELECTRIC PROJECT
FERC NO. 2800
INVASIVE PLANT SPECIES SURVEY
APPROXIMATE INVASIVE SPECIES SURVEY AREA

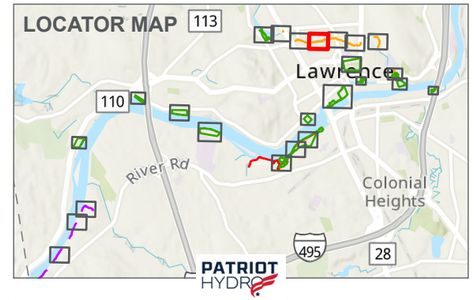
SPICKET RIVER GREENWAY-
MACHESTER STREET PARK
PAGE 4 OF 7



Invasive Species Survey Area

Trail

Spicket River Greenway



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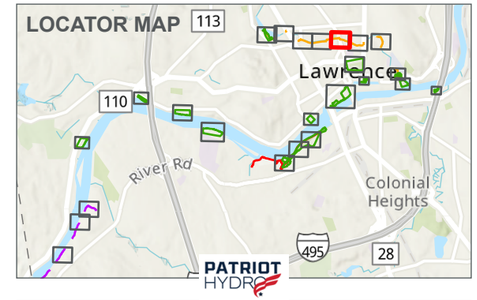
LAWRENCE HYDROELECTRIC PROJECT
FERC NO. 2800
INVASIVE PLANT SPECIES SURVEY
APPROXIMATE INVASIVE SPECIES SURVEY AREA

SPICKET RIVER GREENWAY-
MACHESTER STREET PARK
PAGE 5 OF 7

Invasive Species Survey Area

Trail

Spicket River Greenway



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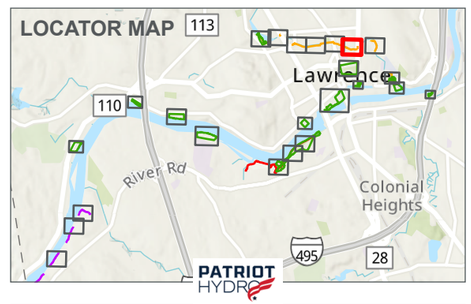
LAWRENCE HYDROELECTRIC PROJECT
FERC NO. 2800
INVASIVE PLANT SPECIES SURVEY
APPROXIMATE INVASIVE SPECIES SURVEY AREA

SPICKET RIVER GREENWAY-
MACHESTER STREET PARK
PAGE 6 OF 7

Invasive Species Survey Area

Trail

Spicket River Greenway



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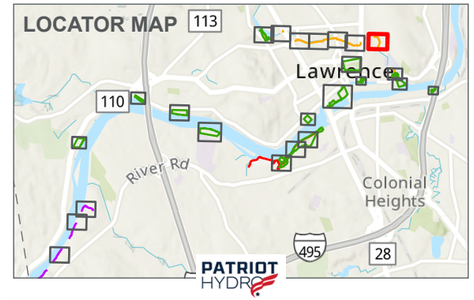
LAWRENCE HYDROELECTRIC PROJECT
FERC NO. 2800
INVASIVE PLANT SPECIES SURVEY
APPROXIMATE INVASIVE SPECIES SURVEY AREA

SPICKET RIVER GREENWAY-
MACHESTER STREET PARK
PAGE 7 OF 7

Invasive Species Survey Area

Trail

Spicket River Greenway



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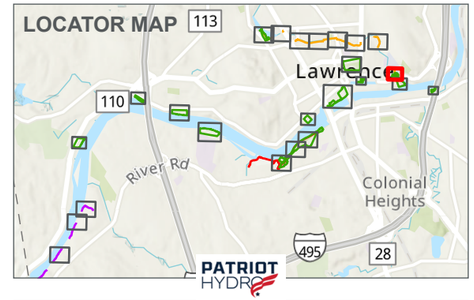
LAWRENCE HYDROELECTRIC PROJECT
FERC NO. 2800
INVASIVE PLANT SPECIES SURVEY
APPROXIMATE INVASIVE SPECIES SURVEY AREA

OXFORD PARK

Invasive Species Survey Area

Trail

Spicket River Greenway



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Appendix B

MIPAG Annotated Plant Species List

Massachusetts Invasive Plants Advisory Group

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Annotated Species Lists:

- **Invasive (39)**
- **Likely Invasive (37)**
- **Potentially Invasive (3)**
- **Not Currently Meeting Criteria (19)**

Criteria:

- **Updated** (2022)
- **Original** (2005)

Species Reviewed:

- **Listed Alphabetically**
- **Listed by Category**

Know a species that should be considered for evaluation? Fill out **this form** or **email** the Evaluation Subcommittee

Plants voted as: INVASIVE

"Invasive" plants are non-native species that have spread into native or minimally managed plant systems in Massachusetts. These plants cause economic or environmental harm by developing self-sustaining populations and becoming dominant and/or disruptive to those systems. As defined here, "species" includes all synonyms, subspecies, varieties, forms, and cultivars of that species unless proven otherwise by a process of scientific evaluation.

Acer platanoides L. **(Norway maple)**
A tree occurring in all regions of the state in upland and wetland habitats, and especially common in woodlands with colluvial soils. It grows in full sun to full shade. Escapes from cultivation; can form dense stands; out-competes native vegetation, including sugar maple; dispersed by water, wind and vehicles.

Acer pseudoplatanus L. **(Sycamore maple)**
A tree occurring mostly in southeastern counties of Massachusetts, primarily in woodlands and especially near the coast. It grows in full sun to partial shade. Escapes from cultivation inland as well as along the coast; salt-spray tolerant; dispersed by wind, water and vehicles.

Aegopodium podagraria L. **(Bishop's goutweed; bishop's weed; goutweed)**
A perennial herb occurring in all regions of the state in uplands and wetlands. Grows in full sun to full shade. Escapes from cultivation; spreads aggressively by roots; forms dense colonies in flood plains.

Ailanthus altissima (P. Miller) Swingle **(Tree-of-heaven)**
This tree occurs in all regions of the state in upland, wetland, & coastal habitats. Grows in full sun to full shade. Spreads aggressively from root suckers, especially in disturbed areas.

Alliaria petiolata (Bieb.) Cavara & Grande **(Garlic mustard)**
Synonym: *Alliaria officinalis* Andrz. Ex Bieb.
A biennial herb occuring in all regions of the state in uplands. Grows in full sun to full shade. Spreads aggressively by seed, especially in wooded areas.

Alnus glutinosa (L.) Gaertner **(Black alder, European alder)**
A rapidly growing tree, native to Europe and portions of northern Africa and Asia, that has been widely planted for ornamental purposes and for erosion control. Black alder is primarily a riparian species that forms large stands and readily disperses via waterways, wildlife and wind. It may hybridize with other alder species.

Aralia elata (Miq.) Seem. **(Japanese angelica tree)**
A conspicuous single- or multi-stemmed spiny tree, 20 to 40 feet tall, with large pinnate leaves and massive many-flowered inflorescences. It can grow in a range of soil types, but prefers moist, well-drained soil, and sun to partial shade. It produces small purple to black berries and also suckers from its base and spreads vegetatively. (Reviewed 2025)

Berberis thunbergii DC. **(Japanese barberry)**
A shrub occuring open and wooded uplands and wetlands in all regions of the state. Grows in full sun to full shade. Escaping from cultivation; spread by birds; forms dense stands.

Cabomba caroliniana A.Gray **(Carolina fanwort; fanwort)**
A perennial herb occuring in all regions of the state in aquatic habitats. Common in the aquarium trade; chokes waterways.

Celastrus orbiculatus Thunb. **(Oriental bittersweet; Asian or Asiatic bittersweet)**

A perennial vine occuring in all regions of the state in uplands. Grows in full sun to partial shade. Escaping from cultivation; berries spread by birds and humans; overwhelms and kills vegetation.

Cynanchum louiseae Kartesz & Gandhi **(Black swallow-wort, Louise's swallow-wort)**
Synonyms: *Cynanchum nigrum* (L.) Pers. non Cav.; *Vincetoxicum nigrum* (L.) Moench
A perennial vine occurring in all regions of the state in upland, wetland, and coastal habitats. Grows in full sun to partial shade. Forms dense stands, out-competing native species: deadly to Monarch butterflies.

Elaeagnus umbellata Thunb. **(Autumn olive)**
A shrub occurring in uplands in all regions of the state. Grows in full sun. Escaping from cultivation; berries spread by birds; aggressive in open areas; has the ability to change soil.

Eragrostis curvula (Schrad.) Nees **(Weeping lovegrass)**
A perennial warm season bunchgrass that occurs on road edges, agricultural grasslands, sandplain grassland, and coastal heathland areas, mainly in coastal and island counties. In globally rare early successional habitats, this grass has demonstrated the ability to expand rapidly. (Reviewed 2021)

Euonymus alatus (Thunb.) Sieb. (**Winged euonymus; Burning bush)**
A shrub occurring in all regions of the state and capable of germinating prolifically in many different habitats. It grows in full sun to full shade. Escaping from cultivation and can form dense thickets and dominate the understory; seeds are dispersed by birds.

Euphorbia esula L. **(Leafy spurge; wolf's milk)**
A perennial herb occurring in all regions of the state in grasslands and coastal habitats. Grows in full sun. An aggressive herbaceous perennial and a notable problem in western USA.

Fallopia japonica (Houtt.) Dcne. **(Japanese knotweed; Japanese or Mexican Bamboo)**
Synonym: *Polygonum cuspidatum* Sieb. & Zucc.; *Reynoutria japonica* Houtt.
A perennial herbaceous subshrub or shrub occurring in all regions of the state in upland, wetland, and coastal habitats. Grows in full sun to full shade, but hardier in full sun. Spreads vegetatively and by seed; forms dense thickets.

Ficaria verna Huds. **(Lesser celandine; fig buttercup)**
Synonyms: *Ranunculus ficaria* L.
A perennial herb occurring on stream banks, and in lowland and uplands woods in all regions of the state. Grows in full sun to full shade. Propagates vegetatively and by seed; forms dense stands especially in riparian woodlands; an ephemeral that outcompetes native spring wildflowers.

Frangula alnus P. Mill. **(European buckthorn; glossy buckthorn)**
Synonyms: *Rhamnus frangula* L.; *R. frangula* var. *angustifolia* Loud.
Shrub or tree occurring in all regions of the state in upland, wetland, and coastal habitats. Grows in full sun to full shade. Produces fruit throughout the growing season; grows in multiple habitats; forms thickets.

Glaucium flavum Crantz **(Sea or horned poppy; yellow hornpoppy)**
A biennial and perennial herb occurring in southeastern MA in coastal habitats. Grows in full sun. Seeds float; spreads along rocky beaches; primarily Cape Cod and Islands.

Hesperis matronalis L. **(Dame's rocket)**
A biennial and perennial herb occurring in all regions of the state in upland and wetland habitats. Grows in full sun to full shade. Spreads by seed; can form dense stands, particularly in flood plains.

Iris pseudacorus L. **(Yellow iris)**
A perennial herb occurring in all regions of the state in wetland habitats, primarily in flood plains. Grows in full sun to partial shade. Out-competes native plant communities.

Lepidium latifolium L. **(Broad-leaved pepperweed; tall pepperweed)**
A perennial herb occurring in eastern and southeastern regions of the state in coastal habitats. Grows in full sun. Primarily coastal at upper edge of wetlands; also found in disturbed areas; salt tolerant.

Lonicera japonica Thunb. **(Japanese honeysuckle)**
A perennial vine occurring in all regions of the state in upland, wetland, and coastal habitats. Grows in full sun to full shade. Rapidly growing, dense stands climb and overwhelm native vegetation; produces many seeds that are bird dispersed; more common in southeastern Massachusetts.

Lonicera morrowii A.Gray **(Morrow's honeysuckle)**A shrub occurring in all regions of the state in upland, wetland, and coastal habitats. Grows in full sun to full shade. Part of a confusing hybrid complex of nonnative honeysuckles commonly planted and escaping from cultivation via bird dispersal.

Lonicera x bella Zabel [*morrowii* x *tatarica*] **(Bell's honeysuckle)**
This shrub occurs in all regions of the state in upland, wetland, and coastal habitats. Grows in full sun to full shade. Part of a confusing hybrid complex of nonnative honeysuckles commonly planted and escaping from cultivation via bird dispersal.

Lysimachia nummularia L. **(Creeping jenny; moneywort)**
A perennial herb occurring in all regions of the state in upland and wetland habitats. Grows in full sun to full shade. Escaping from cultivation; problematic in flood plains, forests and wetlands; forms dense mats.

Lythrum salicaria L. **(Purple loosestrife)**
A perennial herb or subshrub occurring in all regions of the state in upland and wetland habitats. Grows in full sun to partial shade. Escaping from cultivation; overtakes wetlands; high seed production and longevity.

Miscanthus sinensis Anderss. **(Chinese silvergrass; Eulalia)**
A tall ornamental bunch grass with showy flower and seed heads and a silver vein that goes down the middle of each leaf blade. It can be found in variety of habitats from full sun to part shade and does particularly well on road, habitat edges, and in grasslands in coastal and island counties. It grows in dense bunches and is rhizomatous as well as seed-dispersing. Originally categorized as "Do not list at this time" due to the need for more data from minimally managed habitats. (Reviewed 2024/2025)

Myriophyllum heterophyllum Michx. **(Variable water-milfoil; Two-leaved water-milfoil)**
A perennial herb occurring in all regions of the state in aquatic habitats. Chokes waterways, spread by humans and possibly birds.

Myriophyllum spicatum L. **(Eurasian or European water-milfoil; spike water-milfoil)**
A perennial herb found in all regions of the state in aquatic habitats. Chokes waterways, spread by humans and possibly birds.

Phalaris arundinacea L. **(Reed canary-grass)**
This perennial grass occurs in all regions of the state in wetlands and open uplands. Grows in full sun to partial shade. Can form huge colonies and overwhelm wetlands; flourishes in disturbed areas; native and introduced strains; common in agricultural settings and in forage crops.

Phragmites australis (Cav.) Trin. ex Steud. subsp. **australis (Common reed)**

A perennial grass (USDA lists as subshrub, shrub) found in all regions of the state. Grows in upland and wetland habitats in full sun to full shade. Overwhelms wetlands forming huge, dense stands; flourishes in disturbed areas; native and introduced strains.

Polygonum perfoliatum L. **(Mile-a-minute vine or weed; Asiatic tearthumb)**
Synonyms: *Persicaria perfoliata* (L.) H. Gross; *Ampelygonum perfoliatum* (L.) Roberty & Vautier
This annual herbaceous vine is currently known to exist in several counties in MA, and has also has been found in RI and CT. Habitats include streamside, fields, and road edges in full sun to partial shade. Highly aggressive; bird and human dispersed.

Potamogeton crispus L. **(Crisped pondweed; curly pondweed)**
A perennial herb occurring in all regions of the state in aquatic habitats. Forms dense mats in the spring and persists vegetatively.

Rhamnus cathartica L. **(Common buckthorn)**
A shrub or tree occurring in all regions of the state in upland and wetland habitats. Grows in full sun to full shade. Produces fruit in fall; grows in multiple habitats; forms dense thickets.

Robinia pseudoacacia L. **(Black locust)**
A tree that occurs in all regions of the state in upland habitats. Grows in full sun to full shade. While the species is native to central portions of Eastern North America, it is not indigenous to Massachusetts. It has been planted throughout the state since the 1700's and is now widely naturalized. It behaves as an invasive species in areas with sandy soils.

Rosa multiflora Thunb. **(Multiflora rose)**
A perennial vine or shrub occurring in all regions of the state in upland, wetland and coastal habitats. Grows in full sun to full shade. Forms impenetrable thorny thickets that can overwhelm other vegetation; bird dispersed.

Salix atrocinerea/Salix cinerea L. **(Large Gray Willow/Rusty Willow)**
A large shrub or small tree most commonly found in the eastern and southeastern areas of the state, with new occurrences being reported further west. Primarily found on pond shores but is also known from other wetland types and rarely uplands. *Salix atrocinerea* L. / *Salix cinerea* L. are either recognized as closely related species or the conspecific subspecies *Salix cinerea* ssp. *oleifolia* and *S. cinerea* ssp. *cinerea*. Forms dense stands and can out-compete native species along the shores of coastal plain ponds. (Reviewed 2014)

Trapa natans L. **(Water-chestnut)**
An annual herb occurring in the western, central, and eastern regions of the state in aquatic habitats. Forms dense floating mats on water.

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Plants voted as: LIKELY INVASIVE

"Likely Invasive plants" are non-native species that are naturalized in Massachusetts but do not meet the full criteria that would trigger an "Invasive plant" designation. As defined here, "species" includes all synonyms, subspecies, varieties, forms, and cultivars of that species unless proven otherwise by a process of scientific evaluation.

Actinidia arguta (Sieb. & Zucc.) Planch. Ex Miq. **(Hardy kiwi, Tara vine)**
A fast-growing woody vine that may climb to 30 feet or more on trees. Grows in sun or shade. Used in permaculture. Where it escapes it can aggressively climb trees and smother them, while also producing new seedlings. (Reviewed 2015)

Ampelopsis brevipedunculata (Maxim.) Trautv. **(Porcelain-berry; Amur peppervine)**
A woody vine found primarily in southeastern counties of Massachusetts but known from some western counties as well. Occurs in upland woodland edges and thickets and grows in full sun topartial shade. Escapes from cultivation and is bird dispersed.

Anthriscus sylvestris (L.) Hoffmann **(Wild chervil)**
Synonym: *Chaerophyllum sylvestre* L.
A biennial or short-lived perennial herb with a few reported sites in minimally managed habitats scattered across the state. It occurs in old fields, wetlands, roadsides and proliferates in floodplain soils. Grows in full sun to partial shade. It has a very long taproot and is reported to be spreading in Vermont and Connecticut.

Berberis vulgaris L. **(Common barberry; European barberry)**
A shrub occurring in all regions of the state, primarily in uplands. It grows in full sun to full shade. The potential of this plant to spread is high; once common but widely eradicated because it is an alternate host for wheat rust; it hybridizes with Japanese barberry.

Butomus umbellatus L. **(Flowering rush)**
An herbaceous perennial. Can occur on inundated shorelines and in shallow water, river and lakeshores, mudflats, and floodplain forests. (Reviewed 2008)

Cardamine impatiens L. **(Bushy rock-cress; narrowleaf bittercress)**
A winter annual or biennial herb found in western Massachusetts occurring in rich woods, rocky ledges, roadsides, and stream banks. It grows in full sun to full shade. Disperses seeds easily and is spreading rapidly in other parts of New England.

Centaurea stoebe DC. **(Spotted knapweed)**
Synonym: *Centaurea biebersteinii, C. maculosa*
A biennial or perennial herb occurring in all regions of the state in upland and coastal habitats. Grows in full sun. Aggressively grows in well-drained, disturbed soils; serious problem in western states where it out-competes native grassland species, literature reports are currently lacking for this in the northeast.

Cynanchum rossicum (Kleopov) Borhidi **(European swallow-wort; pale swallow-wort)**
Synonym: *Vincetoxicum rossicum* (Kleopov) Barbarich
A perennial herb occurring in the western region of the state in upland habitats. Grows in full sun to partial shade. Forms dense stands; found primarily in the lower Connecticut River Valley.

Cytisus scoparius (L.) Link **(Scotch broom)**
A shrub that occurs along roadsides, coastal sites, disturbed sites, pastures, and dry scrubland. Its nitrogen fixing ability allows it to compete successfully on nutrient-

poor, dry, sandy soils. It is seen as an ecological threat to native grasslands of Massachusetts as well as the globally rare sandplain grasslands of the coast and islands. (Reviewed 2021)

Egeria densa Planchon **(Brazilian waterweed; Brazilian elodea)**
Synonyms: *Anacharis densa* (Planch.) Victorin; *Elodea densa* (Planch.) Caspary
A perennial herb occurring in the eastern and southeastern regions of the state in aquatic habitats. Common in the aquarium trade; chokes waterways; currently only found in a few MA ponds.

Epilobium hirsutum L. **(Hairy willow-herb; Codlins and cream)**
A perennial herb occurring in all regions of the state in wetlands. Grows in full sun. Seeds dispersed by wind and water; evidence currently lacking that this species out- competes other vegetation in minimally managed habitats.

Euphorbia cyparissias L. **(Cypress spurge)**
A perennial herb occurring in all regions of the state in upland habitats. Grows in full sun. Persists in open areas; evidence currently lacking that this species out-competes other vegetation in minimally managed habitats.

Festuca filiformis Pourret **(Hair fescue; fineleaf sheep fescue)**
A perennial grass occurring in all regions of the state, in grasslands and open woodlands. Grows in full sun to partial shade. Common in minimally managed grassland habitats; more data needed on its ability to outcompete native species.

Glyceria maxima (Hartman) Holmburg **(Tall mannagrass; reed mannagrass)**
A perennial grass currently known from one marsh in Essex County. Grows in full sun to partial shade. Spreads vegetatively and produces viable seeds; forms dense stands.

Heracleum mantegazzianum Sommier & Levier **(Giant hogweed)**
A perennial herb occurring in scattered sites across all regions of the state; thrives in multiple habitats. Grows in full sun to full shade. Escapes from cultivation; seeds can be dispersed by water; can cause severe skin reactions.

Humulus japonicus Sieb. & Zucc. **(Japanese hops)**
An annual herbaceous vine with current records in western MA, but historical records from all regions of the state. Grows in floodplain forests and riverbanks in full sun to partial shade. Escapes from cultivation; capable of prolific growth.

Hydrilla verticillata (L.f.) Royle **(Hydrilla; water-thyme; Florida elodea)**
A perennial aquatic herb occurring in the southeastern region of the state. Only found in one MA pond currently (2004); easily dispersed by birds and humans; chokes entire water bodies.

Ligustrum obtusifolium Sieb. & Zucc. **(Border privet)**
A shrub occurring in all regions of the state in woodlands and woodland edges. Grows in full sun to full shade. Widespread and shade tolerant, bird dispersed; more data needed on density and distribution; flowers are needed to identify species.

Lonicera tatarica L. **(Tatarian honeysuckle)**
A shrub found from Boston westward in thickets, woods, and edges of woods. Can grow in full sun to full shade. Commonly confused with other non-native honeysuckles; crosses with Morrow's honeysuckle *(L. morrowii)* to produce the invasive hybrid Belle's honeysuckle *(L.* x*bella)*.

Microstegium vimineum (Trin.) A. Camus **(Japanese stilt grass; Nepalese browntop)**
An annual grass occurring in the western region of the state in upland and wetland habitats. Grows in full sun to full shade. Forms dense stands; currently localized in the lower Connecticut River Valley; spreads in flood plains.

Miscanthus sacchariflorus (Maxim.) Franch. **(Plume grass; Amur silvergrass)**
This perennial grass is currently known to occur in central MA in wetland margins and roadsides. Grows in full sun. Spreads by rhizomes and develops dense stands along roadsides and adjacent native habitats.

Mycelis muralis (L.) Dumort **(Wall Lettuce)**
An annual or biennial herbaceous plant with purple-tinged branched stems 2-3 feet tall. It tolerates full shade as well as a wide range of soil conditions and habitats, from woods to stream valleys, and has demonstrated the ability to spread rapidly. (Reviewed 2022)

Myosotis scorpioides L. **(Forget-me-not)**
A perennial herb occurring in all regions of the state in wetlands. Grows in full sun to full shade. Escaping from cultivation; prolific in open wooded streams, stream-banks and wet meadows; evidence about its persistence is needed.

Myriophyllum aquaticum (Vell.) Verdc. **(Parrot-feather; water-feather; Brazilian watermilfoil)**
Synonym: *Myriophyllum brasiliense* Camb.
A perennial herbaceous aquatic occurring in southeastern MA along a shallow pond edge.
Grows in full sun to partial shade. Reproduces from fragments; commonly used in the water garden trade.

Najas minor All. **(Brittle water-nymph; lesser naiad)**
An annual herb occurring in the western region of the state in aquatic habitats. Chokes waterways; spread by humans and possibly birds; currently found only in Berkshire County (2002).

Nymphoides peltata (Gmel.) Kuntze **(Yellow floating heart)**
This aquatic perennial occurs in ponds in central MA. Grows in full sun to partial shade. Can create a dense floating mat on ponds and can reproduce from fragments.

Phellodendron amurense Rupr. (sensu lato) **(Amur cork-tree)**
Synonyms: *Phellodendron japonicum* Maxim.; *Phellodendron amurense* var. japonicum (Maxim.) Ohwi; *Phellodendron sachalinense* (F. Schmidt) Sarg.; *Phellodendron amurense* var. sachalinense F. Schmidt; *Phellodendron lavallei* Dode; *Phellodendron amurense* var. lavallei (Dode) Sprague
This tree occurs in uplands of eastern to central MA. Grows in full sun to full shade. A bird dispersed species that has escaped cultivation.

Pinus thunbergii Parl. **(Japanese black pine)**
A small evergreen tree that can reach heights of about 6-9 m tall and about 6-11 m wide in cultivation. It occurs in coastal sites, disturbed sites, sand dunes, and dry scrubland. It is seen as an ecological threat to native grasslands and dune systems, including the globally rare sandplain grasslands of coastal Massachusetts and the islands. (Reviewed 2021)

Pueraria montana (Lour.) Merrill **(Kudzu; Japanese arrowroot)**
Synonym: *Pueraria montana* var. *lobata* (Willd.) Maesen & S. Almeida
A perennial herbaceous vine found in southeastern MA. Occurs at Arnold Arboretum; uplands. Grows in full sun to partial shade. Present in MA and subject to control; marginally hardy in MA but has the potential to invade minimally-managed areas based on its performance elsewhere.

Pyrus calleryana Decne. **(Callery Pear; Bradford Pear)**
A small, deciduous tree native to eastern Asia. Many cultivars have been developed, including Bradford Pear. Callery Pear will grow in a variety of different habitat conditions. When mown, it forms dense stands, completely shading the

ground beneath it, preventing the growth of herbaceous species and smaller shrubs. (Reviewed 2022)

Ranunculus repens L. **(Creeping buttercup)**
A perennial herb occurring in wetlands in all regions of the state. Grows in full sun to full shade. Common around springs and wetlands; evidence currently lacking that this species out-competes other vegetation in minimally managed habitats.

Rhodotypos scandens (Thunb.) Makino **(Jetbead; Jetberry bush; White Kerria; Black Jetbead)**
A perennial deciduous shrub with multiple stems and showy white four-petaled flowers. Fruits grow in clusters of 1-4 and appear red before maturing into shiny, black, bead-like fruits. It can be found in full sun to forest understories, tolerates a wide range of soils, and can spread both by seed and vegetatively through layering. (Reviewed 2024/2025)

Rorippa amphibia (L.) Bess. **(Water yellowcress; great yellowcress)**
Synonyms: *Nasturtium amphibium* (L.) Ait. f.; *Sisymbrium amphibium* L.
A perennial herb occurring in central MA. Grows in wetlands in full sun to partial shade. Common and increasing in central MA river drainages; a major threat to riparian habitats forming dense stands at some locations.

Rubus phoenicolasius Maxim. **(Wineberry; Japanese wineberry; wine raspberry)**
A shrub found in uplands of southern MA. Can grow in full sun to partial shade. Animal and human dispersed; forms thickets.

Senecio jacobaea L. **(Tansy ragwort; stinking Willie)**
A biennial herb occurring in a few sites east of the Connecticut River; habitat is open uplands. Grows in sun or partial shade. This species is highly invasive in the Canadian Maritimes; may also spread from disturbed areas.

Symplocos paniculata (Thunb.) Miq.. **(sapphire berry, Asiatic sweetleaf)**
A perennial deciduous shrub or small tree, up to 10 feet tall, with leaves with deeply ridged veins, numerous inconspicuous white flowers, and shiny pea-sized blue berries. It grows in a variety of conditions, and can become dominant in the understory of undisturbed forests. (Reviewed 2025)

Tussilago farfara L. **(Coltsfoot)**
A perennial herb occurring in all regions of the state in upland and wetland habitats. Grows in full sun to full shade. Particularly problematic in lime seeps and disturbed sites; evidence currently lacking that this species out-competes other vegetation in minimally managed habitats.

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Criteria:

- **Updated** (2022)
- **Original** (2005)

Species Reviewed:

- **Listed Alphabetically**
- **Listed by Category**

Know a species that should be considered for evaluation? Fill out **this form** or **email** the Evaluation Subcommittee

Plants voted as: POTENTIALLY INVASIVE

"Potentially invasive plants" are non-native species not currently known to be naturalized in Massachusetts, but that can be expected to become invasive within minimally managed habitats within the Commonwealth. As defined here, "species" includes all synonyms, subspecies, varieties, forms, and cultivars of that species unless proven otherwise by a process of scientific evaluation.

Arthraxon hispidus (Thunb.) Makino (**Hairy joint grass; jointhead; small carpetgrass)**
An annual grass historically known from Franklin County but not currently known from the state. Habitats elsewhere include roadsides, shores, ditches, and low woods and fields. Grows in full to partial shade. Is problematic in Connecticut and southward.

Carex kobomugi Ohwi **(Japanese sedge; Asiatic sand sedge)**
A perennial sedge established mainly in sand dunes and growing in full sun. There is only one current New England location--in Rhode Island; it can spread rapidly in dune systems.

Lonicera maackii (Rupr.) Herder **(Amur honeysuckle)**
A shrub having specimens and reports from a number of MA counties, but verification of naturalization at these locations is needed. The likely habitats are woods and woodland edges. Can grow in full sun or shade. Escapes from cultivation, but documentation needed regarding naturalized populations in MA; recognized as invasive in the Midwest and portions of the southeastern USA.

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Know a species that should be considered for evaluation? Fill out **this form** or **email** the Evaluation Subcommittee

EVALUATED PLANTS NOT MEETING CRITERIA

(Do not list at this time)

The following plants were evaluated for invasiveness by the Massachusetts Invasive Plant Advisory Group. They did not meet the necessary criteria to list them as Invasive, Likely Invasive or Potentially Invasive at the time of evaluation.

Akebia quinata (Houtt.) Dcne. (**Five-leaved Akebia; chocolate vine)**
A woody vine that grows in full sun to full shade. Can form dense stands; evidence needed to evaluate its reproductive ability and potential for establishment away from cultivation.

Amorpha fruticosa L. (**Five-leaved False indigo-bush)**
A large shrub up to 13 ft tall. It is native to the U.S., but not the Northeast. In New England, Amorpha fruticosa is typically found along riverbanks, flood plains, tidal zones and other areas associated with water. It can occasionally be found in moist open woods. (Reviewed 2010)

Catalpa speciosa (Warder) Warder ex Engelm. (**Northern catalpa)**
A tree that grows in full sun to partial shade. Preliminary data suggest that this species could be invasive in floodplain forests; more data is needed on its ability to out compete native species.

Elaeagnus angustifolia L. (**Russian olive)**
A small tree or shrub that grows in full sun to full shade. Not currently known from minimally managed habitats in Massachusetts; invasive elsewhere in the United States; commonly confused with autumn olive (*Elaeagnus umbellata*).

Euonymus europaeus L. (**European spindletree)**
A small tree or shrub that grows in full sun to full shade. Not currently known from minimally managed habitats in Massachusetts; invasive elsewhere in the United States; commonly confused with autumn olive (*Elaeagnus umbellata*). (Reviewed 2015)

Euonymus fortunei (Turcz.) Hand.-Mazz. (**Wintercreeper, Climbing spindle-tree)**
Trailing or climbing vine that can form dense mats when on ground. Found in forest openings, edges and fields. (Reviewed 2015)

Festuca ovina L. (**Sheep fescue)**
A perennial grass that grows in full sun. More data needed on its ability to outcompete native species in minimally managed habitats.

Ligustrum ovalifolium Hassk. **(California privet)**
Shrub. Because of the difficulty in identifying privet species and the current lack of data, we have chosen not to rank most privets; further research is needed in identification and invasiveness.

Ligustrum sinense Lour. **(Chinese privet)**
A shrub that can tolerate full sun or shade. Because of the difficulty in identifying privet species and the current lack of data, we have chosen not to rank most privets; further research is needed on identification and invasiveness.

Ligustrum vulgare L. **(European privet)**
Shrub. Because of the difficulty in identifying privet species and the current lack of data, we have chosen not to rank most privets; further research is needed in identification and invasiveness.

Lonicera xylosteum L. **(Dwarf honeysuckle)**
Shrub. Reports of naturalized occurrences need verification in MA.

Morus alba L. **(White mulberry)**
A tree that grows in full sun to partial shade. Reports of naturalized occurrences and invasiveness need verification in MA.

Polygonum sachalinense F. Schmidt ex Maxim. **(Giant knotweed)**
Synonyms: *Fallopia sachalinensis* (F. Schmidt ex Maxim.) Dcne.;
Reynoutria sachalinensis (F. Schmidt ex Maxim.) Nakai
A perennial herb that grows in full sun. Data needed on occurrences in minimally managed areas in MA; highly invasive in the maritime provinces of Canada.

Populus alba L. **(White poplar)**
A tree that grows in full sun. Data needed on occurrences in minimally managed areas.

Rorippa microphylla (Boenn. ex Reichenb.) Hyland ex A. & D. Löve **(Watercress; onerow yellowcress)**
Synonym: *Nasturtium microphyllum* Boenn. Ex Reichenb. _
A perennial aquatic that grows in full sun to partial shade. There is difficulty in separating this species from *Rorippa nasturtium-aquaticum*; more data needed on its current status on the landscape and its impact on minimally managed habitats.

Rorippa nasturtium-aquaticum (L.) Hayek **(Watercress)**
Synonym: *Nasturtium officinale* Ait. f.
A perennial aquatic that grows in full sun to partial shade. There is difficulty in separating this species from *Rorippa microphylla*; more data needed on its current status on the landscape and its impact on minimally managed habitats.

Rosa rugosa Thunb. **(Japanese rose; rugosa rose)**
A shrub that grows in full sun. This is a widely planted urban & coastal plant; listing it as Invasive or Likely Invasive does not accurately reflect all the properties of this plant; there are no data at this time to suggest that this species is disruptive to native plant habitats in MA.

Sedum telephium L. ssp. telephium **(Live-forever; orpine; witch's moneybags)**
A perennial herb that can grow in full sun to shade. More data needed on taxonomy, nomenclature, and occurrences in minimally managed areas.

Verbascum thapsus L. **(Common mullein; flannel mullein; velvet plant)**
A biennial herb that grows in full sun. Although MIPAG does not feel this species meets the criteria for listing at this time, its occurrence in critical habitats (especially limestone cliff communities) is of concern; species has not been proven to have outcompeting qualities; more data needed on this species and the very similar *Verbascum phlomoides*, including taxonomy, persistence, and their impact on minimally managed habitats.

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Appendix C

Invasive Plant Survey Dates and Conditions During the Recreation Visitor Use Surveys

A component of the *Recreation Facilities, Use, and Aesthetics Study.*

Survey Day	Date	Conditions
1	May 15, 2025	Temperature was a high of 61°F with rain until ~11:00. Cloudy conditions remained for the afternoon.
2	May 18, 2025	Temperature was a high of 60°F with sunny skies. Light winds and cool breezes occurred off and on.
3	May 19, 2025	Temperature was a high of 55°F with partly cloudy skies. Strong winds were present for much of the survey day.
4	May 26, 2025	Temperature was a high of 80°F with sunny skies and light and variable winds. Sky was generally clear for much of the day.
5	May 31, 2025	Temperature was a high of 60°F. Rain for much of the morning with cloudy skies occurring in the early afternoon. Sunny with partly clouding conditions from 11:00 – 18: 00. Off and on cloud coverage and overcast conditions for the remainder of the day.
6	June 10, 2025	Temperature was a high of 56°F with a light drizzle starting in the morning. Overcast skies; no sun from 12:00 – 18:00. Off and on light drizzle near late afternoon.
7	June 11, 2025	Temperature was a high of 64°F with sunny conditions. Generally clear skies with light and variable winds. Morning was cool but became warmer in the afternoon reaching low to mid-70s°F
8	June 19, 2025	Temperature range was 71-84°F with overcast skies and patches of sun. Very humid and sticky morning with higher humid conditions occurring later in the afternoon to end the survey day.
9	June 21, 2025	Temperature was high of 73°F with sunny conditions and clear skies. Humidity was low, mostly drier conditions.
10	June 29, 2025	Temperature range was 65-85°F with cloudy and foggy conditions. No sun and very dense fog/humidity to start the morning. Sunny conditions between 12:00-18:00 with temperatures reaching the mid-80s°F by day's end.
11	July 4, 2025	Temperature range was 65-78°F with sunny conditions and a constant breeze throughout the day.
12	July 26, 2025	Temperature was a high of 82°F with clear skies. Sunny conditions for much of the day. High humidity with light and variable winds.
13	July 27, 2025	Temperature was a high of 73°F with cooler temperatures and low humidity. It was very cloudy and hazy morning with no sun. By approximately 9:25 clouds turning to rain which was present until approximately 14:00. There was a consistent light breeze during the survey day.
14	July 28, 2025	Temperature was a high of 92°F with hot and humid conditions. Clear skies and fully exposed sun with no wind.

Survey Day	Date	Conditions
15	July 29, 2025	Temperature range was 83-96°F with sunny, clear skies. High humidity with no breeze. “Feels like” temperature was 103°F at 15:30.
16	August 7, 2025	Temperature range was 70-80°F with mostly cloudy skies to start the morning. Sun arrived by approximately 10:00 with no wind.
17	August 12, 2025	Temperature range was 80-97°F with sunny skies. No cloud coverage with hot and humid conditions.
18	August 23, 2025	Temperature range was 68-89°F. Afternoon was partly cloudy after a cool morning to start. Light and variable winds during study day.
19	August 24, 2025	Temperature range was 67-82°F. Generally sunny for much of the day, partly cloudy by the afternoon.
20	September 9, 2025	Temperature range was 55-65°F with sunny skies, no winds.
21	September 10, 2025	Temperature range was 55-65°F with mostly cloudy skies, and no wind.
22	September 20, 2025	Temperature range was 52-72°F with sunny conditions. Some clouds and no wind, brisk morning temperatures turning to low 70s°F by afternoon.
23	September 21, 2025	Temperature range was 50-73°F with sunny clear skies and no wind.
24	September 30, 2025	Temperature range was 62-77°F on sunny, cool mornings. Overcast skies occurred later in the afternoon. By 16:00 temperatures reached 77°F.

Appendix D

Invasive Plant Species Observation Documentation Forms

Invasives Species Observation Docmentation Form

Project Name:
Lawrence Hydroelectric Project (FERC No. 2800)

Observer(s):

Date:

Weather and Conditions:

Recreation Location	Invasive Species	Density (1) 1-25%, (2) 26-50%, (3) 51-75%, (4) 76-100%	Notes
Lawrence HeritageState Park			
Merrimack Trail System			
Pemberton State Park			
Lawrence RiverfrontState Park			
Spicket River Greenway			
Nunzio DiMarca Park			

Invasives Species Observation Docmentation Form

Recreation Location	Invasive Species	Density (1) 1-25%, (2) 26-50%, (3) 51-75%, (4) 76-100%	Notes
Abe Bashara Boathouse			
Boys and Girls Club			
Campagnone (North)Common			
Oxford Park			

Appendix E

Dominant Invasive Plant Species Maps

LAWRENCE HYDROELECTRIC PROJECT
FERC NO. 2800
INVASIVE PLANT SPECIES SURVEY
RECREATION FIELD INVENTORY ASSESSMENT

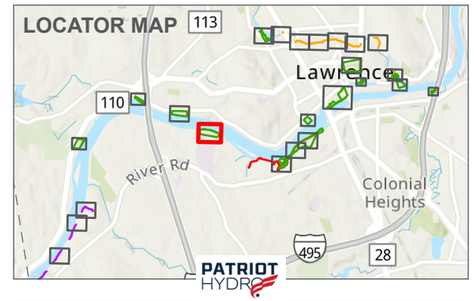
STRAZZULA RESERVATION

Invasive Species Survey Area

Invasive Species Type

Black locust

Note: Invasive plants were commonly observed growing in dense, mixed stands with other invasive species. To accurately represent their distribution within the recreation area, mapped polygons delineate the approximate extent of the dominant invasive plant species present in each localized area.



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LAWRENCE HYDROELECTRIC PROJECT
FERC NO. 2800
INVASIVE PLANT SPECIES SURVEY
RECREATION FIELD INVENTORY ASSESSMENT

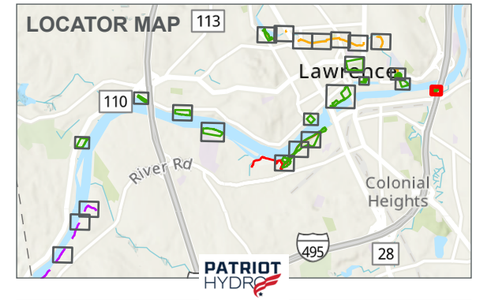
SEWER INTERCEPTOR

Invasive Species Survey Area

Invasive Species Type

Black locust

Note: Invasive plants were commonly observed growing in dense, mixed stands with other invasive species. To accurately represent their distribution within the recreation area, mapped polygons delineate the approximate extent of the dominant invasive plant species present in each localized area.



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LAWRENCE HYDROELECTRIC PROJECT
FERC NO. 2800
INVASIVE PLANT SPECIES SURVEY
RECREATION FIELD INVENTORY ASSESSMENT

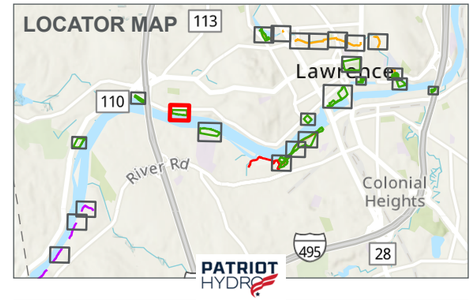
RAYMOND J. MARTIN RIVERSIDE PARK

Invasive Species Survey Area

Invasive Species Type

- Black locust
- Oriental bittersweet; Asian or Asiatic bittersweet
- Tree-of-heaven

Note: Invasive plants were commonly observed growing in dense, mixed stands with other invasive species. To accurately represent their distribution within the recreation area, mapped polygons delineate the approximate extent of the dominant invasive plant species present in each localized area.



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LAWRENCE HYDROELECTRIC PROJECT
FERC NO. 2800
INVASIVE PLANT SPECIES SURVEY
RECREATION FIELD INVENTORY ASSESSMENT

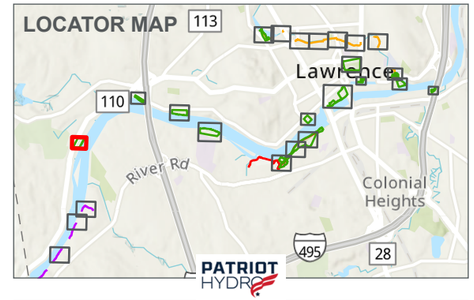
PHILLIPS ACADEMY BOAT HOUSE

Invasive Species Survey Area

Invasive Species Type

- Autumn olive
- European buckthorn; glossy buckthorn
- Multiflora rose
- Oriental bittersweet; Asian or Asiatic bittersweet

Note: Invasive plants were commonly observed growing in dense, mixed stands with other invasive species. To accurately represent their distribution within the recreation area, mapped polygons delineate the approximate extent of the dominant invasive plant species present in each localized area.



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LAWRENCE HYDROELECTRIC PROJECT
FERC NO. 2800
INVASIVE PLANT SPECIES SURVEY
RECREATION FIELD INVENTORY ASSESSMENT

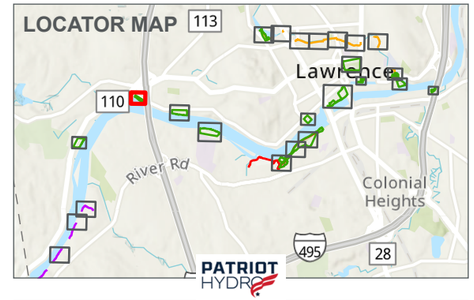
METHUEN BOAT RAMP

Invasive Species Survey Area

Invasive Species Type

- Japanese knotweed; Japanese or Mexican Bamboo
- Oriental bittersweet; Asian or Asiatic bittersweet

Note: Invasive plants were commonly observed growing in dense, mixed stands with other invasive species. To accurately represent their distribution within the recreation area, mapped polygons delineate the approximate extent of the dominant invasive plant species present in each localized area.



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LAWRENCE HYDROELECTRIC PROJECT
FERC NO. 2800
INVASIVE PLANT SPECIES SURVEY
RECREATION FIELD INVENTORY ASSESSMENT

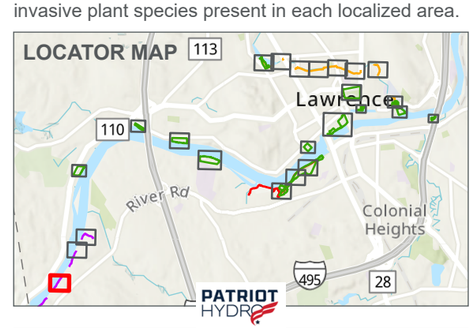
BAY CIRCUIT TRAIL

- Invasive Species Survey Area
- Bay Circuit Trail

Invasive Species Type

- Multiflora rose
- Oriental bittersweet; Asian or Asiatic bittersweet
- Winged euonymus; Burning bush
- Yellow iris

Note: Invasive plants were commonly observed growing in dense, mixed stands with other invasive species. To accurately represent their distribution within the recreation area, mapped polygons delineate the approximate extent of the dominant invasive plant species present in each localized area.



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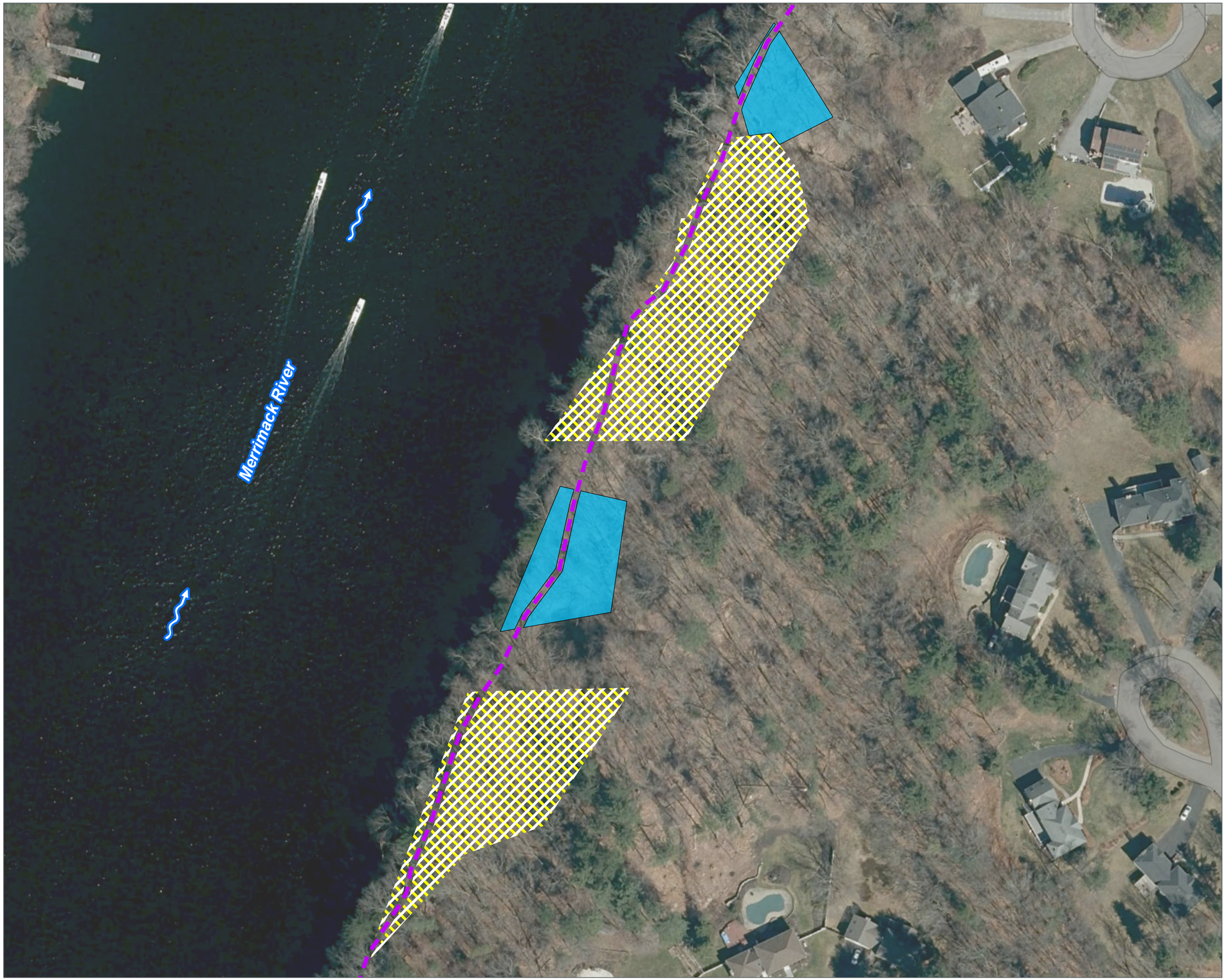
LAWRENCE HYDROELECTRIC PROJECT
FERC NO. 2800
INVASIVE PLANT SPECIES SURVEY
RECREATION FIELD INVENTORY ASSESSMENT

BAY CIRCUIT TRAIL

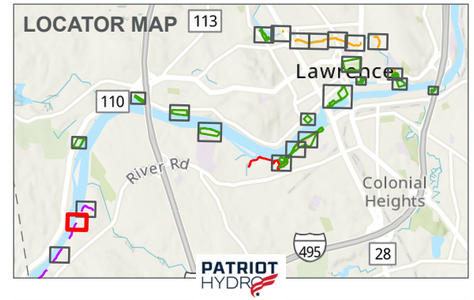


- Invasive Species Survey Area
- Bay Circuit Trail

Invasive Species Type

- Oriental bittersweet; Asian or Asiatic bittersweet
- Winged euonymus; Burning bush

Note: Invasive plants were commonly observed growing in dense, mixed stands with other invasive species. To accurately represent their distribution within the recreation area, mapped polygons delineate the approximate extent of the dominant invasive plant species present in each localized area.



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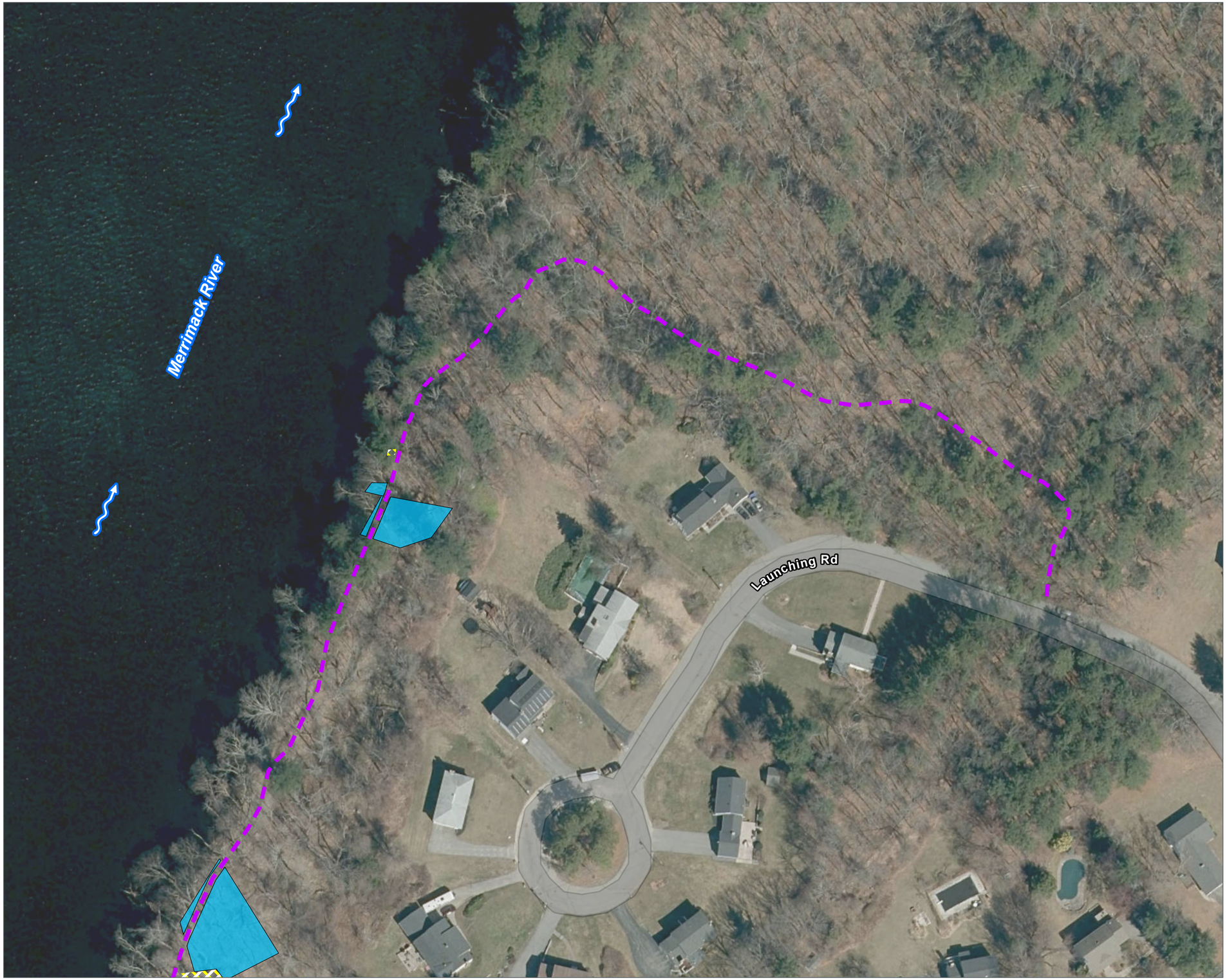
LAWRENCE HYDROELECTRIC PROJECT
FERC NO. 2800
INVASIVE PLANT SPECIES SURVEY
RECREATION FIELD INVENTORY ASSESSMENT

BAY CIRCUIT TRAIL

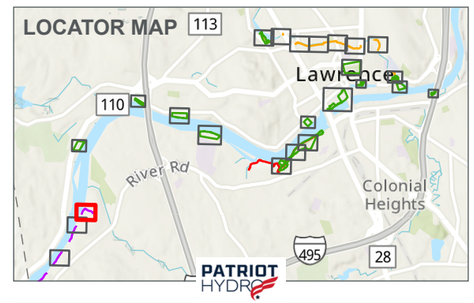


- Invasive Species Survey Area
- Bay Circuit Trail

Invasive Species Type

- Oriental bittersweet; Asian or Asiatic bittersweet
- Winged euonymus; Burning bush

Note: Invasive plants were commonly observed growing in dense, mixed stands with other invasive species. To accurately represent their distribution within the recreation area, mapped polygons delineate the approximate extent of the dominant invasive plant species present in each localized area.



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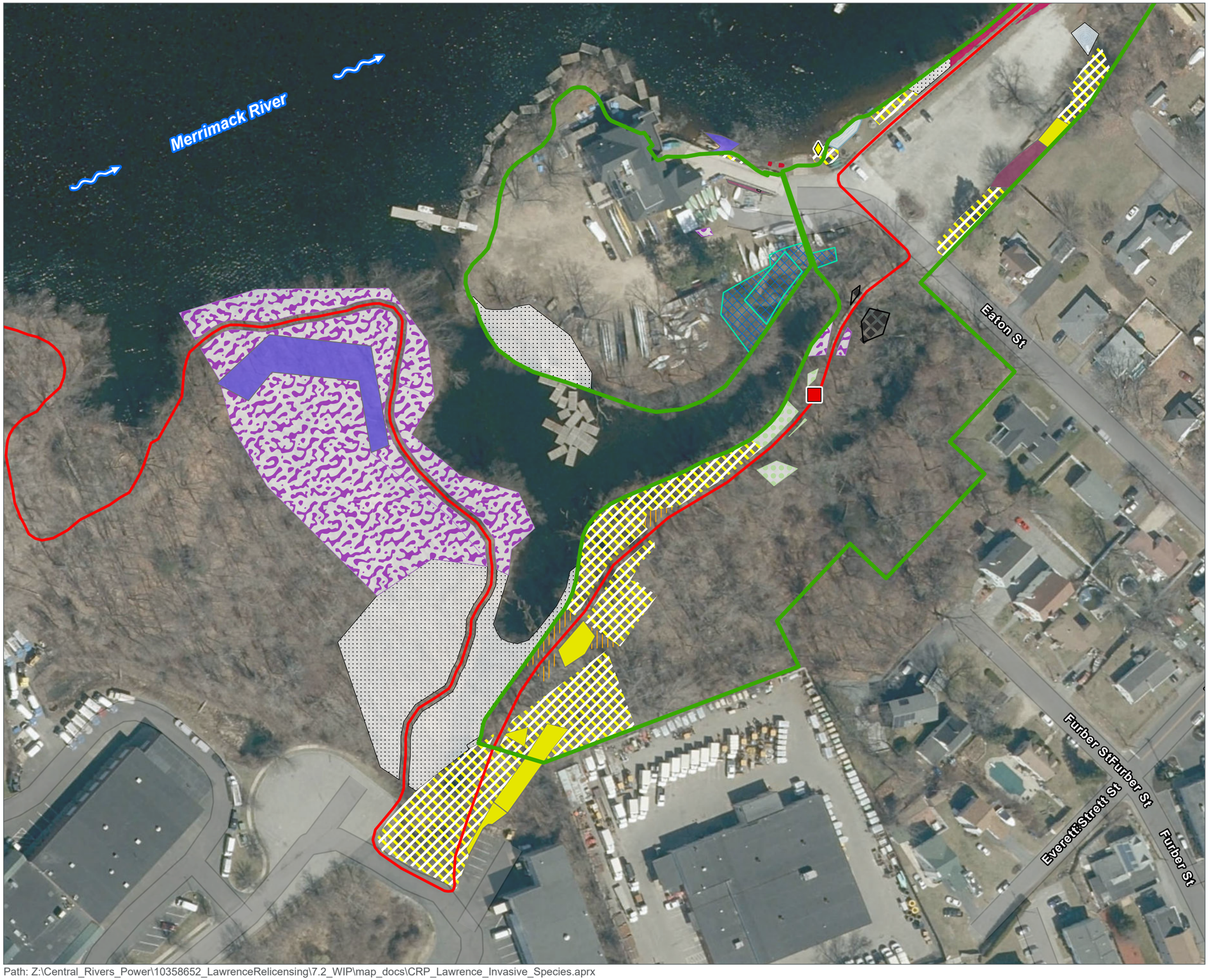

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LAWRENCE HYDROELECTRIC PROJECT
FERC NO. 2800
INVASIVE PLANT SPECIES SURVEY
RECREATION VISITOR USE SURVEYS

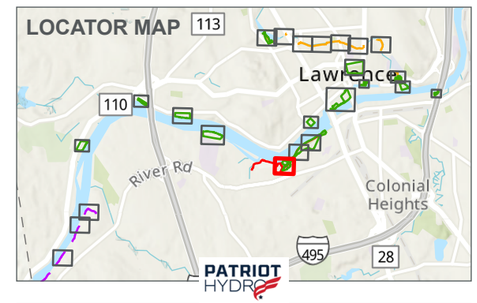
ABE BASHARA BOATHOUSE &
LAWRENCE RIVERFRONT STATE PARK
PAGE 1 OF 3

- Invasive Species Survey Area
- Merrimack River Trail

Invasive Species Type
- Japanese barberry
- Yellow iris

Invasive Species Type
- Autumn olive
- Black locust
- Common buckthorn
- European buckthorn; glossy buckthorn
- Garlic mustard
- Japanese barberry
- Japanese knotweed; Japanese or Mexican Bamboo
- Morrows honeysuckle
- Oriental bittersweet; Asian or Asiatic bittersweet
- Other
- Purple loosestrife
- Reed canary-grass
- Tree-of-heaven
- Yellow iris

Note: Invasive plants were commonly observed growing in dense, mixed stands with other invasive species. To accurately represent their distribution within the recreation area, mapped polygons delineate the approximate extent of the dominant invasive plant species present in each localized area.



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LAWRENCE HYDROELECTRIC PROJECT
FERC NO. 2800
INVASIVE PLANT SPECIES SURVEY
RECREATION VISITOR USE SURVEYS

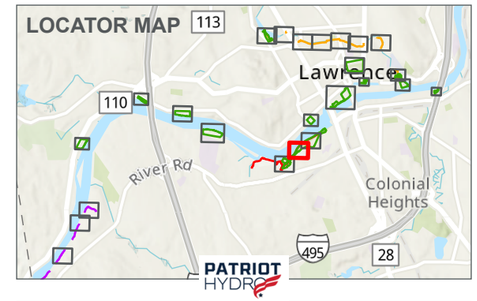
LAWRENCE RIVERFRONT STATE PARK

- Invasive Species Survey Area
- Merrimack River Trail

Invasive Species Type

- Autumn olive
- Black locust
- Common buckthorn
- Japanese barberry
- Japanese knotweed; Japanese or Mexican Bamboo
- Norway maple
- Oriental bittersweet; Asian or Asiatic bittersweet
- Reed canary-grass
- Tree-of-heaven
- Winged euonymus; Burning bush

Note: Invasive plants were commonly observed growing in dense, mixed stands with other invasive species. To accurately represent their distribution within the recreation area, mapped polygons delineate the approximate extent of the dominant invasive plant species present in each localized area.



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LAWRENCE HYDROELECTRIC PROJECT
FERC NO. 2800
INVASIVE PLANT SPECIES SURVEY
RECREATION VISITOR USE SURVEYS

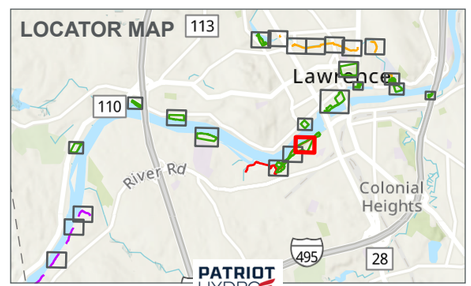
LAWRENCE RIVERFRONT STATE PARK

Invasive Species Survey Area
Merrimack River Trail

Invasive Species Type
- Tatarian honeysuckle

Invasive Species Type
- Autumn olive
- Black locust
- Japanese honeysuckle
- Japanese knotweed; Japanese or Mexican Bamboo
- Morrows honeysuckle
- Oriental bittersweet; Asian or Asiatic bittersweet
- Tatarian honeysuckle
- Yellow iris

Note: Invasive plants were commonly observed growing in dense, mixed stands with other invasive species. To accurately represent their distribution within the recreation area, mapped polygons delineate the approximate extent of the dominant invasive plant species present in each localized area.



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LAWRENCE HYDROELECTRIC PROJECT
FERC NO. 2800
INVASIVE PLANT SPECIES SURVEY
RECREATION VISITOR USE SURVEYS

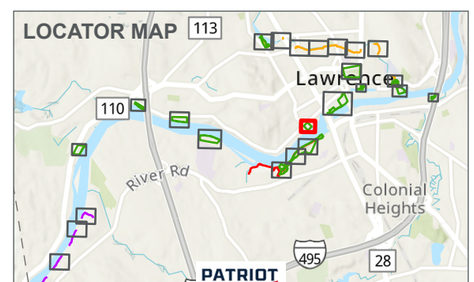
BOYS AND GIRLS CLUB

Invasive Species Survey Area

Invasive Species Type

- Creeping buttercup
- Multiflora rose
- Oriental bittersweet; Asian or Asiatic bittersweet

Note: Invasive plants were commonly observed growing in dense, mixed stands with other invasive species. To accurately represent their distribution within the recreation area, mapped polygons delineate the approximate extent of the dominant invasive plant species present in each localized area.



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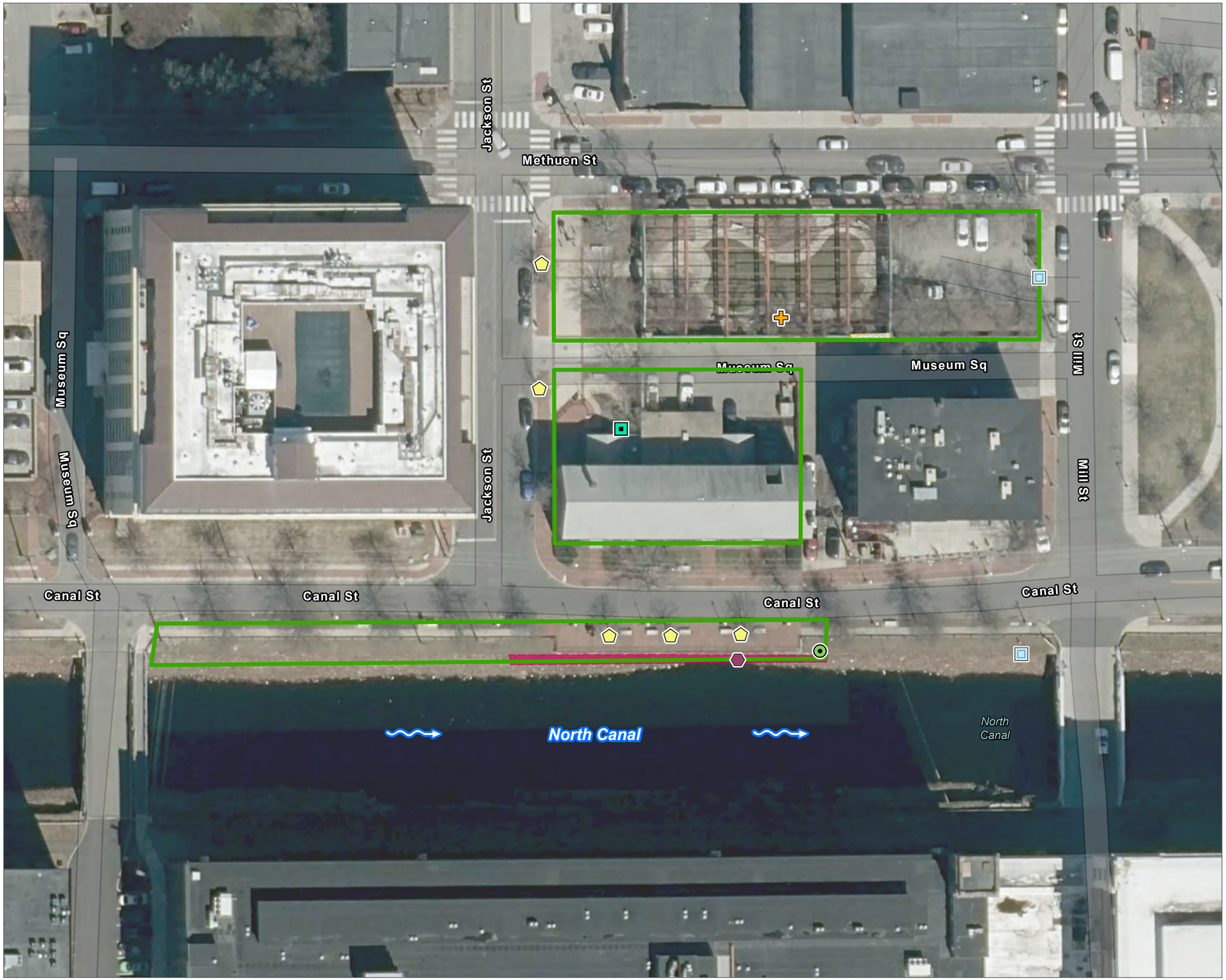
LAWRENCE HYDROELECTRIC PROJECT
FERC NO. 2800
INVASIVE PLANT SPECIES SURVEY
RECREATION VISITOR USE SURVEYS

LAWRENCE HERTIAGE STATE PARK & CANAL ACCESS
PAGE 1 OF 1



Invasive Species Survey Area

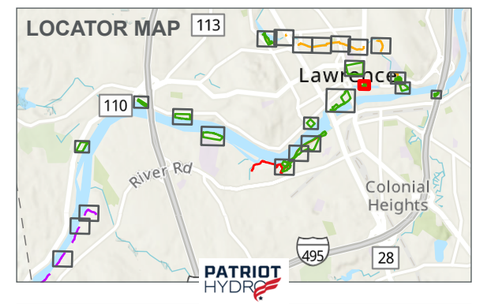
Invasive Species Type

- Norway maple
- Japanese knotweed; Japanese or Mexican Bamboo
- European buckthorn; glossy buckthorn
- Glossy buckthorn
- Tree-of-heaven
- Callery Pear; Bradford Pear

Invasive Species Type

- Norway maple
- Reed canary-grass

Note: Invasive plants were commonly observed growing in dense, mixed stands with other invasive species. To accurately represent their distribution within the recreation area, mapped polygons delineate the approximate extent of the dominant invasive plant species present in each localized area.



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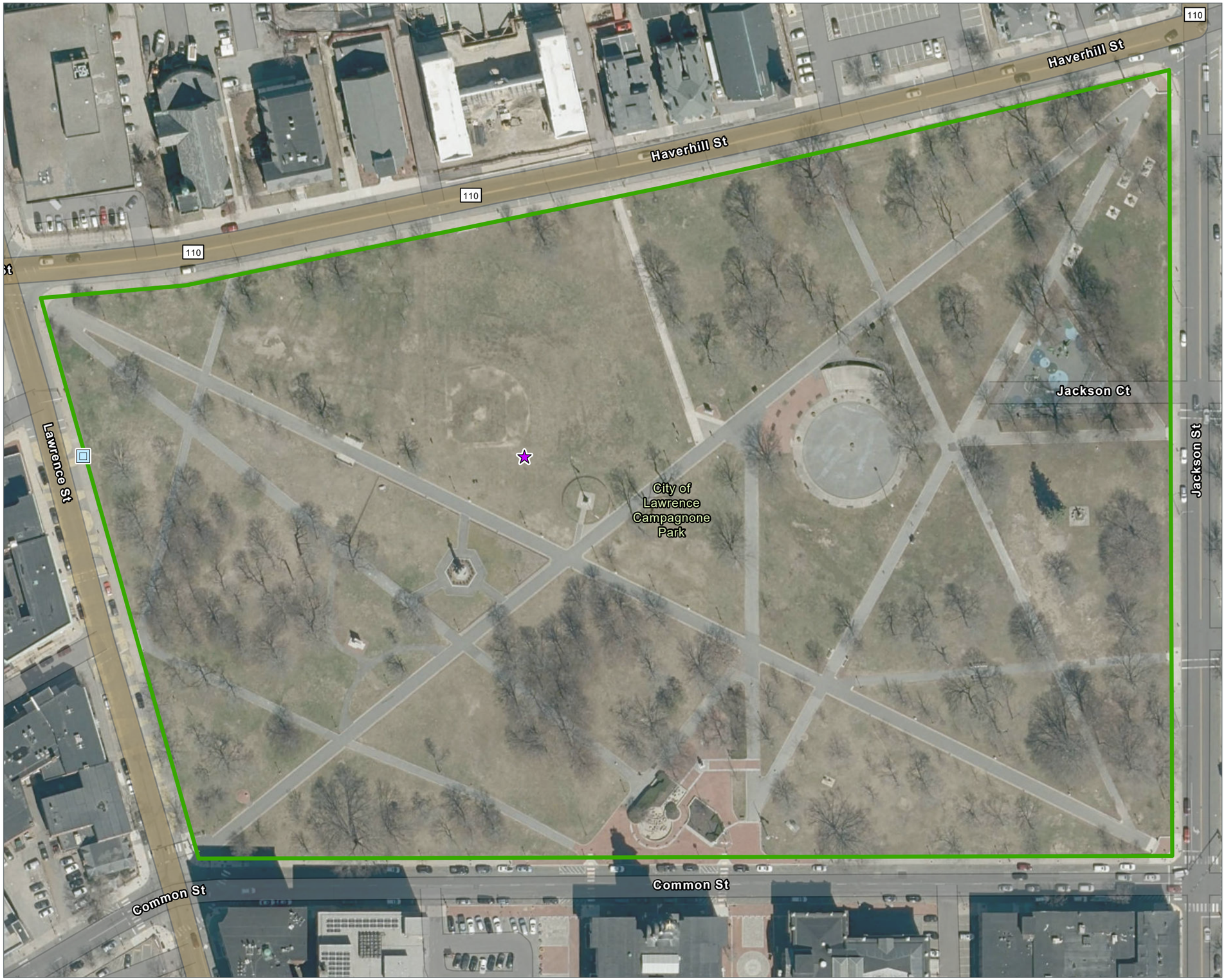
LAWRENCE HYDROELECTRIC PROJECT
FERC NO. 2800
INVASIVE PLANT SPECIES SURVEY
RECREATION VISITOR USE SURVEYS

CAMPAGNONE COMMON

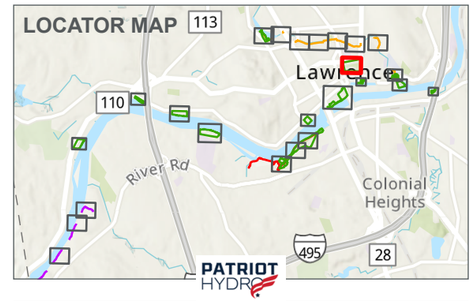


Invasive Species Survey Area

Invasive Species Type

- Tree-of-heaven
- Coltsfoot

Note: Invasive plants were commonly observed growing in dense, mixed stands with other invasive species. To accurately represent their distribution within the recreation area, mapped polygons delineate the approximate extent of the dominant invasive plant species present in each localized area.



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LAWRENCE HYDROELECTRIC PROJECT
FERC NO. 2800
INVASIVE PLANT SPECIES SURVEY
RECREATION VISITOR USE SURVEYS

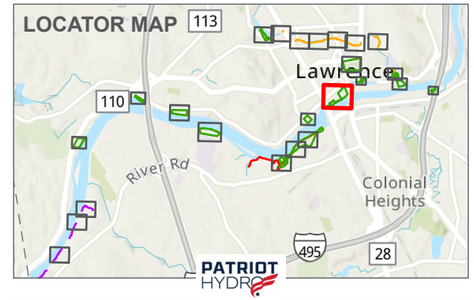
PEMBERTON STATE PARK

Invasive Species Survey Area

Invasive Species Type

- Oriental bittersweet; Asian or Asiatic bittersweet
- Tree-of-heaven

Note: Invasive plants were commonly observed growing in dense, mixed stands with other invasive species. To accurately represent their distribution within the recreation area, mapped polygons delineate the approximate extent of the dominant invasive plant species present in each localized area.



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LAWRENCE HYDROELECTRIC PROJECT
FERC NO. 2800
INVASIVE PLANT SPECIES SURVEY
RECREATION VISITOR USE SURVEYS

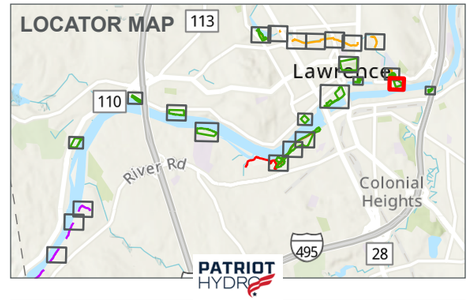
NUNZIO DIMARCA PARK

- Invasive Species Survey Area
- Spicket River Greenway

Invasive Species Type
- Callery Pear; Bradford Pear

Invasive Species Type
- Black locust
- Japanese knotweed; Japanese or Mexican Bamboo
- Oriental bittersweet; Asian or Asiatic bittersweet
- Reed canary-grass
- Tree-of-heaven

Note: Invasive plants were commonly observed growing in dense, mixed stands with other invasive species. To accurately represent their distribution within the recreation area, mapped polygons delineate the approximate extent of the dominant invasive plant species present in each localized area.



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LAWRENCE HYDROELECTRIC PROJECT
FERC NO. 2800
INVASIVE PLANT SPECIES SURVEY
RECREATION VISITOR USE SURVEYS

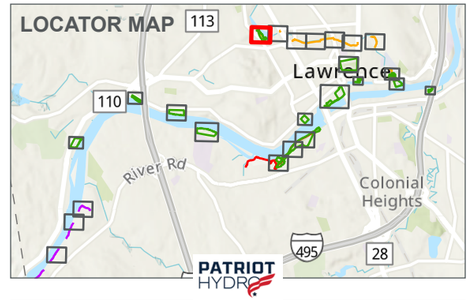
SPICKET RIVER GREENWAY-
MACHESTER STREET PARK
PAGE 1 OF 7

- Invasive Species Survey Area
- Spicket River Greenway

Invasive Species Type

- Autumn olive
- Black locust
- Japanese knotweed; Japanese or Mexican Bamboo
- Oriental bittersweet; Asian or Asiatic bittersweet
- Phragmites

Note: Invasive plants were commonly observed growing in dense, mixed stands with other invasive species. To accurately represent their distribution within the recreation area, mapped polygons delineate the approximate extent of the dominant invasive plant species present in each localized area.



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LAWRENCE HYDROELECTRIC PROJECT
FERC NO. 2800
INVASIVE PLANT SPECIES SURVEY
RECREATION VISITOR USE SURVEYS

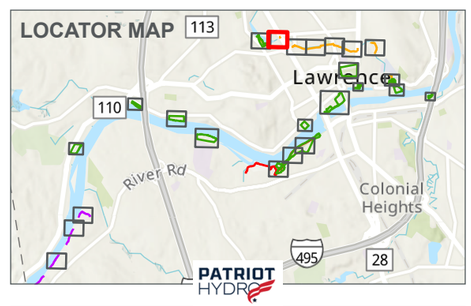
SPICKET RIVER GREENWAY-
MACHESTER STREET PARK
PAGE 2 OF 7

- Invasive Species Survey Area
- Spicket River Greenway

Invasive Species Type

- Black swallow-wort, Louises swallow-wort
- European buckthorn; glossy buckthorn
- Japanese knotweed; Japanese or Mexican Bamboo
- Oriental bittersweet; Asian or Asiatic bittersweet
- Tree-of-heaven
- Variable leaved milfoil

Note: Invasive plants were commonly observed growing in dense, mixed stands with other invasive species. To accurately represent their distribution within the recreation area, mapped polygons delineate the approximate extent of the dominant invasive plant species present in each localized area.



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LAWRENCE HYDROELECTRIC PROJECT
FERC NO. 2800
INVASIVE PLANT SPECIES SURVEY
RECREATION VISITOR USE SURVEYS

SPICKET RIVER GREENWAY-
MACHESTER STREET PARK
PAGE 3 OF 7

- Invasive Species Survey Area
- Spicket River Greenway

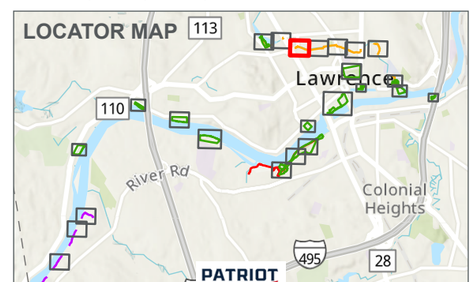
Invasive Species Type

- Black locust

Invasive Species Type

- Japanese knotweed; Japanese or Mexican Bamboo
- Oriental bittersweet; Asian or Asiatic bittersweet
- Honey locust
- Tree-of-heaven

Note: Invasive plants were commonly observed growing in dense, mixed stands with other invasive species. To accurately represent their distribution within the recreation area, mapped polygons delineate the approximate extent of the dominant invasive plant species present in each localized area.



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LAWRENCE HYDROELECTRIC PROJECT
FERC NO. 2800
INVASIVE PLANT SPECIES SURVEY
RECREATION VISITOR USE SURVEYS

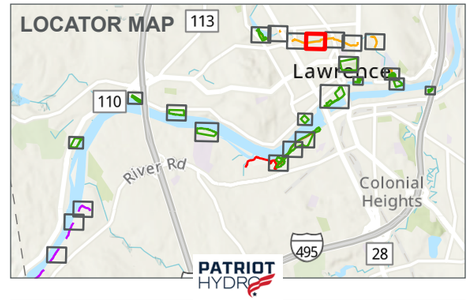
SPICKET RIVER GREENWAY-
MACHESTER STREET PARK
PAGE 4 OF 7

- Invasive Species Survey Area
- Spicket River Greenway

Invasive Species Type

- Black locust
- European buckthorn; glossy buckthorn
- Japanese knotweed; Japanese or Mexican Bamboo
- Norway maple
- Oriental bittersweet; Asian or Asiatic bittersweet

Note: Invasive plants were commonly observed growing in dense, mixed stands with other invasive species. To accurately represent their distribution within the recreation area, mapped polygons delineate the approximate extent of the dominant invasive plant species present in each localized area.



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LAWRENCE HYDROELECTRIC PROJECT
FERC NO. 2800
INVASIVE PLANT SPECIES SURVEY
RECREATION VISITOR USE SURVEYS

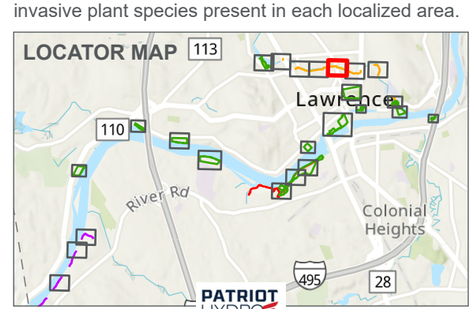
SPICKET RIVER GREENWAY-
MACHESTER STREET PARK
PAGE 5 OF 7

- Invasive Species Survey Area
- Spicket River Greenway

Invasive Species Type

- Garlic mustard
- Japanese knotweed; Japanese or Mexican Bamboo
- Norway maple
- Oriental bittersweet; Asian or Asiatic bittersweet

Note: Invasive plants were commonly observed growing in dense, mixed stands with other invasive species. To accurately represent their distribution within the recreation area, mapped polygons delineate the approximate extent of the dominant invasive plant species present in each localized area.



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LAWRENCE HYDROELECTRIC PROJECT
FERC NO. 2800
INVASIVE PLANT SPECIES SURVEY
RECREATION VISITOR USE SURVEYS

SPICKET RIVER GREENWAY-
MACHESTER STREET PARK
PAGE 6 OF 7

Invasive Species Survey Area

Spicket River Greenway

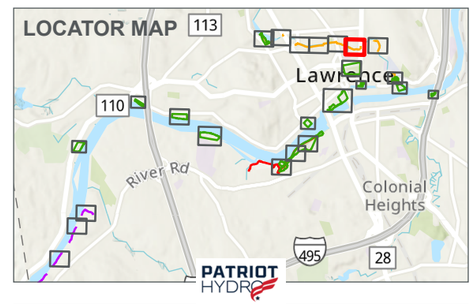
Invasive Species Type

Japanese knotweed; Japanese or Mexican Bamboo

Norway maple

Oriental bittersweet; Asian or Asiatic bittersweet

Note: Invasive plants were commonly observed growing in dense, mixed stands with other invasive species. To accurately represent their distribution within the recreation area, mapped polygons delineate the approximate extent of the dominant invasive plant species present in each localized area.



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LAWRENCE HYDROELECTRIC PROJECT
FERC NO. 2800
INVASIVE PLANT SPECIES SURVEY
RECREATION VISITOR USE SURVEYS

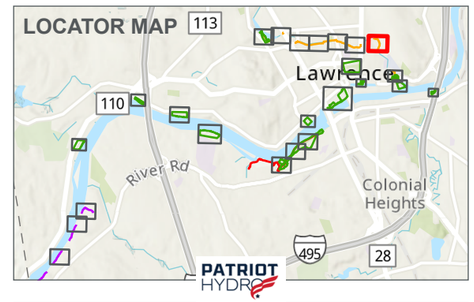
SPICKET RIVER GREENWAY-
MACHESTER STREET PARK
PAGE 7 OF 7

- Invasive Species Survey Area
- Spicket River Greenway

Invasive Species Type

- Japanese knotweed; Japanese or Mexican Bamboo
- Norway maple
- Oriental bittersweet; Asian or Asiatic bittersweet

Note: Invasive plants were commonly observed growing in dense, mixed stands with other invasive species. To accurately represent their distribution within the recreation area, mapped polygons delineate the approximate extent of the dominant invasive plant species present in each localized area.



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LAWRENCE HYDROELECTRIC PROJECT
FERC NO. 2800
INVASIVE PLANT SPECIES SURVEY
RECREATION VISITOR USE SURVEYS

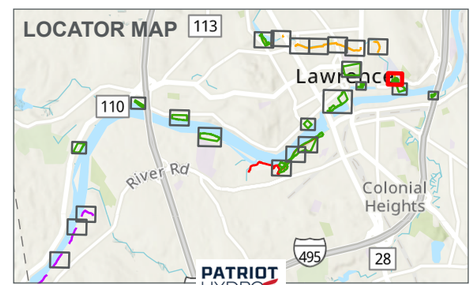
OXFORD PARK

- Invasive Species Survey Area
- Spicket River Greenway

Invasive Species Type
- Black locust
- Tree-of-heaven

Invasive Species Type
- Black locust
- Black swallow-wort, Louises swallow-wort
- European buckthorn; glossy buckthorn
- Garlic mustard
- Multiflora rose
- Reed canary-grass
- Tree-of-heaven

Note: Invasive plants were commonly observed growing in dense, mixed stands with other invasive species. To accurately represent their distribution within the recreation area, mapped polygons delineate the approximate extent of the dominant invasive plant species present in each localized area.



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Appendix F

Invasive Plant Species Distribution Within the Recreation Visitor Use Surveys

INVASIVE PLANT SPECIES DISTRIBUTION WITHIN THE TEN RECREATION SITES

Genus species	Common Name	Primary General Location(s)	Distribution (Areal coverage; 1: *1-25%*, 2: *26-50%*, 3: *51-75%*, and 4: *76-100%*) (Localized or Widespread)	MIPAG Classification	Map No. (X of X)	Description/Site Assessment Notes
Abe Bashara Boathouse						
Rhamnus cathartica	Common Buckthorn	South and southwestern borders. Dispersed sporadically near Merrimack River.	4 - Widespread	Invasive	1 of 3	Densely established along the parcel's terrestrial boat parking and dumpster area near the Merrimack River drainage inlet/wetlands and the Merrimack River Trail. Numerous saplings, approximately 10 ft in height with a diameter at breast height (DBH) of about 2 in. Seedling growth observed throughout study. In areas stem count exceeded 10-15 stems.
Rosa multiflora	Multiflora Rose	South and southwestern borders	3 - Widespread	Invasive	1 of 3	Occurs as sporadic clumps throughout the survey area. Populations were predominantly co-located with other invasive conglomerates near the terrestrial boat parking area. Densities exceeded 50% for some areas. Stem counts at its peak phenology exceeded 10 per bush.
Lonicera morrowii	Morrow's Honeysuckle	South and southwestern borders. Along Merrimack River bank.	2 - Localized	Invasive	1 of 3	Observed in sporadic clumps near the boat parking area and along the Merrimack River bank. Ranged in heights from 3-5 ft with areal perimeters between 3-5 ft round. Observation of "wall-like" dominance was seen for other study sites by morrow's honeysuckle but was not observed for those at Abe Bashara Boathouse. In areas, stem counts generally ranged from 5-10 branches per bush, with a few larger bushes in areas.
Alliaria petiolata	Garlic Mustard	Throughout study area	4 - Widespread	Invasive	1 of 3	Densely established throughout the study area. At its peak flowering period, garlic mustard had an approximate areal coverage nearing 100% for some areas.

Genus species	Common Name	Primary General Location(s)	Distribution (Areal coverage; 1: *1-25%*, 2: *26-50%*, 3: *51-75%*, and 4: *76-100%*) (Localized or Widespread)	MIPAG Classification	Map No. (X of X)	Description/Site Assessment Notes
Ailanthus altissima	Tree-of-Heaven	South and southwestern borders of study area predominantly.	4 – Widespread	Invasive	1 of 3	Tree-of-Heaven was concentrated along the southern to southwestern parcel boundaries, particularly near and adjacent to the terrestrial boat parking area. Numerous canopy-level trees were identified, with heights exceeding 30 ft and DBHs exceeding ~10 in. Some seedling and sapling establishments were observed along the forest floor closer to the Merrimack River Trail, with fewer occurrences near the Abe Bashara Boathouse study area. In areas, stem counts generally range from 5-10.
Fallopia japonica	Japanese Knotweed	South and southwestern borders of study area predominantly.	4 – Widespread	Invasive	1 of 3	Densely occurring along the study area boundary near the terrestrial boat parking and dumpster area. Japanese knotweed formed dense, “wall-like” stands that extended to the edge of boat parking areas and, in some cases, colonized between even the smallest crevices from parked boats and the adjacent land. Stand size covered approximately 100% of the available areal space provided and mapped.
Celastrus orbiculatus	Oriental Bittersweet	Throughout study area.	4 – Widespread	Invasive	1 of 3	Densely established throughout the study area, with the highest densities along the forested edge boundary between wetlands and the Merrimack River to the Abe Bashara Boathouse and field. Dense “walls” of bittersweet were noted in several locations, with some vines extending from the forest floor to neighboring canopy tops dominated by 30+ ft white pines (*Pinus strobus*), forming tangled clusters. Oriental bittersweet is the sub-dominant invasive plant species identified at Abe Bashara Boathouse during the study. Stem counts or colonization estimate are not practical due to the abundance and density of oriental bittersweet observed throughout the 2025 growing season (not all areas were mapped).

Genus species	Common Name	Primary General Location(s)	Distribution (Areal coverage; 1: *1-25%*, 2: *26-50%*, 3: *51-75%*, and 4: *76-100%*) (Localized or Widespread)	MIPAG Classification	Map No. (X of X)	Description/Site Assessment Notes
Elaeagnus umbellata	Autumn Olive	Throughout study area	4 - Widespread	Evaluated Plants Not Meeting Criteria	1 of 3	Observed in sporadic clumps with the highest concentrations near the terrestrial boat parking area and along the immediate banks to the Merrimack River. Some clumps were also found along the fenced-in storage area adjacent to the Abe Bashara Boathouse. Most occurrences consisted of small clusters of 2–3 stems, with heights ranging from approximately 5 to 10 ft. Stem counts for areas ranged from 2-5.
Phalaris arundunacea	Reed Canary-Grass	Merrimack River Bank	2 – Localized	Invasive	1 of 3	Reed canary-grass was observed near the boat ramp along the Merrimack River. Approximately 2 to 3 small clumps were documented. Heights between clumps ranged from approximately 3-4 ft with areal perimeters around 2-3 ft. Reed canary-grass was seen growing among other invasive plants that included yellow iris and purple loosestrife. In areas mapped, areas consisted of 10-15+ stems at times.
Acer platanoides	Norway Maple	South and southwestern borders of study area predominantly.	1 – Localized	Invasive	1 of 3	Observed growing alongside Tree-of-Heaven between the boat parking area and the Merrimack River inlet. Limited seedling and sapling establishment was noted at the lower and mid-canopy levels. Approximate heights of Norway maples observed were approximately 20-30 ft with clusters of saplings generally within the mid-canopy. For some areas, Norway maple consisted of 5-8+ stems.
Iris pseudacorus	Yellow Iris	Merrimack River bank and wetlands/inlet	4 – Widespread	Invasive	1 of 3	Observed in the wetlands and inlet section to the south of the Abe Bashara Boathouse parcel boundary but within the study area. Yellow iris ranged in heights from 3-5 ft with areal perimeters nearly matching that. A few clumps were identified near reed canary-grass patches along the Merrimack River between the Abe Bashara Boathouse boat launch and picnic seating area. These clumps were smaller in size and stem counts exceeded 15-20+ for areas.

Genus species	Common Name	Primary General Location(s)	Distribution (Areal coverage; 1: *1-25%*, 2: *26-50%*, 3: *51-75%*, and 4: *76-100%*) (Localized or Widespread)	MIPAG Classification	Map No. (X of X)	Description/Site Assessment Notes
Lythrum salicaria	Purple Loosestrife	Merrimack River bank and wetlands/inlet	4 – Widespread	Invasive	1 of 3	Observed in the wetlands and inlet section to the south of the Abe Bashara Boathouse parcel boundary. Growing amongst yellow iris, dominating the ground level of the forested wetlands to the south of the Abe Bashara Boathouse parcel boundary. Purple loosestrife reached heights exceeding 5 ft with areal perimeters much smaller, approximately 2-3 ft. Three clumps of purple loosestrife were observed growing near the yellow iris patches on the Merrimack River as well. Some areas generally consisted of 2-3 purple loosestrife stems.
Boys and Girls Club						
Celastrus orbiculatus	Oriental Bittersweet	Throughout study area.	4 – Widespread	Invasive	1 of 1	Observed throughout the study area, with the highest densities along the fence. Dense “walls” of bittersweet were noted throughout the whole bank stretch, with some vines extending from the forest floor to immediate canopy tops, forming very dense, spider-web–like bundles. Stem counts or colonization estimate are not practical due to the abundance and density of oriental bittersweet observed throughout the 2025 growing season. In areas mapped, polygons represented true landscape dominance.
Euonymus alatus	Winged Euonymus	Sporadic patches along fence.	2 – Localized	Invasive	1 of 1	Observed in sporadic patches concentrated along the fence bordering the river. Patches were small and variable, generally not exceeding 3 ft in height. Stem density within observed patches typically ranged from 4 to 6 stems per clump. Winged euonymus was observed growing beneath more dense vegetation at heights greater than 3ft.

Genus species	Common Name	Primary General Location(s)	Distribution (Areal coverage; 1: *1-25%*, 2: *26-50%*, 3: *51-75%*, and 4: *76-100%*) (Localized or Widespread)	MIPAG Classification	Map No. (X of X)	Description/Site Assessment Notes
Frangula alnus	Glossy Buckthorn	Along perimeter of study area.	4 - Widespread	Invasive	1 of 1	Densely established along the parcel's bank between the Merrimack River and fence. Numerous saplings, exceeding 10 ft in height with a DBH of 2 in or more, were observed. In areas where glossy buckthorn was observed, stem counts were conservatively in the 5-10 range.
Berberis thunbergii	Japanese Barberry	Along perimeter of study area	2 - Localized	Invasive	1 of 1	Observed along the perimeter of the study area. Patch heights generally did not exceed 3 ft, though some clumps contained 10–15 stems or more, covering large areas. Japanese barberry was well established in the limited terrestrial upland areas observed.
Acer platanoides	Norway Maple	Throughout study area.	4 – Widespread	Invasive	1 of 1	Observed growing alongside northern catalpa (*Catalpa speciosa)* and green ash (*Fraxinus pennsylvanica)*, which served as the dominant canopy to mid-canopy cover between the bank of the Merrimack River and fence. Approximate heights for canopy level Norway maples exceeded 20 ft with DBHs nearing 10 in at times. Abundant seedling and sapling establishment was noted at the lower and mid-canopy levels. Densities for seedling and sapling growth were well in the 76-100% areal coverage range.
Lawrence Heritage State Park						
Ailanthus altissima	Tree-of-Heaven	Metal post fence and visitor parking lot	1 – Localized	Invasive	1 of 1	Observed growing along the fenceline within the terrestrial portion of the bank strip and between the visitor parking lot chain-link fence. Only 2 seedling stems were recorded during the study period. Establishment never exceeded the seedling stage, as repeated mowing of the banks and adjacent to the visitor parking lot during the growing season effectively removed all aboveground biomass from field observation.

Genus species	Common Name	Primary General Location(s)	Distribution (Areal coverage; 1: *1-25%*, 2: *26-50%*, 3: *51-75%*, and 4: *76-100%*) (Localized or Widespread)	MIPAG Classification	Map No. (X of X)	Description/Site Assessment Notes
Fallopia japonica	Japanese Knotweed	Garden bed	1 - Localized	Invasive	1 of 1	On June 3, 2025, 3 Japanese knotweed stems were observed in a garden bed located between the museum building and the urban garden area. Each stem was very young, not exceeding 6-in in height. All three stems were removed from the garden bed between this survey day and the subsequent survey day by ground crews. No other Japanese knotweed aboveground biomass was observed during this study period within the study area.
Acer platanoides	Norway Maple	Urban park garden	1 – Localized	Invasive	1 of 1	One Norway maple seedling was observed growing between an electrical box and the urban gardens brick wall. The seedling did not exceed a height of 3ft and had only a few leaflets. The seedling was observed throughout the survey period and was present during last survey day in September 2025.
Frangula alnus	Glossy Buckthorn	Metal post fence	1 - Localized	Invasive	1 of 1	Approximately 2 to 3 glossy buckthorn seedlings were documented along the fenceline and terrestrial bank area to the North Canal. These bushels did not exceed 3 ft and had between 2-3 stems from each. Very early leaf to leaflet sets were observed. No other establishment by glossy buckthorn was observed during the study period.
Phalaris arundunacea	Reed Canary-Grass	North Canal bank	4 - Widespread	Invasive	1 of 1	Observed along the left bank of the North Canal near the park's sidewalk and within the study area. Reed canary-grass exceeded an approximate areal coverage of 90%. Biologists observed sometime between the last survey in July and the next survey day in August, groundcrews trimmed back the reed canary-grass stands to the surface. No additional reed canary-grass was further identified during the study period. When reed canary-grass was present, stand(s) dominated the left bank of the North Canal's limited terrestrial area.

Genus species	Common Name	Primary General Location(s)	Distribution (Areal coverage; 1: *1-25%*, 2: *26-50%*, 3: *51-75%*, and 4: *76-100%*) (Localized or Widespread)	MIPAG Classification	Map No. (X of X)	Description/Site Assessment Notes
Pyrus calleryana	Bradford Pear	Sidewalks	2 - Localized	Likely Invasive	1 of 1	Approximately 5 Bradford pear trees were observed growing in designated soil pits located within the approximate centerline of sidewalks along Canal Street and Jackson Street. These trees were intentionally planted, and no seedling or sapling establishment was noted.
Campagnone Common						
Ailanthus altissima	Tree-of-Heaven	Sidewalk	1 – Localized	Invasive	1 of 1	On June 10, 2025, a singular tree-of-heaven seedling was observed growing between the concrete sidewalk on Lawrence Street and its granite shoulder. This seedling was removed sometime between this survey day and the subsequent survey day by groundcrews. No other tree-of-heaven documentation occurred between 6/10/2025 and the end of the survey period.
Tussilago farfara	Coltsfoot	Grass lawn area	1 – Localized	Likely Invasive	1 of 1	On May 18, 2025, a small patch of coltsfoot was observed growing in a grassy lawn square bordered by walking paths near the Common Street side of the study area. Over the course of the study, the patch was reduced or removed through regular mowing by ground crews. Evidence of coltsfoot establishing elsewhere in the study area was not observed.
Merrimack River Trail						

Genus species	Common Name	Primary General Location(s)	Distribution (Areal coverage; 1: *1-25%*, 2: *26-50%*, 3: *51-75%*, and 4: *76-100%*) (Localized or Widespread)	MIPAG Classification	Map No. (X of X)	Description/Site Assessment Notes
Celastrus orbiculatus	Oriental Bittersweet	Throughout study area.	4 – Widespread	Invasive	1 of 3	Observed throughout the study area, with the highest concentrations along the Merrimack River side of the trail. Dense areas of oriental bittersweet were noted in several locations, with some vines growing from other neighboring vegetation. Stem counts or colonization estimates are not practical due to the abundance and density of oriental bittersweet observed throughout the 2025 growing season. In areas, mapped polygons represent landscape dominance.
Iris pseudacorus	Yellow Iris	Wetland inlet to Merrimack River as well as along Merrimack River	3 – Widespread	Invasive	1 of 3	Observed in two broad areas within and adjacent to the Merrimack River Trail: (1) a wetland area associated with the Merrimack River inlet, and (2) along the mainstem of the Merrimack River near the seating and bank fishing area. Approximately 5-6 large clumps of yellow iris were directly observed from the trail, with additional clumps likely present deeper within the wetland system. Several clumps exceeded 3–4 feet in height and formed dense, rounded stands measuring approximately 3–4 feet in areal perimeter. Distribution of yellow iris was high in wetland and riverine areas adjacent to the Merrimack River Trail. For areas, stem counts exceeded 3.
Frangula alnus	Glossy Buckthorn	Throughout study area.	3 - Widespread	Invasive	1 of 3	Densely established along both sides of the Merrimack Trail. Numerous saplings, approximately 5 ft in height with a DBH of about 1 in, were observed. Seedlings were present along the forest floor generally along the forested side for the trail. Where established, glossy buckthorn was a very prominent invasive plant present with the study area. In areas, glossy buckthorns had approximately 5-10 stems.

Genus species	Common Name	Primary General Location(s)	Distribution (Areal coverage; 1: *1-25%*, 2: *26-50%*, 3: *51-75%*, and 4: *76-100%*) (Localized or Widespread)	MIPAG Classification	Map No. (X of X)	Description/Site Assessment Notes
Alliaria petiolata	Garlic Mustard	Throughout study area	3 - Widespread	Invasive	1 of 3	Observed throughout the study area. The largest concentration of garlic mustard was near the Abe Bashara Boathouse parking lot area portion to the Merrimack River Trail. Garlic mustard had an approximate areal coverage of 90% or more ground cover. Density for sporadic spread patches was generally between 50-75% areal coverage for areas.
Elaeagnus umbellata	Autumn Olive	Throughout study area	4 - Widespread	Evaluated Plants Not Meeting Criteria	1 of 3	Observed in sporadic clumps throughout the study area, particularly off the trail on the Merrimack River side. Highest concentrations were near the parking area at Abe Bashara Boathouse where most patches exceeded 10 ft in height and were going directly off the river's bank. Smaller clusters were found farther down the trail as you approach Lawrence Riverfront State Park. These bushes tended to be within 5-8 ft and only a few stems per bushel. For those observed near Abe Bashara Boathouse, approximate diameters were in excess of 12+ ft. Closer to Lawrence Riverfront State Park, approximate diameters were approximately half the size. For areas, stem counts exceeded 5 for most.
Robinia pseudoacacia	Black Locust	Throughout study area	4 - Widespread	Invasive	1 of 3	Most observed individuals of black locust were found along river's side of Merrimack River Trail at heights exceeding 15 ft with DBHs greater than 10 in for some. Greatest distribution of black locust in the study area was identified in the forested side of the trail, approaching the boundaries of Lawrence Riverfront State Park's forested trail system. Black locust, along with American beech and red oak dominated the forest canopy in this section of Lawrence. Seedling and sapling development was prevalent considerably along the terrestrial forested side of the trail. Stem count in some areas exceeded 10 within areas.

Genus species	Common Name	Primary General Location(s)	Distribution (Areal coverage; 1: *1-25%*, 2: *26-50%*, 3: *51-75%*, and 4: *76-100%*) (Localized or Widespread)	MIPAG Classification	Map No. (X of X)	Description/Site Assessment Notes
Ailanthus altissima	Tree-of-Heaven	Forested side of Merrimack River Trail approaching Riverfront State Park.	1 – Localized	Invasive	1 of 3	Densely concentrated along the forested side of the Merrimack River Trail near the parking area to Abe Bashara Boathouse. Very few canopy-level trees were identified, with heights exceeding 15 ft and DBHs ranging from approximately 5-10 in. Some seedling and sapling establishments were observed along the forest floor, particularly as you near Riverfront State Park. In areas, tree-of-heaven has 1-3 stems.
Euonymus alatus	Winged Euonymus	Throughout study area	3 – Widespread	Invasive	1 of 3	Observed in sporadic patches, primarily along the forested side of Merrimack River Trail. Patches were small and variable, generally not exceeding 3 ft in height. Stem density within observed patches typically ranged from 4 to 6 stems per clump in areas. Concentrations were greatest between the low terrace area from Abe Bashara Boathouse parking area to the immediate elevated incline of Lawrence Riverfront State Park. Many sizable bushes were observed along the Merrimack River's water side of the trail with heights more than 5 ft. Some portions of the trail follow winged euonymus "walls" so thick it can be hard to get a view of the water.
Berberis thunbergii	Japanese Barberry	Throughout study area	2 - Localized	Invasive	1 of 3	Observed throughout the study area, with patches established across its full extent, particularly along river's side. Patch heights generally did not exceed 3 ft, though some clumps contained 10–15 stems or more in areas.

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Rosa multiflora	Multiflora Rose	Throughout study area	3 - Widespread	Invasive	1 of 3	Observed in sporadic clumps throughout the study area. Populations were predominantly clumped with other invasive conglomerates near the terrestrial side of the trail and generally did not exceed 5-6 ft in total bush height. Stem counts or colonization estimate were not practical due to the abundance and density of multiflora rose observed throughout the 2025 growing season. In areas, multiflora rose reflects total landscape dominance with areal coverages well beyond 70-80%.
Lonicera tatarica	Tatarian Honeysuckle	Throughout study area	4 – Widespread	Likely Invasive	1 of 3	Observed during the species flowering season when bright pink to rose colored flowers emerged. Their smooth-edged, glabrous leaves were also a key in distinguishing L. tatarica from other known invasive Lonicera(s) in Lawrence. Large, densely populated bushes of Tatarian honeysuckle were identified primarily along the river's edge of the Merrimack River Trail between Abe Barshara Boathouse parking area and Lawrence Riverfront State Park. These were sporadically found within dense conglomerates of other abundant invasive plant species. Very large areas of the bank ground with bushes exceeding 15-20 stems per bush. Stem counts or colonization estimate were not practical due to the abundance and density of Tatarian honeysuckle observed throughout the 2025 growing season. In areas observed, stem counts exceeded 15+ at times.
Rhamnus cathartica	Common Buckthorn	Throughout study area	4 - Widespread	Invasive	1 of 3	Densely established along the Merrimack River Trail near Abe Bashara Boathouse and the Merrimack River inlet and wetland areas. Numerous saplings, approximately 10 ft in height with DBH of about 2 in, were observed. In areas observed, seedling and sapling stems exceeded 10+ in some areas.

Genus species	Common Name	Primary General Location(s)	Distribution (Areal coverage; 1: *1-25%*, 2: *26-50%*, 3: *51-75%*, and 4: *76-100%*) (Localized or Widespread)	MIPAG Classification	Map No. (X of X)	Description/Site Assessment Notes
Cynanchum louiseae	Black Swallow-wort	Bench seating and bank fishing area	2 - Localized	Invasive	1 of 3	Observed in small, isolated patches near the bench seating and bank fishing area. First observable occurrence happened later in the growing season when leaves began to change color to a darker green pigment and dark purple flowering. Patches were ground level and did not exceed a total "vine" length of approximately 3-4 ft. Stem counts for a cluster were approximately 5 main stems with a few additional sub-stems likely growing from the base taproot in areas. Approximate density of black swallow-wort within the study area generally ranged from 4-5 stems in some locations and as much as 10 in other areas.
Lonicera japonica	Japanese Honeysuckle	Forested edge	1 - Localized	Invasive	1 of 3	Observed in a small to medium size patch between the Merrimack River Trail entrance gate and the end of the Abe Abshara Boathouse parking lot / boat and trailer parking area during the species flowering period of the 2025 study period. This patch appears to be growing from a general area where yard clippings and other household waste were dumped. No other occurrence of Japanese honeysuckle was identified within the Merrimack River Trail study area. Patch size was approximately 3 medium size clumps growing side-by-side to one another creating one very dense wall of vine-like vegetation. Approximate height of wall bush was 8 ft with numerous stems in total. Due to how thick the wall was, it was impossible to provide a stem count. Conservatively estimate between 25-50 interwoven vines in areas.

Genus species	Common Name	Primary General Location(s)	Distribution (Areal coverage; 1: *1-25%*, 2: *26-50%*, 3: *51-75%*, and 4: *76-100%*) (Localized or Widespread)	MIPAG Classification	Map No. (X of X)	Description/Site Assessment Notes
Fallopia japonica	Japanese Knotweed	Throughout the study area	4 – Widespread	Invasive	1 of 3	The highest concentrations occurred along the study area boundary near the Abe Bashara Boathouse parking lot and the entrance gate to the Merrimack River Trail. Numerous colonies of Japanese knotweed were observed growing along the bank of the Merrimack River directly off the trail itself. Densities exceeded 50-100 stems in areas, creating a "wall-like" barrier from the edge of the trail to the forested uplands on the trail's forested side.
Pemberton State Park						
Fallopia japonica	Japanese Knotweed	Throughout the study area	4 – Widespread	Invasive	1 of 1	Observed throughout the study area with numerous colonies growing along the fenceline of the Merrimack River directly off the walking trail that runs parallel to the river. Densities exceeded 100 stems in areas, creating a "wall-like" barrier from the edge of the fenceline to the scrub-shrub dominant uplands of the river's bank. Observed growing among other invasive plant conglomerates which generally included oriental bittersweet, Norway maple, and tree-of-heaven predominantly. Japanese knotweed exceeded areal ground coverage of 75%. Total heights for some stands exceeded 7 ft vertically.

Genus species	Common Name	Primary General Location(s)	Distribution (Areal coverage; 1: *1-25%*, 2: *26-50%*, 3: *51-75%*, and 4: *76-100%*) (Localized or Widespread)	MIPAG Classification	Map No. (X of X)	Description/Site Assessment Notes
Acer platanoides	Norway Maple	Along fenceline and near Amesbury Street	2 – Widespread	Invasive	1 of 1	Predominantly observed at the seedling and sapling life stages. Very few mature, adult Norway maple individuals were documented. Grew among other invasive plant conglomerates of oriental bittersweet and Japanese knotweed; with an abundance situated along the fenceline between the walking trail and Merrimack River. In the forested edges between Pemberton State Park and Amesbury Street, Norway maple grew at sapling to young tree stages with seedling offspring visible on the forest floor. Densities among aboveground individuals along fenceline stayed within 5-10 stems per colonized cluster in areas. Near Amesbury Street, densities exceed 10+ stems in some areas.
Cynanchum louiseae	Black Swallow-wort	In garden bed along wooden bridge of walking trail and near bank pavilion	3 - Localized	Invasive	1 of 1	Observed in small, isolated patches near the wooden bridge walking path in a garden bed and near the bank pavilion area adjacent to wooden bridge. Patches were ground level and most did not exceed a total “vine” length of approximately 3-4 ft. Stem counts for this cluster were approximately 2-3 main stems for areas with a few additional sub-stems likely growing from the base taproot below surface. One large stem exceeded 5 ft in length and was observed climbing a tree-of-heaven sapling in the same garden bed. Approximate areal coverage for clusters ranged from 25% to as high as 50%.

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Ailanthus altissima	Tree-of-Heaven	Throughout study area	4 – Widespread	Invasive	1 of 1	Primarily concentrated along the fenceline of the Merrimack River bank and walking trail. Sapling to young trees were generally abundant along bank and many within the interior forested areas of Pemberton State Park. For those within the interior, DBHs exceeded 6-8 in at times. For tree-of-heavens along the bank, many were within the sapling level stage and were very well abundant throughout the entire stretch. Some observed individuals exceeded 8 ft in height and DBHs of 3-4 in. They generally were within other invasive plant conglomerates that included oriental bittersweet and Norway maple. For bank groups, stem counts exceeded 10 in areas for some colonies. In the interior, stem counts were generally less than 5 for areas but had a greater abundance of mature trees as compared to those on the bank.
Celastrus orbiculatus	Oriental Bittersweet	Throughout study area.	4 – Widespread	Invasive	1 of 1	Observed throughout the study area, with the highest concentrations along the Merrimack River bank. Dense areas of oriental bittersweet were noted in several locations, with some vines growing from other neighboring vegetation. Stem counts or colonization estimate are not practical due to the abundance and density of oriental bittersweet observed throughout the 2025 growing season. In areas, oriental bittersweet represents true landscape dominance.

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Berberis thunbergii	Japanese Barberry	Throughout study area	2 - Localized	Invasive	1 of 1	Observed throughout the study area, with patches established across its full extent, particularly in the forested interior of the park. Patch heights generally did not exceed 3 ft, though some clumps containing 20 stems or more in areas. While not the most dominant invasive species within the study area, Japanese barberry was well established in the interior terrestrial upland areas. Very few clumps were found along the Merrimack River bank side of Pemberton State Park. Clumps were smaller in height, approximately 2-3 ft, and have a stem count of approximately 5-10 stems in areas.
Frangula alnus	Glossy Buckthorn	Forested interior and forested edge near Amesbury Street.	4 - Widespread	Invasive	1 of 1	Densest at the mid-canopy of the forested interior and forested edge near Amesbury Street. Numerous saplings, approximately 5-10 ft in height with a diameter at DBH of about 1 in, were observed. Stem counts exceeded 5-10 individuals in areas.
Robinia pseudoacacia	Black locust	Forested interior and forested edge near Amesbury Street.	4 - Widespread	Invasive	1 of 1	Observed in sporadic clumps throughout the terrestrial upland areas of Pemberton State Park. Individuals were generally saplings and very few trees were found. The greatest density of black locust was observed in the forested interior areas of the park directly off the paved walking paths and granite stairs. For saplings identified, colonies consisted of approximately 3-4 stems.
Nunzio DiMarca Park						

Genus species	Common Name	Primary General Location(s)	Distribution (Areal coverage; 1: *1-25%*, 2: *26-50%*, 3: *51-75%*, and 4: *76-100%*) (Localized or Widespread)	MIPAG Classification	Map No. (X of X)	Description/Site Assessment Notes
Celastrus orbiculatus	Oriental Bittersweet	Throughout study area.	4 – Widespread	Invasive	1 of 1	Observed throughout the study area, with the highest concentrations along the banks and around the terrestrial areas of the helical walking path. Dense areas of oriental bittersweet were noted in several locations, with some vines growing from other neighboring vegetation. Oriental bittersweet was also found growing around the trunk of a northern catalpa (*Catalpa speciosa)* with an approximate DBH of 10 in. Stem counts or colonization estimate are not practical due to the abundance and density of oriental bittersweet observed throughout the 2025 growing season. In areas, polygons reflect true landscape dominance.
Fallopia japonica	Japanese Knotweed	Throughout the study area	4 – Widespread	Invasive	1 of 1	Observed throughout the study period with numerous colonies growing along the terrestrial bank of the North Canal and around the helical walking path hillsides. Densities exceeded 100 stems, creating a “wall-like” barrier from the edge of the bank and hillside to the grass lawn and walking trail, respectively. Colonies can be best characterized as dense and dominant. Approximate areal coverage nears 100% in polygons.

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Ailanthus altissima	Tree-of-Heaven	Throughout study area	4 – Widespread	Invasive	1 of 1	Densely concentrated along the fenceline of the North Canal bank where water drains back into the Merrimack River and along numerous levels of the helical walking path's terrestrial hillsides. Trees exceeded DBHs of 6 in at times. Observed amoung other invasive plant conglomerates that included oriental bittersweet, Japanese knotweed, and Japanese barberry. Stem counts exceeded 15 for some colonies in areas. Near the back side of the helical walking trail, tree-of-heaven trees were observed growing amongst stands of staghorn sumac (*Rhus typhina)*. Differentiation between the two became more evident near the middle to end of the growing season when flowering and full leaf development occurred. Between June 11, 2025, and June 19, 2025, survey days, biologists observed the park's hill, which consisted mostly of tree-of-heaven was cut and mowed by groundcrew. Mowed grass was the only remaining aboveground biomass found at the hill by June 19, 2025. Please review figures below for visual representation.
Berberis thunbergii	Japanese Barberry	Throughout study area	2 - Localized	Invasive	1 of 1	Observed throughout the study area, with patches established across its full extent, particularly along the terrestrial hillside of the North Canal where it drains into the Merrimack River. Patch heights at times exceeded 3 ft with some clumps containing 20 stems or more in areas. Japanese barberry was well established along the park's outer exterior edge between the tree line and mowed grass lawn area. Very few clumps were found along the Merrimack River bank side or within the hillside of the helical trail. Clumps were smaller in height, approximately 2-3ft, and have a stem count of approximately 5 to 6 stems.

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Alliaria petiolata	Garlic Mustard	Hillsides of helical trail	4 - Widespread	Invasive	1 of 1	Observed along the helical walking trail's terrestrial hillside. Densely populated near and within the homeless encampment behind the park's hill and directly adjacent to a prolific Japanese knotweed stand. Stands covered the entire landscape's floor with ground coverage for some areas at or near 80-90% coverage.
Phalaris arundunacea	Reed Canary-Grass	North Canal hillsides	4 – Widespread	Invasive	1 of 1	Observed along both sides of the North Canal hillsides . Reed canary-grass grew to heights exceeding 4-5 ft and had an areal coverage of approximately 95% in areas. On June 10, 2025, biologists observed maintenance workers trimming the North Canal banks, significantly reducing the reed canary-grass stand to its roots and belowground biomass. Please review figures below for visual representation.
Rosa multiflora	Multiflora Rose	Hillside of helical trail	3 – Widespread	Invasive	1 of 1	Observed along the back hillside of the helical trail growing amongst other invasive plant conglomerates of tree-of-heaven, garlic mustard, oriental bittersweet, and Japanese knotweed. Density at times exceeded 5-10 stems per cluster in areas and rose to heights no greater than 4 ft. Some areas of the park were blockaded by multiflora rose "walls" where access to the other site was nearly impossible due to thickness of wrapped stems and armature density.
Pyrus calleryana	Bradford Pear	North Canal Bank	2 - Localized	Likely Invasive	1 of 1	Observed along the North Canal bank. Two adult trees were planted in soil pits with mulched crowns near parking spots for the park. No signs of offspring were identified within the immediate vicinity of the adults during the survey period. Similar plantings as compared to what was observed at the Lawrence Heritage State Park site.

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Elaeagnus umbellata	Autumn Olive	Along helical trail	1 - Localized	Evaluated Plants Not Meeting Criteria	1 of 1	Observed growing in small, isolated clumps directly adjacent to the helical walking trail. Observed clumps did not exceed 3 ft and stem counts were found within groups of 2-3 in areas. No other occurrences of autumn olives were found at the park. It's worth noting that autumn olive observance occurred after groundcrews trimmed the hill between the survey days of June 11, 2025, and June 19, 2025.
Spicket River Greenway – Manchester Street Park						
Celastrus orbiculatus	Oriental Bittersweet	Throughout study area.	4 – Widespread	Invasive	1 of 7	Observed throughout the study area for both the Spicket River Greenway and Manchester Street Park with densities generally high throughout. Stem counts or colonization estimate are not practical due to the abundance and density of oriental bittersweet observed throughout the 2025 growing season.
Elaeagnus umbellata	Autumn Olive	Along Spicket River Greenway and in Railroad bed at Manchester Street Park	2 - Widespread	Evaluated Plants Not Meeting Criteria	1 of 7	Observed growing in small, isolated patches adjacent to the Spicket River Greenway near the Lawrence General Hospital. At Manchester Street Park, autumn olive was found growing amongst other invasive plant conglomerates of oriental bittersweet, garlic mustard, and black swallow-wort between the park's concrete wall and relic railroad bed. Observed clumps did not exceed 3 ft and stem counts were found within groups of no more than 2 stems per area. One large autumn olive was found along the Spicket River Greenway just passed the entrance to Manchester Street Park directly adjacent to a warehouse building. This bush was larger than 10 ft in height and had a stem count exceeding 10 stems in this area. Distribution was largely sporadic throughout the study area.

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Cynanchum louiseae	Black Swallow-wort	Railroad bed at Manchester Street Park	2 - Localized	Invasive	1 of 7	Observed in small, isolated patches in the railroad bed just above the Manchester Street Park's concrete wall near the playground area. Patches were ground level and grew mostly horizontally with the ground. Most did not exceed a total "vine" length of approximately 3-4 ft and were small string-like segments. Stem counts for clusters were approximately 3-4 main stems per area.
Robinia pseudoacacia	Black Locust	Spicket River Greenway	4 – Widespread	Invasive	1 of 7	Observed throughout the bank corridor of the Spicket River and directly adjacent to the Spicket River Greenway. Observed individuals were large trees with DBHs greater than 10 in at times and mostly dominated the canopy of some areas. Stem counts generally ranged from 5-10. The greatest density of black locust was observed along the Spicket River Greenway between Chestnut Street, Short Street, and Manchester Street where stem counts exceeded 10. Bennington Street had the largest black locusts overall with trees as tall as 30 ft and DBHs exceeding ~10 in. For many parts of the Spicket River Greenway, black locust was the most dominant tree species at canopy level and generally succeeded in areal dominance as compared to native trees found, particularly green ash and red maple for some parts of the trail. Manchester Street Park had black locusts but were identified in the northern parts of the park where safety concerns were identified. No survey occurred in this area as a result.

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Alliaria petiolata	Garlic Mustard	Throughout study area	4 - Widespread	Invasive	1 of 7	Observed widespread at Manchester Street Park and along many segments of the Spicket River Greenway's grass edges. Densely populated along the railroad bed, community garden area, and grass lawn areas at Manchester Street Park. At Spicket River Greenway, large colonies of garlic mustard were observed between Bennington Street and Erving Avenue with total ground coverage at or near 80-90% coverage. Between Brook Street and Arrow Trail, garlic mustard took over much of the grassy areas adjacent to the trail and was observed throughout the study period. In areas where garlic mustard was found, density was greatest near the beginning of the survey period and slowly dissipated as the growing season prolonged. Ground coverage for some areas was at or near 90% coverage.
Euonymus alatus	Winged Euonymus	Segments along Spicket River Greenway	2 – Localized	Invasive	1 of 7	Observed in sporadic and localized clumps in three segments of the Spicket River Greenway study area. Particularly between Brook Street and Arrow Trail; Marion Avenue; and Chestnut Street, Short Street, and Marion Avenue. Stem count generally ranged from 2-3 young stems in areas and were less "full" as compared to others observed in other areas. Establishment was sporadic and in small clumps between 3-4 ft in height with an approximate areal perimeter of 4-5 ft wide and generally occurred along the upland bank of the Spicket River Greenway.

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Phalaris arundunacea	Reed Canary-Grass	Manchester Street Park	3 – Widespread	Invasive	1 of 7	Observed in dense, thick stands along the railroad bed and within the immediate bank of the Spicket River at Manchester Street Park. Reed canary-grass stands grew as tall as 6-7 ft with an approximate areal coverage nearing 95% in areas. Along the Spicket River, reed canary-grass grew amongst a dense stand of other invasive plant conglomerates that included phragmites (predominantly), oriental bittersweet, multiflora rose, common buckthorn, and tree-of-heaven. Reed canary-grass was not observed along any segments of the Spicket River Greenway trail.
Fallopia japonica	Japanese Knotweed	Throughout the study area	4 – Widespread	Invasive	1 of 7	Observed throughout the study period. Numerous colonies of Japanese knotweed were observed growing along the bank of the Spicket River for most Spicket River Greenway segments and within the railroad bed at Manchester Street Park. Densities exceeded 150 stems in areas, creating a "wall-like" barrier from the edge of the Spicket River bank and walking trail, respectively. Colonies can be best characterized as dense and dominant.
Acer platanoides	Norway Maple	Throughout study area	4 – Widespread	Invasive	1 of 7	Observed as the canopy cover tree along with black locust for most segments of the Spicket River Greenway. Grew among other invasive plant conglomerates of oriental bittersweet and Japanese knotweed. Densities among aboveground individuals along the Spicket River consisted of 1 dominant stem in areas. Numerous seedlings and saplings were found along the bank with heights as tall as 10-15 ft and seedling sprouts covering most of the upland ground. At Manchester Street Park, similar findings were found.

Genus species	Common Name	Primary General Location(s)	Distribution (Areal coverage; 1: *1-25%*, 2: *26-50%*, 3: *51-75%*, and 4: *76-100%*) (Localized or Widespread)	MIPAG Classification	Map No. (X of X)	Description/Site Assessment Notes
Berberis thunbergii	Japanese Barberry	Throughout study area	3 - Widespread	Invasive	1 of 7	Observed throughout the study area, with dense patches established across its full extent, particularly along the banks of the Spicket River. A few sporadic patches were found at Manchester Street Park growing in the railroad bed and near the pavilion area. Segments of the Spicket River Greenway where patches were prominent included areas near Marion Avenue and between Chestnut Street, Short Street, and Marion Avenue intersection. For the Spicket River Greenway observations, patch heights at times exceeded 3.5 ft with some clumps containing 10-15 stems or more in areas. At Manchester Street Park, densities were less and clumps were generally smaller, approximately 2-3 ft tall and 5-10 stems in a clump per area.
Rosa multiflora	Multiflora Rose	Throughout study area	4 – Widespread	Invasive	1 of 7	Observed at some segments of the Spicket River Greenway and extensively at Manchester Street Park near the Spicket River bank. Most occurrences were found directly along the river's bank creating a "wall-like" barrier to the wetted edge. Density at times exceeded 20 stems in a cluster per area and rose to heights greater than 4 ft.

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Lonicera morrowii	Morrow's Honeysuckle	Segments along Spicket River Greenway and along Spicket River at Manchester Street Park	2 – Localized	Invasive	1 of 7	Observed predominantly in three segments of the Spicket River Greenway, between Marion Avenue; Brook Street and Arrow Trail; and near Park Street. All occurrences of morrow's honeysuckle were within the Spicket River's banks and were densely established in large chunks. Some bushes exceeded 5 ft in height, had areal perimeters beyond 4-5 ft, and had stem counts greater than 5 in areas. Morrow's honeysuckle during some portions of the Spicket River Greenway segments created "wall-like" dominance and blockaded other vegetation from establishing. At Manchester Street Park, morrow's honeysuckle grew near the pavilion area directly adjacent to the right descending bank (downstream view) of the Spicket River.
Phragmites australis	Phragmites	Spicket River near Manchester Street Park	4 – Widespread	Invasive	1 of 7	Observed both in 2024 and throughout the 2025 growing season along the wetland margins of the Spicket River near Manchester Street Park. This dense stand measured approximately 560 linear feet from one end of boundary to the other and had an areal ground coverage of approximately 90-100% in areas. This stand was found to be within an area dominated by other invasive plant conglomerates which included reed canary-grass in more wetter areas and oriental bittersweet, multiflora rose, Japanese knotweed, common buckthorn, tree-of-heaven, and autumn olive in upland bank areas. Stand heights exceeded 7-8 ft in some areas.

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Ailanthus altissima	Tree-of-Heaven	Throughout study area	4 – Widespread	Invasive	1 of 7	Observed at Manchester Street Park primarily within the relic railroad bed and along the Spicket River Greenway. Some trees along the Spicket River banks exceeded DBHs of 8 in. For those specific trees, many were within canopy level coverage or at least mid-canopy. At the canopy they were within other invasive plant conglomerates that included black locust and Norway maple. At Manchester Street Park, seedling to sapling levels were most abundant and dense with stem counts exceeding 7 for some colonies. Limited seedling and sapling level tree establishment along the Spicket River banks was observed.
Lonicera tatarica	Tatarian Honeysuckle	Spicket River Greenway	2 – Localized	*Likely Invasive*	1 of 7	Observed along the upland areas to the Spicket River near Erving Street and Bennington Street. Identification of the species occurred during its flowering stage where bright light pink to dark pink flowers were in bloom for approximately 2 weeks. This species was found in sporadic patches of approximately 7-8 stems per area growing amongst other invasive plant conglomerates of morrow's honeysuckle, multiflora rose, oriental bittersweet, and Japanese knotweed to name a few. No other occurrence of the species was found in the study area. For patches observed, heights were approximately 5ft with an areal diameter of approximately 8 ft for some.
Frangula alnus	Glossy Buckthorn	Spicket River Greenway	3 - Widespread	Invasive	1 of 7	Observed at Spicket River Greenway segments between Erving Avenue, Bennington Street, Brook Street, and Arrow Trail. Some sporadic patches were found at the Manchester Street Park near the Pavilion area but were less prevalent as compared to areas along the Greenway. Numerous saplings, approximately 5-10 ft in height with a DBH of about 1 in, were observed. Stem count for saplings exceeded 8+ individuals per area.

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Myriophyllum heterophyllum	Variable Leaved Milfoil	Spicket River near pavilion area to Manchester Street Park	4 – Widespread	Invasive	1 of 7	Observed along the immediate river-right bank of the Spicket River near the pavilion area at Manchester Street Park. While the infestation likely extends further into the river, observation was limited from just the Spicket River Greenway. In several areas, variable-leaved milfoil occurred at very high densities and was documented throughout all river bends in the vicinity of Manchester Street Park. In areas observable from the Spicket River Greenway, areal coverage from viewing the surface water extended beyond 90-100% in areas.
Gleditsia triacanthos	Honey Locust	Spicket River Greenway near Daisy Street and Marion Avenue	1 – Localized	Honey locust is not a listed MIPAG species but has invasive properties and is listed as invasive in other neighboring states. This species was added to the table for reference purposes only.	1 of 7	Observed along the Spicket River Greenway near Daisy Street and Marion Avenue and directly adjacent to William Kennedy Community Park. Trees were planted in soil pits adjacent to the trail. Some seedling offspring were found growing around the immediate base of adult trees. Planted trees were between 10-15 ft tall with DBHs approximately 4-6 in. Honey locust was not observed anywhere else in the study area.
Lythrum salicaria	Purple Loosestrife	Spicket River near pavilion area to Manchester Street Park	4 – Widespread	Invasive	1 of 7	Observed growing in dense clumps along the Spicket River near the pavilion area to Manchester Street Park. It was observed growing amongst other invasive conglomerates that include phragmites and reed canary-grass predominately. Purple loosestrife was approximately 5 ft tall with an approximate diameter of 3-4 ft wide in some locations. In areas, purple loosestrife exceeded 5 stems per area. Purple loosestrife occurred throughout the entire wetland margins separating Spicket River's wetted edge to the park's terrestrial boundary / concrete wall for the Spicket River Greenway trail.

Genus species	Common Name	Primary General Location(s)	Distribution (Areal coverage; 1: *1-25%*, 2: *26-50%*, 3: *51-75%*, and 4: *76-100%*) (Localized or Widespread)	MIPAG Classification	Map No. (X of X)	Description/Site Assessment Notes
Lawrence Riverfront State Park						
Fallopia japonica	Japanese Knotweed	Throughout the study area	4 – Widespread	Invasive	1 of 3	Observed throughout the study area with numerous colonies growing along the hillside where the Merrimack River Trail enters the Lawrence Riverfront State Park as well as along the trailered-boat parking lot terrestrial hill. Densities exceeded 500 stems, creating a "wall-like" barrier from the areas its separated. Japanese knotweed stands exceeded 6-8 ft in height and dominated much of the terrestrial land it was observed in.
Celastrus orbiculatus	Oriental Bittersweet	Throughout study area.	4 – Widespread	Invasive	1 of 3	Observed throughout the study area with high densities particularly within the interior forested trails area of the park. Biologists observed some vines growing from other neighboring vegetation and strangling the trucks of native trees like red oak and shagbark hickory (*Carya ovata)*. Stem counts or colonization estimate are not practical due to the abundance and density of oriental bittersweet observed throughout the 2025 growing season.
Acer platanoides	Norway Maple	Throughout study area	4 – Widespread	Invasive	1 of 3	Observed throughout the interior forested walking trail area of Lawrence Riverfront State Park, generally at the seedling sapling level. Grew among other invasive plant conglomerates of oriental bittersweet and Japanese knotweed predominately. Densities among seedlings and saplings ranged as high as 7-10 stems within areas to as little as just a few. Numerous saplings to trees were found along the Merrimack River's bank with heights as tall as 20 ft.

Genus species	Common Name	Primary General Location(s)	Distribution (Areal coverage; 1: *1-25%*, 2: *26-50%*, 3: *51-75%*, and 4: *76-100%*) (Localized or Widespread)	MIPAG Classification	Map No. (X of X)	Description/Site Assessment Notes
Lonicera morrowii	Morrow's Honeysuckle	Forested trails area	4 – Widespread	Invasive	1 of 3	Observed throughout the interior forested trail area of Lawrence Riverfront State Park. Some bushes exceeded 5 ft and had areal diameters beyond 4-5 ft. Occurrences of Morrow's honeysuckle were found within the terrestrial edge of the Merrimack River bank and trailered-boat parking area. Most patches were sporadic and offset between open shoreline gaps and other invasive plants. Stem counts exceeded 5 to 10 per area.
Ailanthus altissima	Tree-of-Heaven	Throughout study area	4 – Widespread	Invasive	1 of 3	Observed throughout Lawerence Riverfront State Park, particularly near the Merrimack River bank and interior forested trails area. Some trees along the Merrimack River bank had DBHs within a few inches and were mostly at the sapling level life stage. Along the park's outward extended boundary, many tree-of-heaven saplings were observed but as you moved toward the interior zone, abundance was reduced. Approximate stem counts were 3-5 per area for some areas within the study area.
Lonicera tatarica	Tatarian Honeysuckle	Merrimack River bank	1 – Localized	Likely Invasive	1 of 3	Observed along the bank of the Merrimack River in an area between the entrance gate to Lawrence Riverfront State Park and the Merrimack River Trail. Identification of the species occurred during its flowering stage where bright light pink to rose flowers were in bloom for approximately 2 weeks. This species was found in 2 large, isolated patches between other invasive plant conglomerates of oriental bittersweet, Morrow's honeysuckle, and Japanese barberry to name a few. For patches observed, heights were approximately 6-7 ft and more with an aerial diameter of approximately 10 ft for some.

Genus species	Common Name	Primary General Location(s)	Distribution (Areal coverage; 1: *1-25%*, 2: *26-50%*, 3: *51-75%*, and 4: *76-100%*) (Localized or Widespread)	MIPAG Classification	Map No. (X of X)	Description/Site Assessment Notes
Elaeagnus umbellata	Autumn Olive	Along walking trails	3 - Widespread	Evaluated Plants Not Meeting Criteria	1 of 3	Observed growing in small, isolated patches along the paved walking trails, particularly near the interior forested areas. Autumn olive was found growing amongst other invasive plants conglomerates of oriental bittersweet and Morrow's honeysuckle. Observed bushes exceeded 5 ft or more and with 20+ stems per area. At some locations, autumn olive had stem counts that exceeded 10-15 stems per bush and created dense thickets.
Berberis thunbergii	Japanese Barberry	Throughout study area	3 - Widespread	Invasive	1 of 3	Observed throughout the study area, with dense patches established across its full extent, particularly with stands of Japanese knotweed. A few sporadic patches were found along the Merrimack River bank growing near other documented invasive plants. Patch heights for those growing near the Japanese knotweed stands at times were low growing and did not exceed 3 ft. Generally, these clumps contained a few stems at most. Near the Merrimack River bank, densities were greater and clumps were generally larger, approximately 3 ft tall and 10-15 stems per bush.
Frangula alnus	Glossy Buckthorn	Interior forested trails area	2 - Widespread	Invasive	1 of 3	Observed mostly within the interior forested trails area of the park where numerous saplings, approximately 5-10 ft in height with a DBH of about 1 in, were identified. Very few seedlings were present along the forest floor, and the species was most abundant at a low- to mid-canopy coverage level. For sapling colonies identified, stem counts were around 5 individuals. Larger buckthorns were rarer and limited in abundance. A few buckthorn saplings were found growing along the Merrimack River bank and generally shared similar heights and distributions as those found in the interior forested area.

Genus species	Common Name	Primary General Location(s)	Distribution (Areal coverage; 1: *1-25%*, 2: *26-50%*, 3: *51-75%*, and 4: *76-100%*) (Localized or Widespread)	MIPAG Classification	Map No. (X of X)	Description/Site Assessment Notes
Lonicera japonica	Japanese honeysuckle	Interior forested trails edge	3 – Widespread	Invasive	1 of 3	Observed growing along the interior forested trails edge within proximity to the Japanese knotweed stand near the Merrimack River Trail trailhead entrance. Japanese honeysuckle was dense and aggressive, climbing up and along other vegetation's stems, branches, and leaflet sets. All occurrences were within the forested edge and directly adjacent to the paved walking trails of Lawrence Riverfront State Park. If Japanese honeysuckle stems were stretched out, lengths would likely exceed 10 ft. Stem counts or colonization estimate are not practical due to the abundance and density of Japanese honeysuckle observed throughout the 2025 growing season.
Iris pseudacorus	Yellow Iris	Merrimack River shoreline	2 - Widespread	Invasive	1 of 3	Observed in sporadic patches all throughout the immediate riparian shorelines of the Merrimack River. Patches were small, approximately 2-3 ft in diameter coverage with heights less than 2 ft. The greatest density of yellow iris was near the entrance gate to the Merrimack River Trail and trailered-boat parking area. Abundance decreased as you walked closer to the park's boat launch. Stem counts exceeded 3 per area.
Oxford Park						
Ailanthus altissima	Tree-of-Heaven	Along Spicket River banks	4 – Widespread	Invasive	1 of 1	Observed along the banks of the Spicket River and on the hillside near Canal Street Bridge. Diameter at breast height of the documented trees ranged from a few inches to more than 10 inches, and the species frequently dominated the limited local canopy. Stem counts exceeded 8 per area.

Genus species	Common Name	Primary General Location(s)	Distribution (Areal coverage; 1: *1-25%*, 2: *26-50%*, 3: *51-75%*, and 4: *76-100%*) (Localized or Widespread)	MIPAG Classification	Map No. (X of X)	Description/Site Assessment Notes
Cynanchum louiseae	Black Swallow-wort	Along Spicket River banks	3 - Widespread	Invasive	1 of 1	Observed in dense patches near the Spicket River bank and within areas dominated by tree-of-heaven. Patches were ground level and most exceeded a total "vine" length of approximately 5-6+ ft if stretched out. Stem counts for this population exceeded 20 stems.
Robinia pseudoacacia	Black Locust	Throughout study area	4 - Widespread	Invasive	1 of 1	Observed and documented primarily at the sapling and tree level. Most observed growing amongst tree-of-heaven along the Spicket River bank at heights exceeding 15 ft with DBHs greater than 10 in for some. Numerous saplings were found growing along the hillside near Canal Street Bridge. Stem counts well exceeded 10.
Alliaria petiolata	Garlic Mustard	Throughout study area	4 - Widespread	Invasive	1 of 1	Observed throughout the study area with the largest concentration of garlic mustard along the hillside near Canal Street Bridge. Garlic mustard dominated the ground with nearly 100% areal coverage.
Celastrus orbiculatus	Oriental Bittersweet	Throughout study area.	4 – Widespread	Invasive	1 of 1	Observed throughout the study area with densities greatest in the garden beds adjacent to the Spicket River Greenway trail and along the Spicket River forested banks within the study area. Stem counts or colonization estimate are not practical due to the abundance and density of oriental bittersweet observed throughout the 2025 growing season.
Frangula alnus	Glossy Buckthorn	Garden beds near Spicket River Greenway towards park's northern boundary	3 - Localized	Invasive	1 of 1	Observed at the seedling level within the garden beds adjacent to the Spicket River Greenway Trail near the northern boundary of the park. Seedling heights were approximately 2-3 ft with a DBH no greater than 1 in, were identified. Stem counts were around 3-4 individuals.

Genus species	Common Name	Primary General Location(s)	Distribution (Areal coverage; 1: *1-25%*, 2: *26-50%*, 3: *51-75%*, and 4: *76-100%*) (Localized or Widespread)	MIPAG Classification	Map No. (X of X)	Description/Site Assessment Notes
Phalaris arundunacea	Reed Canary-Grass	Garden beds near Spicket River Greenway towards park's northern boundary	4 – Localized	Invasive	1 of 1	Observed in dense, thick stands within the garden beds adjacent to the Spicket River Greenway Trail near the northern boundary of the park. Reed canary-grass overtook most of the garden bed's available area, with stand heights exceeding 4 ft by August 2025. An approximate areal coverage was between 76-100% and was amongst a dense stand of other invasive plant conglomerates particularly oriental bittersweet, multiflora rose, and glossy buckthorn.
Rosa multiflora	Multiflora Rose	Garden beds near Spicket River Greenway towards park's northern boundary	2 – Localized	Invasive	1 of 1	Observed in dense, thick bushes within the garden beds adjacent to the Spicket River Greenway Trail near the northern boundary of the park. Density at times exceeded 15 stems in a cluster and rose to heights between 2-3 ft. Multiflora rose grew more horizontally than vertically in the garden beds, which generally differed when compared to other observed growth patterns at other recreation sites during this study.

Appendix G

North Canal Vegetation Survey Results - Tables and Maps

Table G-1 Lawrence Hydroelectric Project North Canal Vegetation Polygon Inventory

Polygon Number	Date	Dominate Species	Acres	Square Footage	Notes
VP-01	10/30/2024	Oriental bittersweet	0.0161	702.29	Oriental bittersweet with interstitial Tree-of heaven, and Multiflora rose
VP-02	10/30/2024	Tree-of-heaven	0.0159	692.58	Additional oriental bittersweet along fence line
VP-03	10/30/2024	Oriental bittersweet	0.0036	156.61	Not applicable (N/A)
VP-04	10/30/2024	Japanese knotweed	0.0077	337.04	Japanese knotweed on bridge and street corner, this includes oriental bittersweet
VP-05	10/30/2024	Tree-of-heaven	0.0174	757.42	Tree-of heaven dominate with black locust and oriental bittersweet as subdominant
VP-06	5/20/2025	Reed canary grass	0.0101	441.57	Scattered mugwort and spotted knapweed also identified
VP-07	5/20/2025	Spotted knapweed	0.0038	167.14	Multiple plants along hillside
VP-08	10/30/2024	Tree-of-heaven	0.0021	90.27	Multiple stumps with new growth sprouting
VP-09	5/20/2025	Oriental bittersweet	0.0081	353.76	Multiple vines observed
VP-10	5/20/2025	Spotted knapweed	0.0273	1187.00	Multiple plants with scattered sheep's sorrel
VP-11	5/20/2025	Tree-of-heaven	0.0079	342.11	Interstitial Spotted knapweed, mugwort and sheep sorrel
VP-12	10/30/2024	Spotted knapweed	0.0004	19.18	N/A
VP-13	10/30/2024	Spotted knapweed	0.0010	45.22	Tree-of-heaven and mugwort
VP-14	10/30/2024	Tree-of-heaven	0.0016	68.10	N/A
VP-15	10/30/2024	Oriental bittersweet	0.0020	88.63	N/A
VP-16	10/30/2024	Reed canary grass	0.0140	609.04	Reed canary dominate with scattered mugwort
VP-17	10/30/2024	Purple loosestrife	0.0466	2029.64	Scattered mugwort and reed canary grass with Japanese creeper covering canal wall
VP-18	10/30/2024	Other	0.0203	882.40	Japanese creeper growing along canal wall. Scattered reed canary grass, purple loosestrife and mugwort. Additional spring cinquefoil
VP-19	10/30/2024	Reed canary grass	0.0085	368.32	N/A
VP-20	10/30/2024	Other	0.0140	607.65	Japanese creeper growing along canal wall. Small cluster of black locust, ADD black swallow wort
VP-21	10/30/2024	Other	0.0027	115.80	Japanese creeper
VP-22	10/30/2024	Reed canary grass	0.0050	219.10	Japanese creeper, cinquefoil, sheep sorrel
VP-23	5/20/2025	Other	0.0231	1005.04	Virginia creeper, silver cinquefoil, jap knot, mugwort
VP-24	5/20/2025	Reed canary grass	0.0086	373.05	Cut leaf blackberry, silver cinquefoil, mugwort, oriental bittersweet, sheep sorrel
VP-25	10/30/2024	Reed canary grass	0.0072	313.50	Cluster of reed canary, mugwort, and black locust

Polygon Number	Date	Dominate Species	Acres	Square Footage	Notes
VP-26	10/30/2024	Reed canary grass	0.0065	281.29	Reed canary grass dominate with scattered TOH, mugwort, bittersweet nightshade, and black locust
VP-27	5/20/2025	Other	0.0023	101.93	Cutleaf blackberry, Tree-of-heaven, and mugwort scattered throughout canal wall.
VP-28	10/30/2024	Oriental bittersweet	0.0260	1130.67	Oriental bittersweet with scattered tree of heaven
VP-29	10/30/2024	Tree-of-heaven	0.0353	1537.26	Tree-of-heaven dominant with black locust, reed canary grass, Cutleaf blackberry, bittersweet nightshade, oriental bittersweet, and Japanese creeper scattered throughout.
VP-30	10/30/2024	Tree-of-heaven	0.0059	254.95	Several clusters of managed stumps and regrowth
VP-31	10/30/2024	Tree-of-heaven	0.0921	4010.79	Also clusters of tree or heaven, glossy buckthorn, purple loosestrife, oriental bittersweet, reed canary grass, bittersweet nightshade
VP-32	10/30/2024	Oriental bittersweet	0.0143	624.78	Bittersweet growing up fence and canal structure. Japanese creeper - scattered throughout canal structure
VP-33	10/30/2024	Reed canary grass	0.0805	3507.64	Reed canary dominant, swallow-wort, Phragmites and oriental bittersweet scattered throughout.
VP-34	10/30/2024	Tree-of-heaven	0.0253	1101.55	Conglomerate or Tree-of-heaven and Oriental bittersweet
VP-35	10/30/2024	Oriental bittersweet	0.0124	540.72	Scattered
VP-36	5/20/2025	Japanese knotweed	0.0208	904.12	N/A
VP-37	10/30/2024	Oriental bittersweet	0.0075	324.74	Multiple vines
VP-38	10/30/2024	Oriental bittersweet	0.0478	2081.17	Scattered stems and clumps
VP-39	5/20/2025	Tree-of-heaven	0.0006	24.79	Multiflora rose, Oriental bittersweet
VP-40	10/30/2024	Reed canary grass	0.0040	176.10	N/A
VP-41	10/30/2024	Japanese knotweed	0.0026	113.22	Short dense stand.
VP-42	5/20/2025	Reed canary grass	0.0185	804.69	N/A
VP-43	10/30/2024	Japanese knotweed	0.0048	210.30	Moderate cluster
VP-44	5/20/2025	Other	0.0023	102.08	St. John’s wort
VP-45	5/20/2025	Black locust	0.0011	48.45	Poison ivy, mugwort, bittersweet nightshade
VP-46	10/30/2024	Purple loosestrife	0.0015	63.33	Few scattered stems
VP-47	5/20/2025	Other	0.0032	137.30	Scattered mugwort & yellow salsify
VP-48	10/30/2024	Oriental bittersweet	0.0435	1894.22	Scattered bittersweet, Japanese creeper, black locust, tree of heaven, purple loosestrife, and common mugwort.
VP-49	5/20/2025	Other	0.0644	2803.14	Sheep sorrel, scattered mugwort, silver cinquefoil, yellow salsify
VP-50	5/20/2025	Other	0.0009	39.14	Sheep sorrel
VP-51	10/30/2024	Oriental bittersweet	0.0062	267.99	Also, mugwort, loosestrife, Japanese knotweed, black locust, and buckthorn

Polygon Number	Date	Dominate Species	Acres	Square Footage	Notes
VP-52	10/30/2024	Oriental bittersweet	0.0057	246.57	Multiple stems along canal wall, also scattered mugwort
VP-53	10/30/2024	Oriental bittersweet	0.0016	67.79	Several clusters and Japanese knotweed
VP-54	10/30/2024	Oriental bittersweet	0.0001	3.55	Moderate cluster
VP-55	5/20/2025	Spotted knapweed	0.0004	17.95	N/A
VP-56	10/30/2024	Oriental bittersweet	0.0008	34.22	Scattered along canal wall
VP-57	10/30/2024	Oriental bittersweet	0.0002	8.31	2 stems of Japanese knotweed
VP-58	10/30/2024	Oriental bittersweet	0.0111	482.20	Also 4 clumps of black locust
VP-59	10/30/2024	Oriental bittersweet	0.0093	404.17	Scattered stems
VP-60	10/30/2024	Oriental bittersweet	0.0044	193.69	Also, mugwort and small patches of reed canary
VP-61	5/20/2025	Oriental bittersweet	0.0016	69.13	With scattered bittersweet nightshade
VP-62	5/20/2025	Reed canary grass	0.0023	101.98	Mix of Reed canary grass, Bittersweet nightshade, Jap knott, black locust
VP-63	10/30/2024	Tree-of-heaven	0.0031	133.67	Conglomerate including buckthorn, black locust, mugwort and oriental bittersweet
VP-64	5/20/2025	Phragmites	0.0122	531.80	Conglomerate of young black locust, CR, BSNS,
VP-65	5/20/2025	Morrow's honeysuckle	0.0346	1507.45	Bittersweet, canary reed grass, jap knot, Bradford pear, black swallow wort, mugwort
VP-66	5/20/2025	Tree-of-heaven	0.0232	1011.50	Oriental Bittersweet identified in polygon
VP-67	10/30/2024	Oriental bittersweet	0.1499	6529.33	Scattered tree-of-heaven, spotted knapweed, and black locust.
VP-68	10/30/2024	Spotted knapweed	0.0009	40.77	N/A

Table G-2: Lawrence Hydroelectric Project North Canal Vegetation Polyline Inventory

Vegetation Polyline Number	Date	Dominate Species	Line length (Ft)	Notes
VL-01	10/30/2024	Tree-of-heaven	179.70	Oriental bittersweet, tree-of-heaven, black locust, some mugwort
VL-02	5/20/2025	Other	27.79	Mugwort, sheep sorrel, bittersweet nightshade
VL-03	5/20/2025	Other	127.35	Scattered mugwort, spring cinquefoil, sheep sorrel, spotted knapweed
VL-04	5/20/2025	Other	128.82	Japanese creeper with a mix of poison ivy
VL-05	5/20/2025	Other	54.41	Yellow toadflax
VL-06	5/20/2025	Other	27.93	Sheep sorrel
VL-07	5/20/2025	Other	80.64	Silver cinquefoil
VL-08	5/20/2025	Poison Ivy	80.29	Poison ivy
VL-09	10/30/2024	Other	89.57	Mugwort and reed canary and waterborne trash along canal wall and water's edge
VL-10	5/20/2025	Oriental bittersweet	81.37	Scattered & mugwort
VL-11	10/30/2024	Glossy buckthorn	69.27	Buckthorn atop canal wall, cut and managed
VL-12	5/20/2025	Oriental bittersweet	82.59	Scattered
VL-13	10/30/2024	Black locust	136.27	celestris sporadic, TOH sporadic
VL-14	10/30/2024	Oriental bittersweet	27.52	along top of canal wall, cut and managed
VL-15	10/30/2024	Oriental bittersweet	244.60	scattered along wall with Tree-of-heaven, no RR access to this section
VL-16	10/30/2024	Oriental bittersweet	135.53	Located along canal wall fence

Table G-3 Lawrence Hydroelectric Project North Canal Vegetation Point Inventory

Vegetation point Number	Date	Dominate Species	Notes
P-001	5/20/2025	Oriental bittersweet	Confirmed polygon
P-002	5/20/2025	Oriental bittersweet	N/A
P-003	5/20/2025	Tree-of-heaven	Confirmed polygon
P-004	5/20/2025	Japanese knotweed	Confirmed with OBS
P-005	10/30/2024	Japanese knotweed	Located under bridge
P-005	10/30/2024	Japanese knotweed	Located under bridge, Confirmed during spring survey
P-006	10/30/2024	Tree-of-heaven	Small cluster of young trees
P-007	10/30/2024	Tree-of-heaven	Small cluster of young trees
P-008	10/30/2024	Tree-of-heaven	Small cluster of young trees
P-009	10/30/2024	Oriental bittersweet	N/A
P-010	10/30/2024	Oriental bittersweet	N/A
P-011	10/30/2024	Tree-of-heaven	Stump with new growth
P-012	5/20/2025	Tree-of-heaven	Cluster of multiple young trees
P-013	5/20/2025	Black swallow wort	One plant
P-014	10/30/2024	Oriental bittersweet	N/A
P-015	10/30/2024	Oriental bittersweet	N/A
P-016	10/30/2024	Oriental bittersweet	Cluster of multiple vines
P-017	10/30/2024	Tree-of-heaven	Three Stumps with new growth
P-018	10/30/2024	Tree-of-heaven	N/A
P-019	10/30/2024	Tree-of-heaven	N/A
P-020	10/30/2024	Tree-of-heaven	N/A
P-021	5/20/2025	Tree-of-heaven	Multiple young trees
P-022	10/30/2024	Spotted knapweed	Multiple plants
P-023	10/30/2024	Spotted knapweed	N/A
P-024	10/30/2024	Tree-of-heaven	N/A
P-025	5/20/2025	Spotted knapweed	N/A
P-026	5/20/2025	Tree-of-heaven	Mugwort
P-027	10/30/2024	Black locust	N/A
P-028	10/30/2024	Spotted knapweed	N/A
P-029	10/30/2024	Oriental bittersweet	N/A
P-030	10/30/2024	Other	Mugwort
P-031	10/30/2024	Tree-of-heaven	N/A
P-032	10/30/2024	Tree-of-heaven	N/A

Vegetation point Number	Date	Dominate Species	Notes
P-033	10/30/2024	Other	Mugwort
P-034	10/30/2024	Oriental bittersweet	N/A
P-035	5/20/2025	Tree-of-heaven	Mugwort
P-036	10/30/2024	Black locust	N/A
P-037	10/30/2024	Other	Mugwort
P-038	10/30/2024	Tree-of-heaven	N/A
P-039	10/30/2024	Tree-of-heaven	Stumps with new growth.
P-040	5/20/2025	Spotted knapweed	N/A
P-041	10/30/2024	Tree-of-heaven	Stump with new growth.
P-042	10/30/2024	Tree-of-heaven	Stump with new growth.
P-043	10/30/2024	Tree-of-heaven	N/A
P-044	5/20/2025	Other	Bouncing bet/soapwort
P-045	10/30/2024	Spotted knapweed	N/A
P-046	10/30/2024	Other	Mugwort
P-047	10/30/2024	Other	Mugwort
P-048	10/30/2024	Tree-of-heaven	N/A
P-049	10/30/2024	Tree-of-heaven	Large stump in canal wall with new growth.
P-050	10/30/2024	Tree-of-heaven	Cluster of small trees
P-051	10/30/2024	Other	Mugwort
P-052	5/20/2025	Other	Mugwort
P-053	10/30/2024	Oriental bittersweet	N/A
P-054	10/30/2024	Tree-of-heaven	N/A
P-055	10/30/2024	Tree-of-heaven	Small tree growing in canal wall
P-056	5/20/2025	Other	Bittersweet nightshade multiple stems
P-057	10/30/2024	Tree-of-heaven	N/A
P-058	5/20/2025	Tree-of-heaven	One plant
P-059	5/20/2025	Oriental bittersweet	Multiple vines along canal wall
P-060	5/20/2025	Other	Mugwort - multiple plants growing out of canal wall
P-061	5/20/2025	Other	Mugwort - multiple plants growing out of canal wall
P-062	10/30/2024	Tree-of-heaven	Partially submerged in canal
P-063	5/20/2025	Purple loosestrife	Multiple plants
P-064	5/20/2025	Other	Bittersweet nightshade
P-065	5/20/2025	Other	Mugwort growing out of canal wall - multiple plants

Vegetation point Number	Date	Dominate Species	Notes
P-066	10/30/2024	Tree-of-heaven	N/A
P-067	5/20/2025	Norway maple	Sprouts from cut stump
P-068	10/30/2024	Oriental bittersweet	N/A
P-069	5/20/2025	Purple loosestrife	2 plants
P-070	5/20/2025	Purple loosestrife	5 plants
P-071	5/20/2025	Other	Bittersweet nightshade - One plant
P-072	5/20/2025	Purple loosestrife	One plant
P-073	5/20/2025	Purple loosestrife	One plant
P-074	10/30/2024	Other	Mugwort
P-075	10/30/2024	Other	Mugwort
P-076	10/30/2024	Black swallow-wort	Cluster of approximately 6 plants
P-077	5/20/2025	Black swallow-wort	Cluster of plants
P-078	5/20/2025	Other	Bittersweet nightshade - multiple plants
P-079	10/30/2024	Phragmites	Scattered plants
P-080	5/20/2025	Other	Bittersweet nightshade - multiple plants
P-081	10/30/2024	Other	Mugwort
P-082	10/30/2024	Other	Mugwort
P-083	10/30/2024	Black locust	Cluster of young trees
P-084	5/20/2025	Purple loosestrife	Multiple plants
P-085	5/20/2025	Bradford pear	Ornamental Park tree
P-086	5/20/2025	Bradford pear	Ornamental Park tree
P-087	5/20/2025	Bradford pear	Ornamental Park tree
P-088	10/30/2024	Other	Japanese creeper
P-089	10/30/2024	Other	Japanese creeper
P-090	10/30/2024	Other	Japanese creeper
P-091	5/20/2025	Other	Mugwort
P-092	10/30/2024	Tree-of-heaven	N/A
P-093	10/30/2024	Other	Mugwort
P-094	10/30/2024	Other	Japanese creeper
P-095	5/20/2025	Other	Bittersweet nightshade cluster
P-096	10/30/2024	Other	Common mugwort
P-097	10/30/2024	Black swallow-wort	N/A
P-098	10/30/2024	Other	Common mugwort
P-099	10/30/2024	Black locust	Cluster of small plants

Vegetation point Number	Date	Dominate Species	Notes
P-100	10/30/2024	Reed canary grass	N/A
P-101	10/30/2024	Black locust	Cluster of small trees
P-102	10/30/2024	Black locust	Cluster of small trees
P-103	10/30/2024	Black locust	Cluster of small trees
P-104	10/30/2024	Black locust	Cluster of small trees
P-105	5/20/2025	Other	Mulberry
P-106	10/30/2024	Purple loosestrife	N/A
P-107	10/30/2024	Other	Mugwort
P-108	10/30/2024	Oriental bittersweet	N/A
P-109	10/30/2024	Other	Mugwort
P-110	10/30/2024	Oriental bittersweet	Cluster around bridge structure/mugwort
P-111	10/30/2024	Japanese knotweed	Single plant
P-112	10/30/2024	Oriental bittersweet	Cluster around bridge structure
P-113	10/30/2024	Other	Cluster of mugwort
P-114	10/30/2024	Tree-of-heaven	Single small tree
P-115	10/30/2024	Other	Mugwort
P-116	10/30/2024	Reed canary grass	N/A
P-117	10/30/2024	Black locust	N/A
P-118	10/30/2024	Black locust	Cluster of young trees
P-119	10/30/2024	Reed canary grass	Small patch
P-120	10/30/2024	Other	Mugwort
P-121	10/30/2024	Tree-of-heaven	N/A
P-122	5/20/2025	Other	Bittersweet nightshade - multiple plants
P-123	5/20/2025	Other	Cutleaf blackberry - multiple plants
P-124	10/30/2024	Black locust	2 small clumps with several stems and some celestrus orbiculata
P-125	10/30/2024	Oriental bittersweet	N/A
P-126	10/30/2024	Oriental bittersweet	N/A
P-127	10/30/2024	Tree-of-heaven	1 cut stem with regrowth
P-128	5/20/2025	Other	Cutleaf blackberry - multiple plants growing out of canal wall
P-129	10/30/2024	Black locust	Small cluster of black locust growing on canal wall.
P-130	10/30/2024	Black locust	1 small cluster of stems
P-131	5/20/2025	Oriental bittersweet	Single vine growing up canal wall

Vegetation point Number	Date	Dominate Species	Notes
P-132	5/20/2025	Other	Mugwort - multiple plants
P-133	5/20/2025	Tree-of-heaven	2 stems
P-134	10/30/2024	Tree-of-heaven	1 stem
P-135	10/30/2024	Tree-of-heaven	Few stems on canal bottom
P-136	10/30/2024	Other	Japanese creeper
P-137	5/20/2025	Other	Cutleaf blackberry - large cluster
P-138	10/30/2024	Oriental bittersweet	Multiple stems in small cluster
P-139	10/30/2024	Black locust	Small clump, managed by cut
P-140	10/30/2024	Other	Japanese creeper
P-141	10/30/2024	Black locust	Few stems in small cluster
P-142	10/30/2024	Japanese knotweed	Five stems growing out of canal wall.
P-143	10/30/2024	Other	Japanese creeper
P-144	10/30/2024	Other	Japanese creeper
P-145	10/30/2024	Oriental bittersweet	N/A
P-146	5/20/2025	Other	Cutleaf blackberry - multiple plants
P-147	10/30/2024	Oriental bittersweet	N/A
P-148	10/30/2024	Tree-of-heaven	1 medium stem
P-149	10/30/2024	Tree-of-heaven	1 small clump
P-150	10/30/2024	Black swallow-wort	Small cluster with 5 small patches
P-151	10/30/2024	Black swallow-wort	Small cluster.
P-152	10/30/2024	Tree-of-heaven	2 cut and managed stems
P-153	10/30/2024	Black swallow-wort	3 small patches
P-154	10/30/2024	Black locust	Large clump of 50 stems
P-155	10/30/2024	Purple loosestrife	1-3 stem clump
P-156	5/20/2025	Purple loosestrife	Skeleton confirmed
P-157	5/20/2025	Oriental bittersweet	Polygon confirmed
P-158	5/20/2025	Oriental bittersweet	Polygon confirmed
P-159	5/20/2025	Tree-of-heaven	N/A
P-160	10/30/2024	Japanese knotweed	Small cluster, confirmed during spring survey
P-161	5/20/2025	Tree-of-heaven	N/A
P-162	5/20/2025	Tree-of-heaven	Multiple single trunk clumps
P-163	5/20/2025	Oriental bittersweet	N/A
P-164	5/20/2025	Oriental bittersweet	Polygon confirmed

Vegetation point Number	Date	Dominate Species	Notes
P-165	10/30/2024	Purple loosestrife	Single plant, not observed during spring survey
P-166	10/30/2024	Phragmites	Stunted Phragmites, area appears to be maintained.
P-167	5/20/2025	Reed canary grass	Confirmed
P-168	10/30/2024	Japanese knotweed	Single plant, confirmed during spring survey
P-169	10/30/2024	Oriental bittersweet	Couple of stems, confirmed during spring survey
P-170	10/30/2024	Phragmites	Single plant, confirmed during spring survey
P-171	5/20/2025	Japanese knotweed	Confirmed polygon
P-172	10/30/2024	Black locust	10-20 stems in small cluster, not observed during spring survey
P-173	10/30/2024	Japanese knotweed	Single plant
P-174	5/20/2025	Japanese knotweed	Polygon confirmed
P-175	5/20/2025	Oriental bittersweet	Along wall, mugwort
P-176	10/30/2024	Oriental bittersweet	Growing along canal wall
P-177	5/20/2025	Other	Sheep sorrel
P-178	10/30/2024	Tree-of-heaven	2 stems from 1 base, cut and managed
P-179	10/30/2024	Other	Scattered mugwort
P-180	10/30/2024	Purple loosestrife	3-8 stems
P-181	10/30/2024	Purple loosestrife	Single plant growing in canal wall
P-182	10/30/2024	Purple loosestrife	1 stem
P-183	5/20/2025	Glossy buckthorn	N/A
P-184	10/30/2024	Oriental bittersweet	Growing on canal wall.
P-185	10/30/2024	Oriental bittersweet	N/A
P-186	10/30/2024	Other	Japanese creeper - Parthenocissus tricuspidata
P-187	10/30/2024	Phragmites	1 stem
P-188	5/20/2025	Other	Yellow salsify
P-189	5/20/2025	Other	Bladder campion- cultivated
P-190	5/20/2025	Other	Silver cinquefoil- introduced/scattered
P-191	5/20/2025	Black locust	N/A
P-192	5/20/2025	Other	Common wintercress- invasive
P-193	5/20/2025	Oriental bittersweet	N/A
P-194	5/20/2025	Other	St John’s wort scattered
P-195	5/20/2025	Oriental bittersweet	N/A

Vegetation point Number	Date	Dominate Species	Notes
P-196	10/30/2024	Bradford pear	Ornamental planting
P-197	5/20/2025	Other	Crabapple spp.
P-198	5/20/2025	Oriental bittersweet	Large patch, cut leaf blackberry
P-199	5/20/2025	Other	Hoary alyssum
P-200	5/20/2025	Japanese knotweed	N/A
P-201	5/20/2025	Japanese knotweed	N/A
P-202	5/20/2025	Japanese knotweed	N/A
P-203	5/20/2025	Purple loosestrife	N/A
P-204	5/20/2025	Purple loosestrife	N/A
P-205	5/20/2025	Oriental bittersweet	Confirmed
P-206	5/20/2025	Other	Sheep sorrel
P-207	10/30/2024	Tree-of-heaven	1 stem
P-208	10/30/2024	Purple loosestrife	2 single stems, Confirmed during spring survey
P-209	5/20/2025	Purple loosestrife	Skeleton
P-210	10/30/2024	Black locust	Single plant, not observed during spring survey
P-211	5/20/2025	Reed canary grass	N/A
P-212	5/20/2025	Japanese knotweed	Confirmed polygon
P-213	5/20/2025	Glossy buckthorn	N/A
P-214	5/20/2025	Glossy buckthorn	N/A
P-215	5/20/2025	Glossy buckthorn	And Oriental bittersweet
P-216	5/20/2025	Oriental bittersweet	N/A
P-217	5/20/2025	Other	Cutler blackberry
P-218	5/20/2025	Oriental bittersweet	Confirmed polygon
P-219	5/20/2025	Oriental bittersweet	N/A
P-220	5/20/2025	Oriental bittersweet	Confirmed polygon
P-221	5/20/2025	Oriental bittersweet	Confirmed polygon
P-222	10/30/2024	Tree-of-heaven	1 small cut clump, confirmed during spring survey
P-223	5/20/2025	Oriental bittersweet	Confirmed polygon
P-224	10/30/2024	Black locust	2 stems
P-225	10/30/2024	Other	1 stem of mugwort, confirmed during spring survey
P-226	10/30/2024	Black locust	2 stems
P-227	5/20/2025	Reed canary grass	N/A
P-228	5/20/2025	Oriental bittersweet	Confirmed

Vegetation point Number	Date	Dominate Species	Notes
P-229	5/20/2025	Japanese knotweed	N/A
P-230	5/20/2025	Oriental bittersweet	N/A
P-231	10/30/2024	Black locust	3 separate stems, confirmed during spring survey
P-232	10/30/2024	Oriental bittersweet	1 stem of mugwort, confirmed during spring survey
P-233	5/20/2025	Oriental bittersweet	Confirmed polygon
P-234	10/30/2024	Black locust	1 small clump, cut and managed, confirmed during spring survey
P-235	5/20/2025	Oriental bittersweet	Confirmed
P-236	10/30/2024	Black locust	1 small clump, cut and managed, confirmed during spring survey
P-237	10/30/2024	Black locust	1 small clump, cut and managed, confirmed during spring survey
P-238	5/20/2025	Glossy buckthorn	N/A
P-239	5/20/2025	Oriental bittersweet	Confirmed with patches of nightshade and mugwort
P-240	10/30/2024	Black locust	1 moderate clump. cut and managed, confirmed during spring survey
P-241	10/30/2024	Other	Mugwort, 3-4 small stems and clusters
P-242	5/20/2025	Tree-of-heaven	Confirmed poly with additional RCG in majority of poly
P-243	10/30/2024	Purple loosestrife	Also 1 stem of mugwort, not observed during spring survey
P-244	5/20/2025	Spotted knapweed	N/A
P-245	10/30/2024	Other	Japanese creeper and 1 stem purple loosestrife
P-246	10/30/2024	Purple loosestrife	2 stems, not observed during spring survey
P-247	10/30/2024	Black locust	1 small stem, confirmed during spring survey with additional cluster of bittersweet nightshade
P-248	10/30/2024	Oriental bittersweet	Clump of stems cut, confirmed during spring survey
P-249	10/30/2024	Phragmites	2 stems, confirmed during spring survey
P-250	10/30/2024	Black locust	Moderate clump within stems, cut and managed, confirmed during spring survey
P-251	10/30/2024	Black locust	1 cut and managed clump, confirmed during spring survey

Vegetation point Number	Date	Dominate Species	Notes
P-252	10/30/2024	Phragmites	1 stem, confirmed during spring survey
P-253	10/30/2024	Other	Mugwort, 3 small clumps, confirmed during spring survey
P-254	10/30/2024	Black locust	2 stems cut and managed
P-255	10/30/2024	Phragmites	1 stem
P-256	10/30/2024	Other	Mugwort, 1 stem
P-257	10/30/2024	Other	5 stems of mugwort in canal wall, confirmed during spring survey
P-258	10/30/2024	Other	Mugwort, 8 stems, confirmed during spring survey
P-259	5/20/2025	Phragmites	N/A
P-260	5/20/2025	Other	Patch of mugwort
P-261	5/20/2025	Spotted knapweed	N/A
P-262	5/20/2025	Narrowleaf bittercress	N/A
P-263	10/30/2024	Tree-of-heaven	1 stem
P-264	5/20/2025	Morrow's honeysuckle	N/A
P-265	10/30/2024	Japanese knotweed	Couple of stems
P-266	10/30/2024	Phragmites	also mugwort along canal wall, oriental bittersweet near footbridge and reed canary in canal along shore, trash along entire segment
P-267	10/30/2024	Purple loosestrife	1 stem and mugwort along entire section, scattered along canal wall crevasse
P-268	10/30/2024	Black locust	multiple stems growing out of canal wall, cut managed and regrowth
P-269	10/30/2024	Tree-of-heaven	1 small tree and oriental bittersweet along fence
P-270	10/30/2024	Other	scattered stems and oriental bittersweet along fence
P-271	10/30/2024	Other	mugwort, sporadic scattered stems
P-272	10/30/2024	Glossy Buckthorn	few stems along property fenceline
P-273	5/20/2025	Glossy buckthorn	N/A
P-274	10/30/2024	Oriental bittersweet	1 stem
P-275	5/20/2025	Bradford pear	Two large trees
P-276	10/30/2024	Glossy buckthorn	1 clump
P-277	10/30/2024	Japanese knotweed	1 medium clump

Vegetation point Number	Date	Dominate Species	Notes
P-278	10/30/2024	Yellow flag iris	Assumed to be yellow iris - check when flowering in spring.

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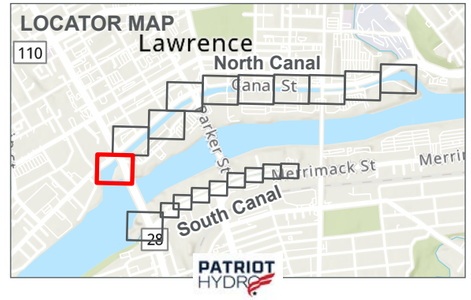
Invasive Species Type
- Bradford pear
- Buckthorn
- Glossy buckthorn
- Japanese knotweed
- Oriental bittersweet
- Tree-of-heaven
- Yellow flag iris

Invasive Species Type
- Oriental bittersweet
- Tree-of-heaven

Invasive Species Type
- Japanese knotweed
- Oriental bittersweet
- Spotted knapweed
- Tree-of-heaven

Map provides compiled results from multiple vegetation surveys through the growing season



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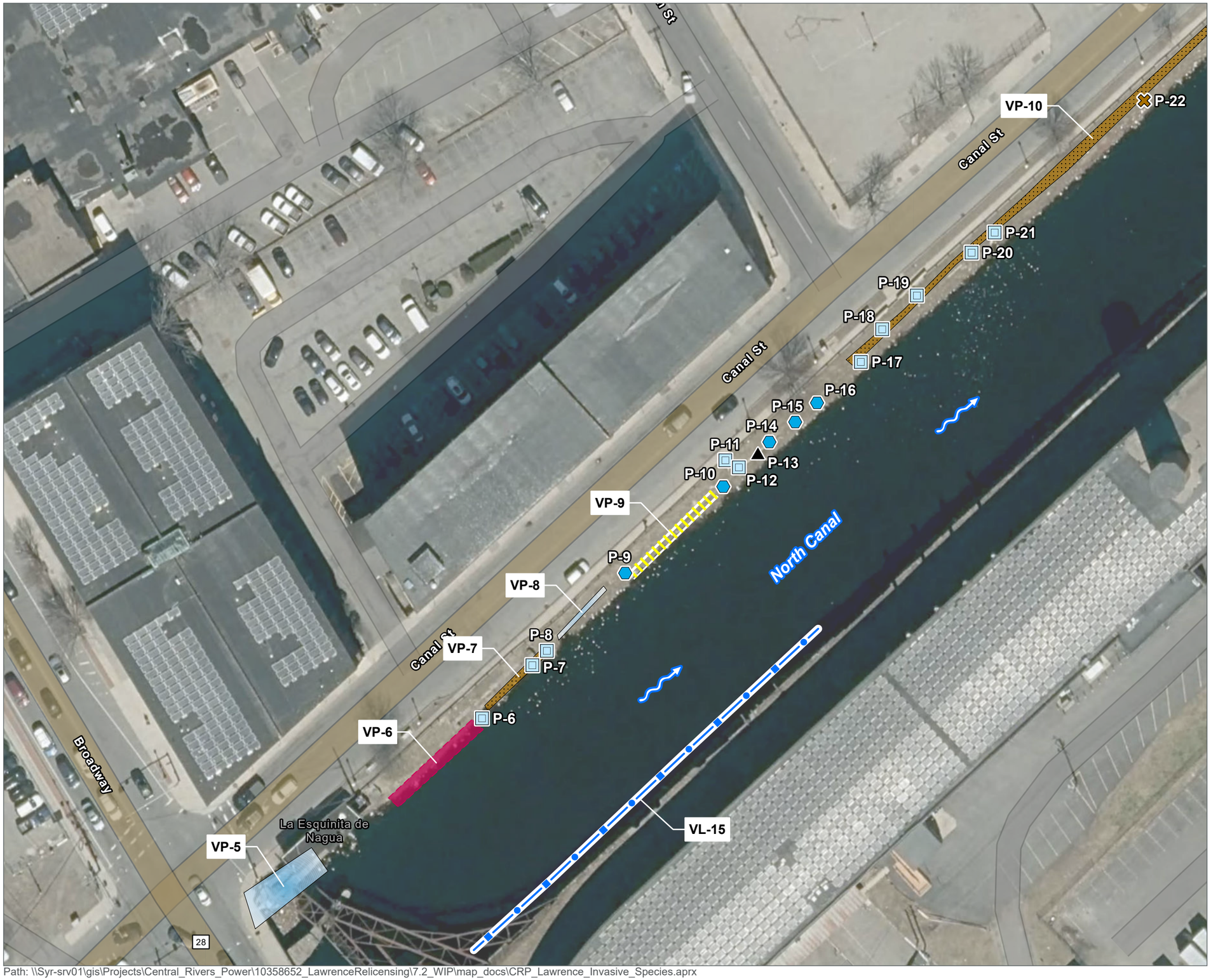
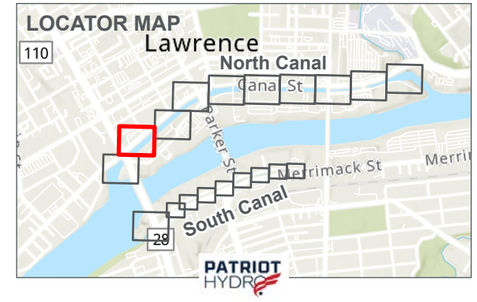


Invasive Species Type
- Black swallow-wort
- Oriental bittersweet
- Spotted knapweed
- Tree-of-heaven

Invasive Species Type
- Oriental bittersweet

Invasive Species Type
- Oriental bittersweet
- Reed canary-grass
- Spotted knapweed
- Tree-of-heaven

Map provides compiled results from multiple vegetation surveys through the growing season



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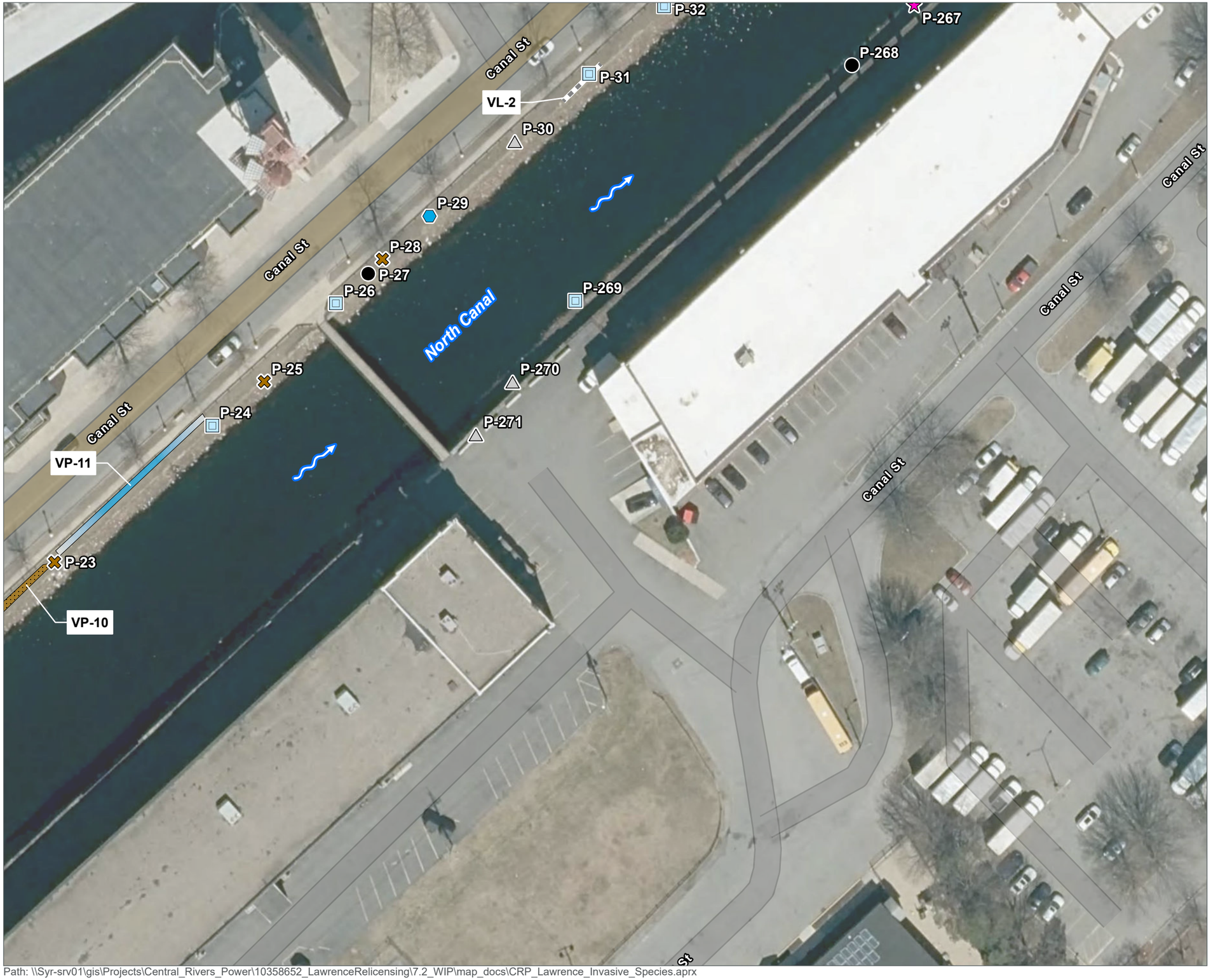
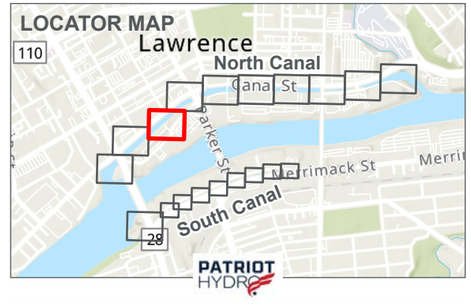


Invasive Species Type
- Black locust
- Oriental bittersweet
- Other
- Purple loosestrife
- Spotted knapweed
- Tree-of-heaven

Invasive Species Type
- Other

Invasive Species Type
- Spotted knapweed
- Tree-of-heaven

Map provides compiled results from multiple vegetation surveys through the growing season



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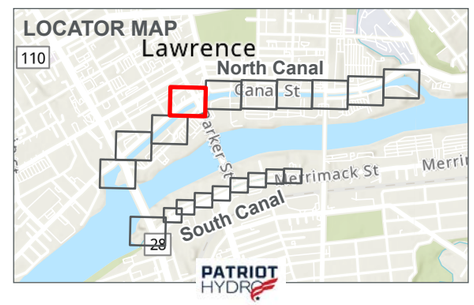
Invasive Species Type
- Black locust
- Oriental bittersweet
- Other
- Phragmites
- Purple loosestrife
- Spotted knapweed
- Tree-of-heaven

Invasive Species Type
- Black locust
- Oriental bittersweet
- Other

Invasive Species Type
- Morrows honeysuckle
- Oriental bittersweet
- Spotted knapweed
- Tree-of-heaven

Map provides compiled results from multiple vegetation surveys through the growing season



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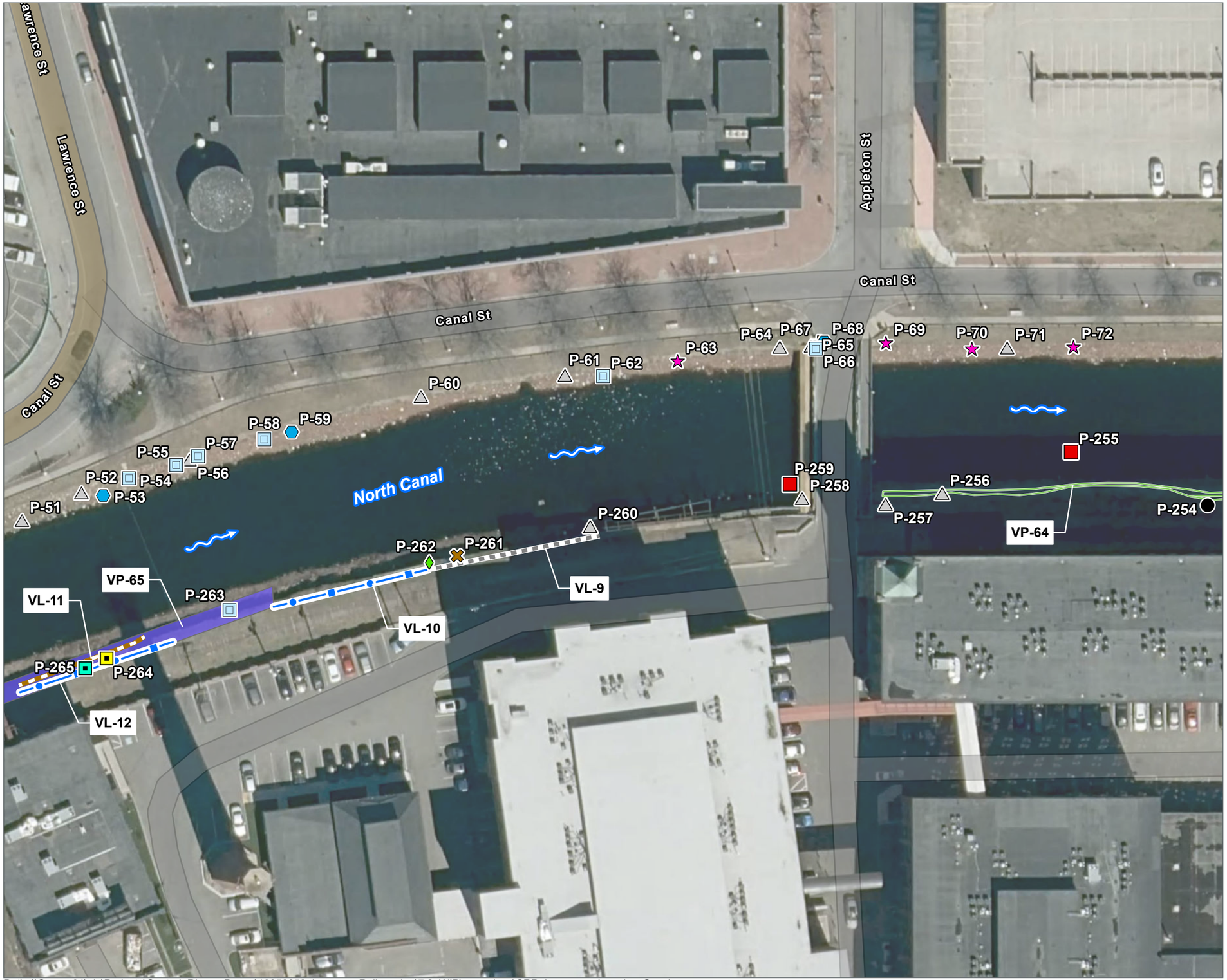
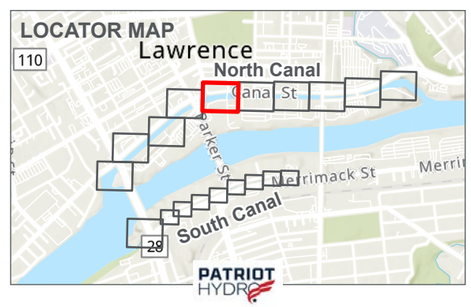


Invasive Species Type
- Black locust
- Japanese knotweed
- Morrows honeysuckle
- Narrowleaf bittercress
- Norway maple
- Oriental bittersweet
- Other
- Phragmites
- Purple loosestrife
- Spotted knapweed
- Tree-of-heaven

Invasive Species Type
- Buckthorn
- Oriental bittersweet
- Other

Invasive Species Type
- Morrows honeysuckle
- Phragmites

Map provides compiled results from multiple vegetation surveys through the growing season



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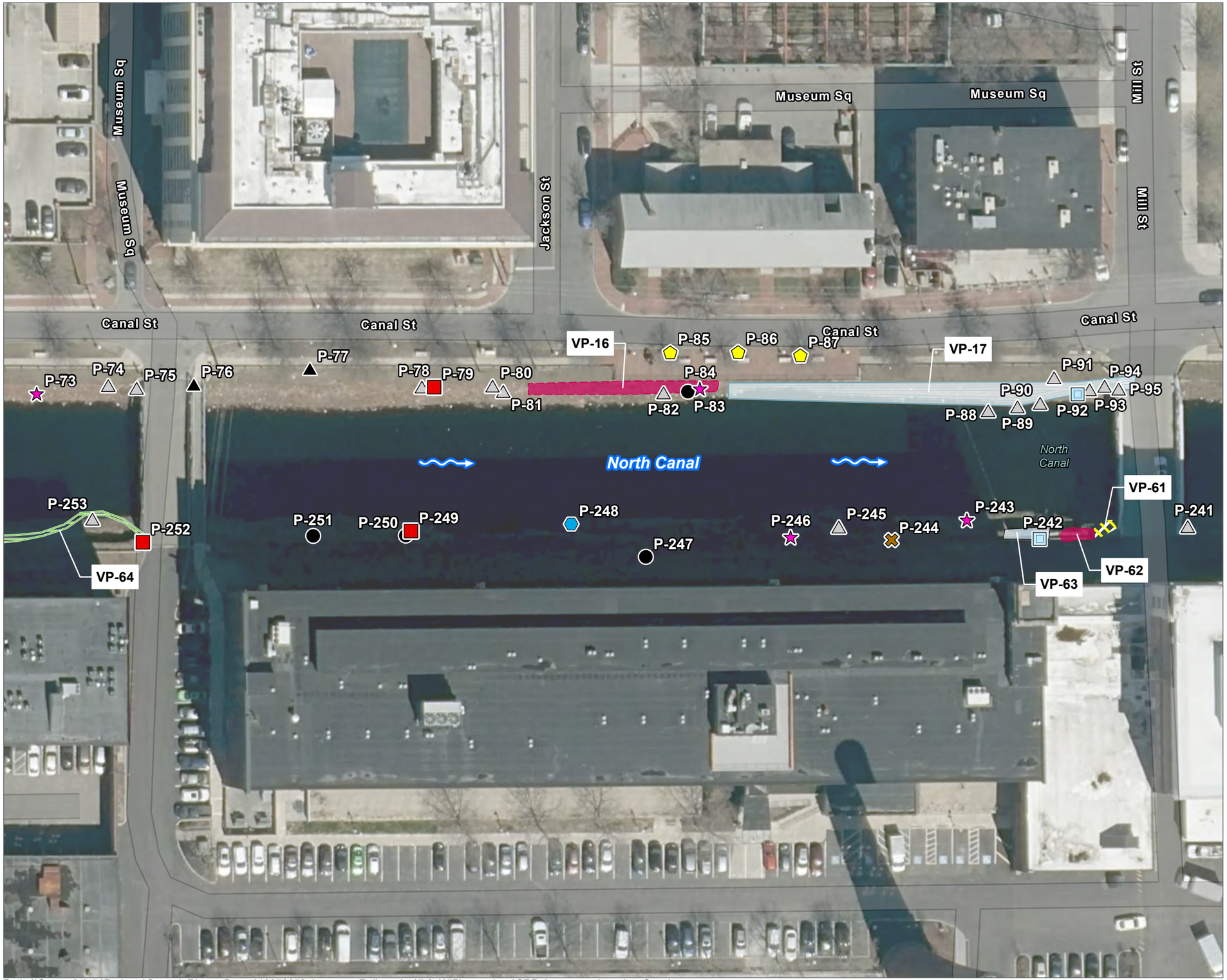
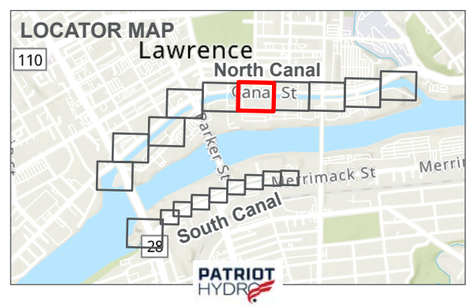


Invasive Species Type
- Black locust
- Black swallow-wort
- Bradford pear
- Oriental bittersweet
- Other
- Phragmites
- Purple loosestrife
- Spotted knapweed
- Tree-of-heaven

Invasive Species Type
- Oriental bittersweet
- Phragmites
- Purple loosestrife
- Reed canary-grass
- Tree-of-heaven

Map provides compiled results from multiple vegetation surveys through the growing season



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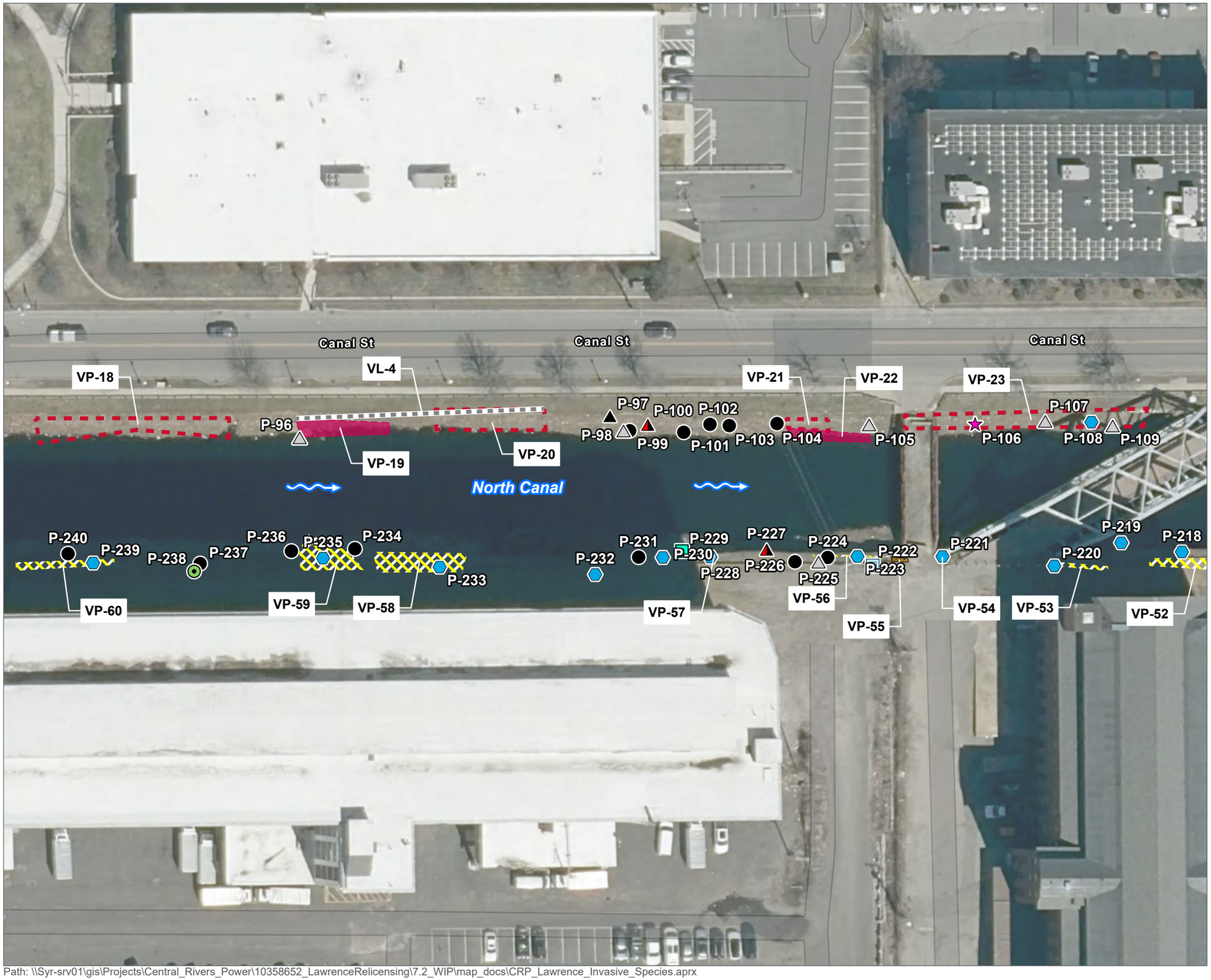
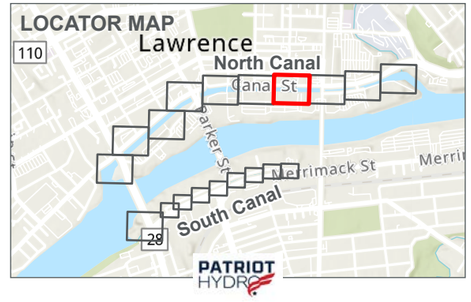


Invasive Species Type
- Black locust
- Black swallow-wort
- Glossy buckthorn
- Japanese knotweed
- Oriental bittersweet
- Other
- Purple loosestrife
- Reed canary-grass
- Tree-of-heaven

Invasive Species Type
- Other

Invasive Species Type
- Oriental bittersweet
- Other
- Reed canary-grass
- Spotted knapweed

Map provides compiled results from multiple vegetation surveys through the growing season



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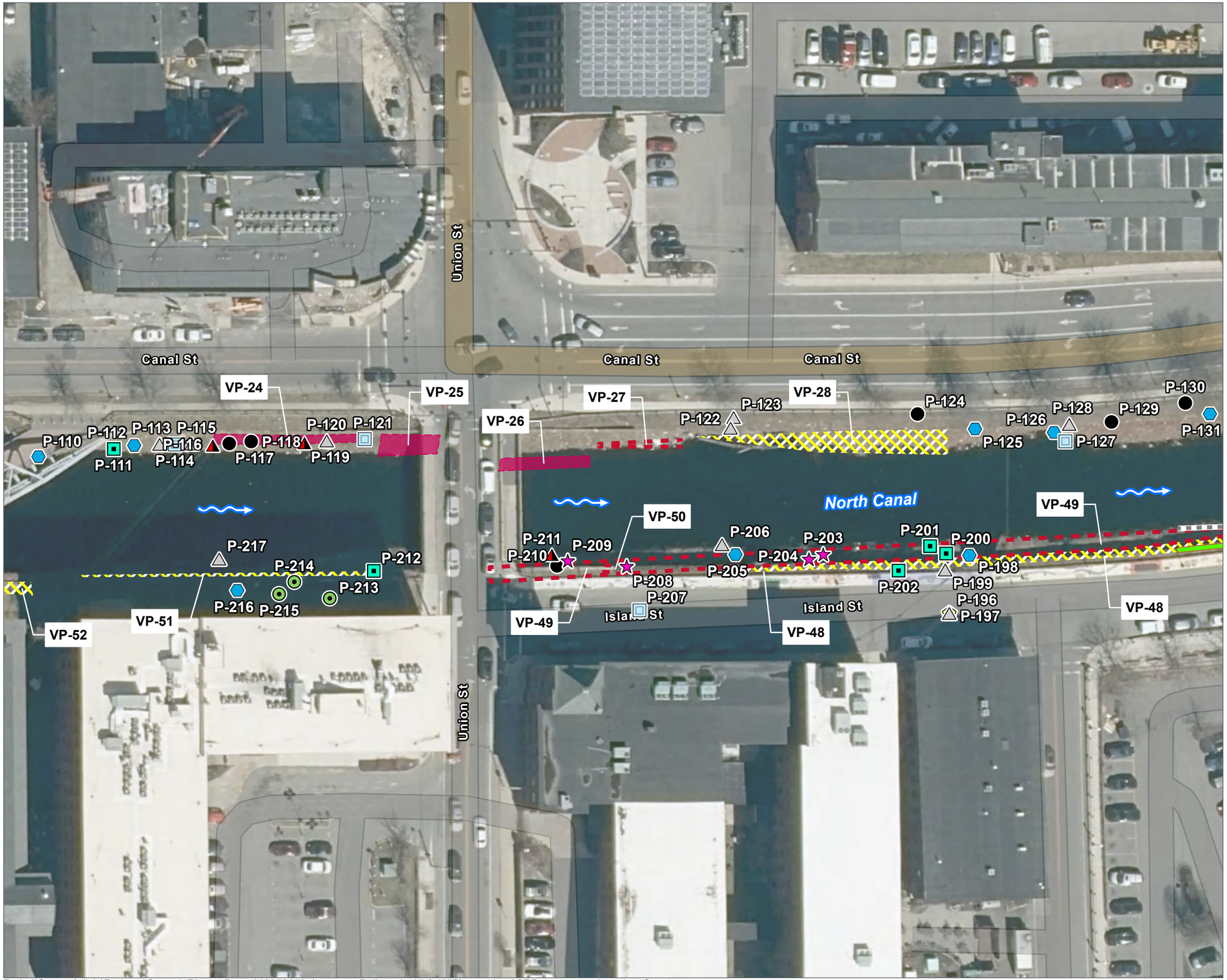
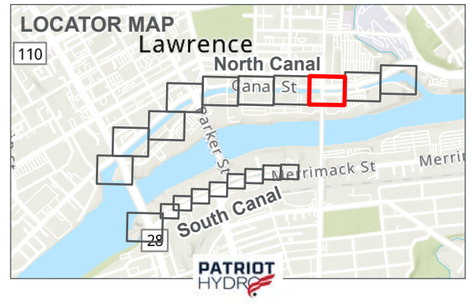


Invasive Species Type
- Black locust
- Bradford pear
- Glossy buckthorn
- Japanese knotweed
- Oriental bittersweet
- Other
- Purple loosestrife
- Reed canary-grass
- Tree-of-heaven

Invasive Species Type
- Other
- Poison ivy

Invasive Species Type
- Oriental bittersweet
- Other
- Reed canary-grass

Map provides compiled results from multiple vegetation surveys through the growing season



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LAWRENCE HYDROELECTRIC PROJECT
FERC NO. 2800
INVASIVE SPECIES SURVEY

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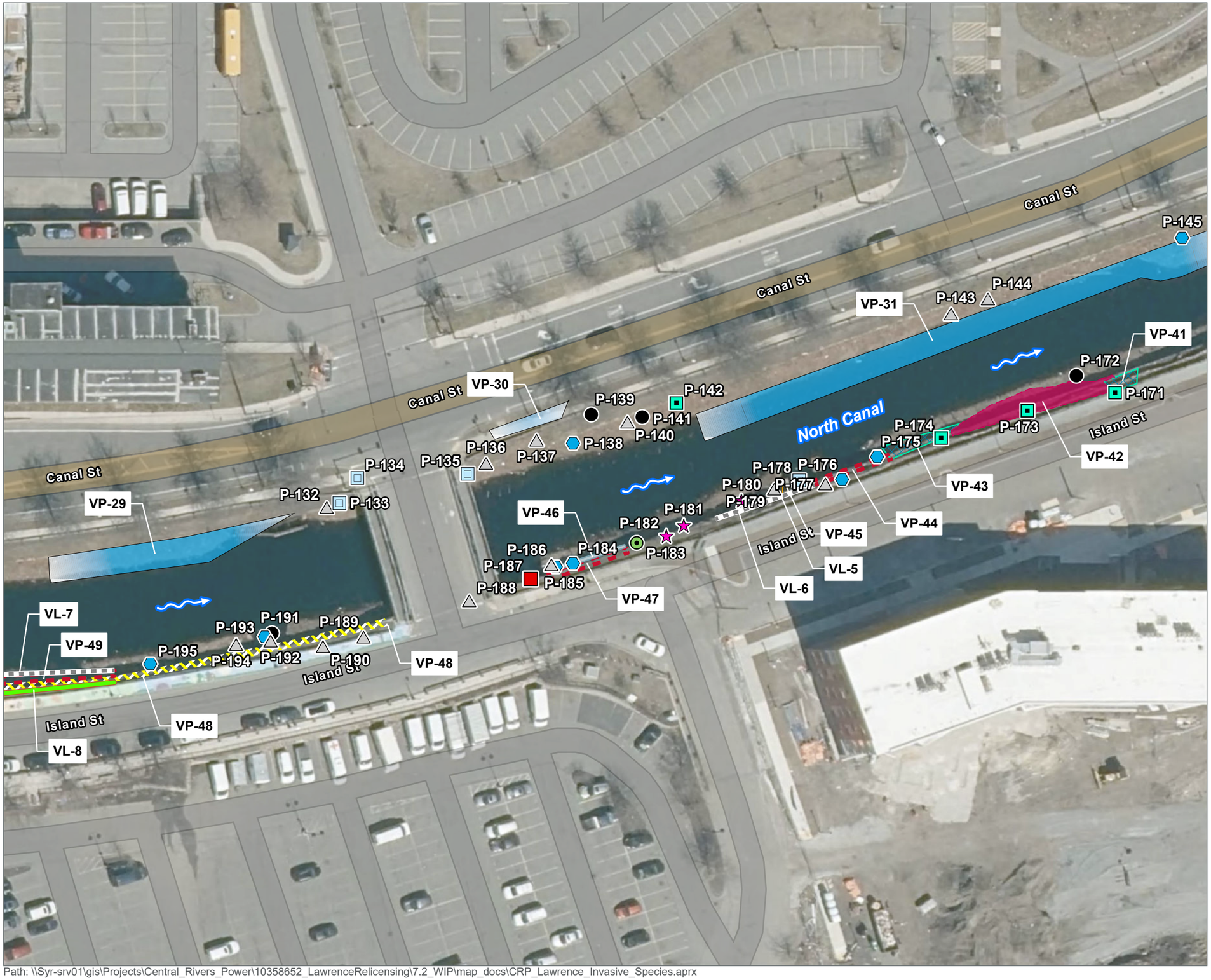
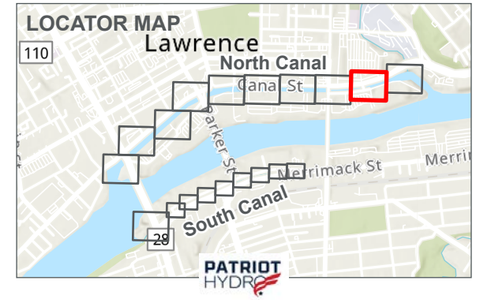


Invasive Species Type
- Black locust
- Glossy buckthorn
- Japanese knotweed
- Oriental bittersweet
- Other
- Phragmites
- Purple loosestrife
- Tree-of-heaven

Invasive Species Type
- Other
- Poison ivy

Invasive Species Type
- Black locust
- Japanese knotweed
- Oriental bittersweet
- Other
- Purple loosestrife
- Reed canary-grass
- Tree-of-heaven

Map provides compiled results from multiple vegetation surveys through the growing season



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LAWRENCE HYDROELECTRIC PROJECT
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NORTH CANAL
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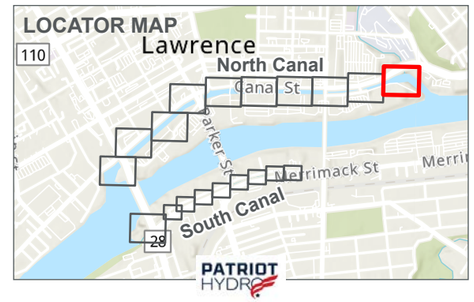
Invasive Species Type
- Black locust
- Black swallow-wort
- Japanese knotweed
- Oriental bittersweet
- Other
- Phragmites
- Purple loosestrife
- Reed canary-grass
- Tree-of-heaven

Invasive Species Type
- Japanese knotweed
- Oriental bittersweet
- Reed canary-grass
- Tree-of-heaven

Map provides compiled results from multiple vegetation surveys through the growing season



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Appendix H

Representative Photographs Taken During North and South Canal Vegetation Surveys

Photo 1- Representative photo of oriental bittersweet, Lawrence Hydroelectric North Canal, May 20th, 2025.

Photo 2: Representative photo of tree-of-heaven, Lawrence Hydroelectric North Canal, October 30, 2024.

Photo 3: Representative photo of bittersweet nightshade, Lawrence Hydroelectric North Canal, May 20th, 2025.

Photo 4: Representative photo of Norway maple, Lawrence Hydroelectric North Canal, May 20th, 2025.

Photo 5: Representative photo of black swallow-wort, Lawrence Hydroelectric North Canal, May 20th, 2025.

Photo 6: Representative photo of Bradford pear, Lawrence Hydroelectric North Canal, May 20th, 2025.

Photo 7: Representative photo of common mugwort, Lawrence Hydroelectric North Canal, May 20th, 2025.

Photo 7: Representative photo of Japanese creeper and poison ivy along canal wall, Lawrence Hydroelectric North Canal, May 20th, 2025.

Photo 8: Representative photo of reed canary grass, Lawrence Hydroelectric North Canal, May 20th, 2025

Photo 9: Representative photo of spotted knapweed, Lawrence Hydroelectric North Canal, May 20th, 2025.

Photo 10: Representative photo of cutler blackberry, Lawrence Hydroelectric North Canal, May 20th, 2025.

Photo 11: Representative photo of purple loosestrife skeleton, Lawrence Hydroelectric North Canal, May 20th, 2025.

Photo 12: Representative photo of Japanese knotweed, Lawrence Hydroelectric North Canal, May 20th, 2025.

Photo 13: Representative photo of silver cinquefoil, Lawrence Hydroelectric North Canal, May 20th, 2025.

Photo 14: Representative photo of bladder campion, Lawrence Hydroelectric North Canal, May 20th, 2025

Photo 15: Representative photo of sheep sorrel, Lawrence Hydroelectric North Canal, May 20th, 2025.

Photo 16: Representative photo of a cluster of Japanese knotweed, Lawrence Hydroelectric North Canal, October 30th, 2024.

Photo 17: Representative photo of tree-of-heaven, Lawrence Hydroelectric North Canal, October 30th, 2024.

Photo 18: Representative photo of tree-of-heaven, Lawrence Hydroelectric South Canal, June 28th, 2024.

Photo 19: Representative photo of glossy buckthorn, Lawrence Hydroelectric South Canal, May 20th, 2025.

Photo 20: Representative photo of Japanese knotweed, Lawrence Hydroelectric South Canal, May 19th, 2025.

Photo 21: Representative photo of black locust, Lawrence Hydroelectric South Canal, June 27th, 2024.

Photo 22: Representative photo of oriental bittersweet, Lawrence Hydroelectric South Canal, May 19th, 2025.

Photo 23: Representative photo of common mugwort, Lawrence Hydroelectric South Canal, May 19th, 2025.

Photo 24: Representative photo of multiflora rose, Lawrence Hydroelectric South Canal, May 19th, 2025.

Photo 25: Representative photo of tree-of-heaven, Lawrence Hydroelectric South Canal, May 19th, 2025.

Photo 26: Representative photo of Japanese creeper, Lawrence Hydroelectric South Canal, May 20th, 2025.

Photo 27: Representative photo of cut spotted knapweed, Lawrence Hydroelectric South Canal, May 20th, 2025.

Photo 28: Representative photo of scattered spotted knapweed, Lawrence Hydroelectric South Canal, May 20th, 2025.

Photo 29: Representative photo of purple loosestrife skeloton, Lawrence Hydroelectric South Canal, May 20th, 2025.

Photo 30: Representative photo of purple loosestrife, Lawrence Hydroelectric South Canal, June 28th, 2024.

Photo 31: Representative photo of bittersweet nightshade, Lawrence Hydroelectric South Canal, May 19th, 2025.

Photo 32: Representative photo of yellow salsify, Lawrence Hydroelectric South Canal, May 20th, 2025.

Appendix I

South Canal Vegetation Survey Results - Tables and Maps

Table I-1 Lawrence Hydroelectric Project Vegetation Polygon Inventory along South Canal

Polygon Number	Date	Dominate Species	Acres	Square Footage	Notes
VP-01	5/20/2025	Spotted knapweed	0.0031	136.10	N/A
VP-02	5/20/2025	Other	0.0017	73.80	Conglomerate of Oriental bittersweet, spotted knapweed, glossy buckthorn clusters
VP-03	5/20/2025	Spotted knapweed	0.0301	1310.88	On hill and along fence
VP-04	5/20/2025	Black locust	0.0060	261.93	N/A
VP-05	6/28/2024	Spotted knapweed	0.0004	18.70	Clumps on wall
VP-06	6/28/2024	Black locust	0.0009	38.66	N/A
VP-07	6/28/2024	Black locust	0.0026	114.61	N/A
VP-08	5/20/2025	Spotted knapweed	0.0061	266.82	Polygon of Spotted knapweed and common mugwort
VP-09	6/28/2024	Other	0.0003	14.61	Common mugwort, scattered 20 or more stems
VP-10	6/28/2024	Black locust	0.0019	84.54	Black locust dominate
VP-11	6/28/2024	Black locust	0.0015	66.08	N/A
VP-12	5/20/2025	Spotted knapweed	0.0030	129.00	Scattered Mugwort and black locust
VP-13	5/20/2025	Japanese knotweed	0.0023	99.20	Large cluster, 100 or more stems
VP-14	5/20/2025	Japanese knotweed	0.0006	24.35	N/A
VP-15	5/20/2025	Spotted knapweed	0.0010	44.35	Thin band of scattered knotweed on fence line
VP-16	5/20/2025	Black locust	0.0013	54.95	Black locust with interstitial spot knotweed multi to single stems
VP-17	5/20/2025	Spotted knapweed	0.0016	69.07	Multi steam inside and outside fence
VP-18	5/20/2025	Spotted knapweed	0.0479	2086.65	Large patches along fence line, mixed in mugwort, black locust & or oriental bittersweet
VP-19	5/20/2025	Black locust	0.0014	62.88	N/A
VP-20	5/20/2025	Black locust	0.0002	7.52	N/A
VP-21	5/20/2025	Black locust	0.0005	21.31	N/A
VP-22	5/20/2025	Black locust	0.0014	60.65	N/A
VP-23	5/20/2025	Black locust	0.0003	14.01	N/A
VP-24	5/20/2025	Black locust	0.0006	26.26	N/A
VP-25	5/20/2025	Black locust	0.0016	67.74	Dominate black locust with scattered knapweed 1 stem to multi stem
VP-26	5/20/2025	Black locust	0.0018	80.50	Band of black locust
VP-27	5/20/2025	Black locust	0.0015	63.84	Black locust dominant, tree of heaven, oriental bittersweet
VP-28	5/20/2025	Black locust	0.0002	9.10	N/A
VP-29	5/20/2025	Black locust	0.0025	107.77	Band of black locust on canal wall inside of fence
VP-30	5/20/2025	Black locust	0.0027	117.85	N/A
VP-31	5/19/2025	Black locust	0.0039	168.59	Multiple black locust, black swallow-wort, mugwort,
VP-32	5/19/2025	Other	0.0014	62.80	Japanese creeper
VP-33	5/20/2025	Other	0.0014	58.95	Japanese creeper climbing bridge structure
VP-34	5/20/2025	Oriental bittersweet	0.0007	28.68	Small scattered clusters, 5 stems each, 50 different clusters
VP-35	5/20/2025	Japanese knotweed	0.0116	507.29	Multiple young plants sprouting in mowed hillside

Polygon Number	Date	Dominate Species	Acres	Square Footage	Notes
VP-36	5/20/2025	Oriental bittersweet	0.0019	80.81	Scattered, 10+ in each cluster, 10 clusters
VP-37	5/20/2025	Oriental bittersweet	0.0091	397.56	Small clusters along hillside, 5-10 stems each plant. 5/20 hillside mowed, still along canal wall.
VP-38	5/20/2025	Oriental bittersweet	0.0027	115.97	Scattered clusters along hill side, groups of 5-10 stems
VP-39	5/20/2025	Oriental bittersweet	0.0009	40.79	Small, scattered clusters, 10+ in each grouping
VP-40	5/20/2025	Other	0.0019	82.41	Japanese creeper
VP-41	5/20/2025	Oriental bittersweet	0.0024	102.73	Scattered clusters
VP-42	6/28/2024	Oriental bittersweet	0.0163	707.94	Large amounts in clusters, more towards left bridge, smaller clusters along hillside down, 10 stems each
VP-43	6/28/2024	Oriental bittersweet	0.0010	44.71	N/A
VP-44	6/28/2024	Black locust	0.0023	100.39	N/A
VP-45	5/20/2025	Black locust	0.0127	552.87	Dominate black locust with interstitial oriental bittersweet and tree of heaven

Table I-2: Lawrence Hydroelectric Project Vegetation Polyline Inventory along South Canal

Vegetation Line Number	Date	Dominate Species	Length (Ft)	Notes
VL-01	5/20/2025	Oriental Bittersweet	76.61	N/A
VL-02	5/19/2025	Spotted knapweed	25.73	N/A
VL-03	6/28/2024	Tree-of-heaven	107.85	5 clumps, several stems each, atop canal wall
VL-04	5/19/2025	Oriental Bittersweet	236.06	Large mix of oriental bittersweet, Tree-of-heaven, Black locust, dead purple loosestrife, mugwort POLYGON
VL-05	5/20/2025	Oriental Bittersweet	66.81	Scattered clumps of oriental bittersweet, spotted knapweed, tree-of-heaven
VL-06	5/20/2025	Japanese knotweed	49.32	Scattered clumps of Japanese knotweed, oriental bittersweet, tree-of-heaven fence outside boundary
VL-07	6/28/2024	Japanese knotweed	16.63	100 sq ft, 50-100 stems
VL-08	6/27/2024	Japanese knotweed	62.65	community along canal wall, 50-100 stems
VL-09	5/19/2025	Black locust	10.50	Clumped and scattered
VL-10	5/19/2025	Black locust	46.53	Scattered locust
VL-11	5/19/2025	Black locust	41.15	Cluster
VL-12	5/19/2025	Japanese knotweed	31.25	Confirmed from previous survey
VL-13	6/27/2024	Japanese knotweed	15.88	N/A
VL-14	6/27/2024	Japanese knotweed	5.26	50-100 stems among small clump
VL-15	6/27/2024	Black locust	245.19	Black locust, purple loosestrife, oriental bittersweet, jap knot, common mudwort (artemisia vulgaris)
VL-16	5/19/2025	Other	45.76	Boston ivy
VL-17	5/19/2025	Other	10.30	Boston ivy
VL-18	5/19/2025	Other	11.87	Boston ivy
VL-19	5/19/2025	Other	13.76	Boston ivy
VL-20	5/19/2025	Poison Ivy	14.60	Poison ivy
VL-21	6/28/2024	Oriental Bittersweet	120.66	Large clusters, scattered along whole edge, grouping of 10 or more stems, some larger

VL-22	6/28/2024	Oriental Bittersweet	62.53	Small clusters, 5 each, 50 different groups

Table I-3: Lawrence Hydroelectric Project Vegetation Points Inventory along the South Canal

Vegetation point Number	Date	Dominate Species	Notes
P-001	6/28/2024	Oriental bittersweet	Different small cluster, 5-10 stems
P-002	6/28/2024	Spotted knapweed	N/A
P-003	5/20/2025	Other	Mugwort clusters
P-004	6/28/2024	Tree-of-heaven	2 clumps with several stems
P-005	5/20/2025	Glossy buckthorn	N/A
P-006	6/28/2024	Spotted knapweed	N/A
P-007	6/28/2024	Spotted knapweed	N/A
P-008	6/28/2024	Spotted knapweed	N/A
P-009	5/20/2025	Glossy buckthorn	New growth, not previously identified during summer survey
P-010	6/28/2024	Purple loosestrife	1 clump, 6 stems
P-011	6/28/2024	Oriental bittersweet	Small cluster, 20 stems
P-012	6/28/2024	Tree-of-heaven	1 cluster, many stems
P-013	6/28/2024	Tree-of-heaven	1 cluster, many stems
P-014	6/28/2024	Tree-of-heaven	8 tree trunks
P-015	6/28/2024	Tree-of-heaven	2 clusters, many stems
P-016	6/28/2024	Purple loosestrife	1 stem
P-017	6/28/2024	Oriental bittersweet	Large cluster along side fence, 100 or more
P-018	6/28/2024	Oriental bittersweet	Along cement barrier, 1 long piece
P-019	6/28/2024	Spotted knapweed	Confirmed during spring survey
P-020	6/28/2024	Spotted knapweed	Confirmed during spring survey
P-021	6/28/2024	Black locust	Confirmed during spring survey
P-022	6/28/2024	Other	Common mugwort, 2 stems, confirmed during spring survey
P-023	6/28/2024	Spotted knapweed	Confirmed during spring survey
P-024	6/28/2024	Black locust	Confirmed during spring survey
P-025	6/28/2024	Japanese Knotweed	1 clump, 6 stems, confirmed during spring survey
P-026	6/28/2024	Tree-of-heaven	1 stem, confirmed during spring survey
P-027	6/28/2024	Spotted knapweed	Confirmed during spring survey
P-028	6/28/2024	Tree-of-heaven	Confirmed during spring survey
P-029	5/20/2025	Spotted knapweed	Confirmed polygon of spotted knapweed
P-030	6/28/2024	Black locust	Multi strand, confirmed during spring survey
P-031	6/28/2024	Spotted knapweed	Confirmed during spring survey
P-032	6/28/2024	Purple loosestrife	2 clumps, 8 stems, confirmed during spring survey
P-033	6/28/2024	Spotted knapweed	Confirmed during spring survey
P-034	5/20/2025	Oriental bittersweet	On fence outside project boundary
P-035	6/28/2024	Black locust	
P-036	6/28/2024	Glossy buckthorn	Confirmed- multi stem during spring survey
P-037	6/28/2024	Spotted knapweed	Confirmed during spring survey
P-038	6/28/2024	Black locust	Confirmed during spring survey
P-039	6/28/2024	Purple loosestrife	1 clump, 3 stems, Skeleton not present during spring survey
P-040	6/28/2024	Black locust	Confirmed during spring survey

Vegetation point Number	Date	Dominate Species	Notes
P-041	5/20/2025	Glossy buckthorn	N/A
P-042	6/28/2024	Spotted knapweed	Confirmed during spring survey
P-043	6/28/2024	Other	Common mugwort, scattered, 10 stems, confirmed during spring survey
P-044	6/28/2024	Black locust	Confirmed during spring survey
P-045	6/28/2024	Purple loosestrife	1 clump, 4 stems, skeleton not present during spring survey
P-046	6/28/2024	Black locust	Confirmed during spring survey
P-047	6/28/2024	Spotted knapweed	Confirmed during spring survey
P-048	6/28/2024	Oriental bittersweet	Large cluster on large metal near concrete structure, 20 or more, confirmed and observed during spring survey
P-049	6/28/2024	Other	Common mugwort, large cluster, 20 or more stems, confirmed during spring survey
P-050	6/28/2024	Spotted knapweed	Confirmed during spring survey
P-051	5/20/2025	Black locust	Confirmed Black locust polygon
P-052	5/20/2025	Purple loosestrife	Skeleton remains of PLS
P-053	6/28/2024	Other	Japanese ivy along wall, vine for 5 feet, confirmed during spring survey
P-054	5/20/2025	Black locust	Black locust polygon confirmed
P-055	6/28/2024	Other	Common mugwort, scattered, 10 or more stems
P-056	6/28/2024	Other	Common mugwort, scattered, 20 or more stems, confirmed during spring survey
P-057	5/20/2025	Oriental bittersweet	
P-058	6/28/2024	Other	Common mugwort, single stem, confirmed during spring survey
P-059	5/20/2025	Glossy buckthorn	Patch multi stem
P-060	6/28/2024	Spotted knapweed	N/A
P-061	5/20/2025	Black locust	Polygon confirmed
P-062	6/28/2024	Glossy buckthorn	Confirmed during spring survey
P-063	6/28/2024	Glossy buckthorn	Confirmed during spring survey
P-064	6/28/2024	Other	Common mugwort, 1 single, confirmed during spring survey
P-065	6/28/2024	Black locust	Confirmed during spring survey, two fishermen observed during spring survey
P-066	5/20/2025	Oriental bittersweet	N/A
P-067	6/28/2024	Spotted knapweed	Confirmed during spring survey
P-068	6/28/2024	Purple loosestrife	1 clump, 6 stems, confirmed skeletons during spring survey
P-069	6/28/2024	Black locust	Confirmed during spring survey
P-070	6/28/2024	Glossy buckthorn	N/A
P-071	6/28/2024	Spotted knapweed	N/A
P-072	5/20/2025	Tree-of-heaven	N/A
P-073	5/20/2025	Tree-of-heaven	N/A
P-074	6/28/2024	Other	Common mugwort, small single, 5 stems
P-075	6/28/2024	Glossy buckthorn	N/A
P-076	6/28/2024	Spotted knapweed	N/A
P-077	6/28/2024	Spotted knapweed	N/A
P-078	6/28/2024	Oriental bittersweet	Small cluster, 5 stems

Vegetation point Number	Date	Dominate Species	Notes
P-079	6/28/2024	Glossy buckthorn	N/A
P-080	6/28/2024	Black locust	N/A
P-081	6/28/2024	Black locust	N/A
P-082	6/28/2024	Black locust	N/A
P-083	6/28/2024	Spotted knapweed	N/A
P-084	6/28/2024	Spotted knapweed	N/A
P-085	6/28/2024	Black locust	N/A
P-086	6/28/2024	Black locust	Multi stem
P-087	6/28/2024	Spotted knapweed	N/A
P-088	6/28/2024	Black locust	Multi stem
P-089	6/28/2024	Black locust	N/A
P-090	6/28/2024	Purple loosestrife	2 stems
P-091	6/28/2024	Spotted knapweed	N/A
P-092	6/28/2024	Spotted knapweed	N/A
P-093	6/28/2024	Spotted knapweed	N/A
P-094	6/28/2024	Spotted knapweed	N/A
P-095	6/28/2024	Spotted knapweed	N/A
P-096	6/28/2024	Spotted knapweed	N/A
P-097	6/28/2024	Black locust	N/A
P-098	6/28/2024	Spotted knapweed	N/A
P-099	6/28/2024	Tree-of-heaven	N/A
P-100	6/28/2024	Black locust	N/A
P-101	6/28/2024	Spotted knapweed	N/A
P-102	6/28/2024	Black locust	N/A
P-103	6/28/2024	Glossy buckthorn	N/A
P-104	6/28/2024	Other	Common mugwort, scattered 2 stems
P-105	6/28/2024	Spotted knapweed	N/A
P-106	6/28/2024	Black locust	N/A
P-107	6/28/2024	Spotted knapweed	N/A
P-108	6/28/2024	Spotted knapweed	N/A
P-109	6/28/2024	Spotted knapweed	N/A
P-110	6/28/2024	Spotted knapweed	N/A
P-111	6/28/2024	Black locust	N/A
P-112	6/28/2024	Spotted knapweed	N/A
P-113	6/28/2024	Other	Common mugwort, 2 observed stems
P-114	5/20/2025	Other	Common mugwort, scattered, 6 stems
P-115	6/28/2024	Other	Common mugwort, scattered, 6 stems
P-116	6/28/2024	Japanese Knotweed	2 clumps, 3 stems
P-117	6/28/2024	Other	Common mugwort, scattered, 3 stems
P-118	6/28/2024	Other	Common mugwort, scattered, 5 stems
P-119	6/28/2024	Spotted knapweed	N/A
P-120	6/28/2024	Purple loosestrife	2 stems
P-121	6/28/2024	Spotted knapweed	N/A
P-122	6/28/2024	Spotted knapweed	N/A
P-123	6/28/2024	Spotted knapweed	N/A
P-124	6/28/2024	Black locust	N/A

Vegetation point Number	Date	Dominate Species	Notes
P-125	6/28/2024	Tree-of-heaven	N/A
P-126	6/28/2024	Oriental bittersweet	Large cluster, 10 or more stems
P-127	6/28/2024	Tree-of-heaven	1 stem
P-128	6/28/2024	Oriental bittersweet	Large cluster, 20 or more stems
P-129	6/28/2024	Purple loosestrife	old remnants and new growth, 1 clump, 10 stems
P-130	6/28/2024	Tree-of-heaven	N/A
P-131	6/28/2024	Oriental bittersweet	Large cluster, 10 stems
P-132	6/28/2024	Other	Common mugwort, scattered, 5 stems
P-133	6/28/2024	Spotted knapweed	N/A
P-134	6/28/2024	Oriental bittersweet	N/A
P-135	6/28/2024	Other	Common mugwort, scattered, 4 stems
P-136	6/28/2024	Other	Common mugwort, 1 stem
P-137	6/28/2024	Spotted knapweed	N/A
P-138	6/28/2024	Purple loosestrife	2 clumps, 5 stems
P-139	6/28/2024	Tree-of-heaven	N/A
P-140	6/28/2024	Oriental bittersweet	Large cluster, 20 stems
P-141	6/28/2024	Spotted knapweed	N/A
P-142	6/28/2024	Other	Common mugwort, cluster 4 stems
P-143	6/28/2024	Spotted knapweed	N/A
P-144	6/28/2024	Other	Common mugwort, scattered 3 stems
P-145	6/28/2024	Black locust	N/A
P-146	6/28/2024	Spotted knapweed	N/A
P-147	6/28/2024	Spotted knapweed	N/A
P-148	6/28/2024	Other	Common mugwort, 1 stem
P-149	5/19/2025	Tree-of-heaven	Below overpass
P-150	6/27/2024	Black locust	Confirmed during spring survey
P-151	6/27/2024	Black locust	Confirmed during spring survey
P-152	6/28/2024	Tree-of-heaven	1 stem, confirmed during spring survey
P-153	6/27/2024	Spotted knapweed	Confirmed during spring survey
P-154	6/27/2024	Black locust	Confirmed during spring survey
P-155	5/19/2025	Oriental bittersweet	N/A
P-156	6/27/2024	Oriental bittersweet	Small cluster, 10+
P-157	6/27/2024	Spotted knapweed	Confirmed during spring survey
P-158	6/27/2024	Spotted knapweed	Confirmed during spring survey
P-159	6/27/2024	Black locust	Confirmed during spring survey
P-160	6/27/2024	Oriental bittersweet	Confirmed during spring survey
P-161	6/27/2024	Black locust	Confirmed during spring survey
P-162	5/19/2025	Black locust	N/A
P-163	6/27/2024	Spotted knapweed	Confirmed during spring survey
P-164	6/27/2024	Black locust	Confirmed during spring survey
P-165	6/27/2024	Spotted knapweed	Confirmed during spring survey
P-166	6/27/2024	Black locust	Confirmed during spring survey
P-167	6/27/2024	Black locust	Confirmed during spring survey
P-168	6/27/2024	Japanese Knotweed	1 clump 20 stems, confirmed during spring survey

Vegetation point Number	Date	Dominate Species	Notes
P-169	5/19/2025	Japanese Knotweed	N/A
P-170	5/19/2025	Japanese Knotweed	N/A
P-171	5/19/2025	Oriental bittersweet	N/A
P-172	6/27/2024	Black locust	Confirmed during spring survey
P-173	5/19/2025	Oriental bittersweet	N/A
P-174	5/19/2025	Japanese Knotweed	Small cluster
P-175	6/27/2024	Spotted knapweed	Confirmed during spring survey
P-176	6/27/2024	Spotted knapweed	Confirmed during spring survey
P-177	5/19/2025	Oriental bittersweet	N/A
P-178	6/27/2024	Oriental bittersweet	Small cluster, 5, confirmed during spring survey
P-179	6/27/2024	Japanese Knotweed	small clump, 3 stems, confirmed during spring survey
P-180	5/19/2025	Oriental bittersweet	Confirmed from fall summer survey, observed during spring survey
P-181	5/19/2025	Oriental bittersweet	N/A
P-182	6/27/2024	Spotted knapweed	N/A
P-183	6/27/2024	Oriental bittersweet	Cluster, 3 feet along the wall
P-184	5/19/2025	Oriental bittersweet	N/A
P-185	6/27/2024	Spotted knapweed	N/A
P-186	6/27/2024	Black locust	Confirmed during spring survey
P-187	6/27/2024	Spotted knapweed	Confirmed during spring survey
P-188	5/19/2025	Oriental bittersweet	N/A
P-189	6/27/2024	Spotted knapweed	Confirmed during spring survey
P-190	5/19/2025	Multiflora rose	Large clump
P-191	6/27/2024	Black locust	Confirmed during spring survey
P-192	6/27/2024	Oriental bittersweet	Large cluster > 10
P-193	6/27/2024	Spotted knapweed	N/A
P-194	6/27/2024	Black locust	N/A
P-195	6/27/2024	Spotted knapweed	N/A
P-196	6/27/2024	Black locust	N/A
P-197	6/27/2024	Oriental bittersweet	Single, 2 stems, confirmed during spring survey
P-198	6/27/2024	Black locust	Confirmed during spring survye
P-199	5/19/2025	Oriental bittersweet	N/A
P-200	6/27/2024	Black locust	Confirmed during spring survey
P-201	6/27/2024	Spotted knapweed	N/A
P-202	6/28/2024	Japanese Knotweed	several single stems, confirmed and observed during spring survey
P-203	5/19/2025	Japanese Knotweed	N/A
P-204	6/27/2024	Black locust	Confirmed during spring survey
P-205	5/19/2025	Japanese Knotweed	N/A
P-206	6/27/2024	Oriental bittersweet	Small cluster, 5 stems, confirmed and observed during spring survey
P-207	6/27/2024	Black locust	Confirmed during spring survey
P-208	6/27/2024	Black locust	Confirmed during spring survey
P-209	5/19/2025	Oriental bittersweet	N/A
P-210	6/27/2024	Black locust	Confirmed during spring survey

Vegetation point Number	Date	Dominate Species	Notes
P-211	6/27/2024	Black locust	N/A
P-212	6/27/2024	Black locust	N/A
P-213	5/19/2025	Oriental bittersweet	N/A
P-214	6/27/2024	Black locust	N/A
P-215	6/27/2024	Black locust	N/A
P-216	5/19/2025	Black locust	N/A
P-217	6/27/2024	Purple loosestrife	3 stems, confirmed and observed during spring survey
P-218	5/19/2025	Oriental bittersweet	N/A
P-219	6/27/2024	Japanese Knotweed	small clump, 4 stems, confirmed and observed during spring survey
P-220	6/27/2024	Black locust	N/A
P-221	6/27/2024	Spotted knapweed	3 stems
P-222	6/27/2024	Black locust	N/A
P-223	6/27/2024	Black locust	N/A
P-224	6/27/2024	Black locust	Confirmed during spring survey with additional mixed jap knotweed
P-225	6/27/2024	Black locust	Confirmed during spring survey
P-226	6/27/2024	Oriental bittersweet	Large cluster, 10+ on and underneath bridge, confirmed during spring survey
P-227	5/19/2025	Oriental bittersweet	N/A
P-228	5/19/2025	Oriental bittersweet	N/A
P-229	5/19/2025	Multiflora rose	N/A
P-230	5/19/2025	Japanese Knotweed	N/A
P-231	5/19/2025	Black locust	N/A
P-232	5/19/2025	Oriental bittersweet	N/A
P-233	6/28/2024	Multiflora rose	small cluster, 1-6 stems
P-234	5/19/2025	Oriental bittersweet	N/A
P-235	6/27/2024	Japanese Knotweed	2 stems
P-236	5/19/2025	Black locust	N/A
P-237	5/19/2025	Japanese Knotweed	N/A
P-238	5/19/2025	Oriental bittersweet	N/A
P-239	5/19/2025	Spotted knapweed	Cluster
P-240	6/28/2024	Bittersweet nightshade	2 stems
P-241	6/27/2024	Oriental bittersweet	Cluster, 10
P-242	6/27/2024	Purple loosestrife	1 stem
P-243	6/27/2024	Purple loosestrife	2 stems
P-244	5/19/2025	Bittersweet nightshade	Multiple stems
P-245	6/27/2024	Oriental bittersweet	Single stem
P-246	5/19/2025	Purple loosestrife	Four stems
P-247	6/27/2024	Purple loosestrife	5 stems
P-248	5/19/2025	Bittersweet nightshade	Multiple young plants
P-249	6/27/2024	Japanese Knotweed	12 stems among 3 small clumps
P-250	5/19/2025	Other	Mugwort, multiple plants
P-251	5/19/2025	Other	Mugwort
P-252	6/27/2024	Oriental bittersweet	Cluster, 4 stems

Vegetation point Number	Date	Dominate Species	Notes
P-253	5/19/2025	Japanese Knotweed	Small cluster between oriental bittersweet and black locust
P-254	5/19/2025	Oriental bittersweet	Dense cluster
P-255	6/28/2024	Tree-of-heaven	1 stem
P-256	5/19/2025	Oriental bittersweet	Multiple vines
P-257	6/27/2024	Oriental bittersweet	Big cluster all along the fence
P-258	6/27/2024	Black locust	N/A
P-259	6/27/2024	Oriental bittersweet	Large cluster along fence
P-260	5/19/2025	Bittersweet nightshade	Multiple plants growing on fencing
P-261	6/27/2024	Oriental bittersweet	Single stem
P-262	6/27/2024	Black locust	N/A
P-263	6/27/2024	Black locust	N/A
P-264	5/19/2025	Oriental bittersweet	Bittersweet within cluster of black locust.
P-265	5/19/2025	Black locust	Multi stemmed, one mugwort within.
P-266	6/27/2024	Black locust	N/A
P-267	5/19/2025	Purple loosestrife	Two plants
P-268	5/19/2025	Other	Mugwort
P-269	5/19/2025	Tree-of-heaven	One stem
P-270	6/27/2024	Black locust	N/A
P-271	5/19/2025	Japanese Knotweed	Multiple plants
P-272	6/27/2024	Black locust	Multiple plants
P-273	6/27/2024	Oriental bittersweet	Multi stem
P-274	6/27/2024	Black locust	N/A
P-275	6/27/2024	Spotted knapweed	N/A
P-276	6/27/2024	Black locust	N/A
P-277	6/27/2024	Black locust	N/A
P-278	5/19/2025	Oriental bittersweet	Multiple stems
P-279	6/27/2024	Black locust	N/A
P-280	5/19/2025	Other	Mugwort
P-281	5/19/2025	Japanese Knotweed	Multiple stems
P-282	6/27/2024	Purple loosestrife	2 stems
P-283	6/27/2024	Black locust	N/A
P-284	6/27/2024	Other	mugwort, 3 stems
P-285	6/27/2024	Japanese Knotweed	1 stem
P-286	6/27/2024	Purple loosestrife	1 stem
P-287	6/27/2024	Other	mugwort
P-288	6/27/2024	Purple loosestrife	2 stems
P-289	6/27/2024	Purple loosestrife	2 stems
P-290	6/27/2024	Japanese Knotweed	N/A
P-291	6/27/2024	Oriental bittersweet	Single 3 stems
P-292	6/27/2024	Purple loosestrife	1 stem
P-293	6/27/2024	Other	mugwort 1 clump, 10 stems
P-294	6/27/2024	Other	mugwort, 8 stems
P-295	6/27/2024	Oriental bittersweet	Single 1 stem
P-296	6/27/2024	Oriental bittersweet	Cluster, 5 stems
P-297	5/19/2025	Other	Mugwort

Vegetation point Number	Date	Dominate Species	Notes
P-298	5/19/2025	Other	Mugwort
P-299	6/27/2024	Oriental bittersweet	Single, 5 stems
P-300	6/27/2024	Oriental bittersweet	Cluster, 3
P-301	6/27/2024	Other	mugwort, 10 stems
P-302	6/27/2024	Oriental bittersweet	Large cluster, 5 stems
P-303	6/27/2024	Oriental bittersweet	Cluster, 10
P-304	5/19/2025	Other	Mugwort
P-305	6/27/2024	Purple loosestrife	1 stem
P-306	6/27/2024	Oriental bittersweet	Scattered, 10
P-307	6/27/2024	Oriental bittersweet	Cluster, 5
P-308	6/27/2024	Oriental bittersweet	Cluster, 5
P-309	6/27/2024	Other	mugwort
P-310	6/27/2024	Oriental bittersweet	Cluster, 5 stems
P-311	5/19/2025	Other	Mugwort
P-312	5/19/2025	Oriental bittersweet	N/A
P-313	5/19/2025	Spotted knapweed	N/A
P-314	5/19/2025	Other	Mugwort
P-315	6/27/2024	Japanese Knotweed	1 clump, 3 stems
P-316	5/19/2025	Other	Mugwort
P-317	5/19/2025	Other	Mugwort
P-318	6/27/2024	Other	mugwort, 10 stems
P-319	5/19/2025	Other	Mugwort
P-320	6/27/2024	Oriental bittersweet	Large cluster on end of bridge
P-321	6/27/2024	Black locust	N/A
P-322	6/27/2024	Oriental bittersweet	Cluster, 8 stems
P-323	6/27/2024	Black locust	N/A
P-324	6/27/2024	Other	mugwort, 1 stem
P-325	6/27/2024	Oriental bittersweet	Small single stem
P-326	6/27/2024	Oriental bittersweet	Small cluster, 5- stems
P-327	5/19/2025	Oriental bittersweet	N/A
P-328	6/27/2024	Spotted knapweed	1 clump, 8 stems
P-329	6/27/2024	Oriental bittersweet	Single stem
P-330	6/27/2024	Oriental bittersweet	Scattered, 3 different stems
P-331	6/28/2024	Bittersweet nightshade	2 stems
P-332	6/27/2024	Purple loosestrife	3 stems
P-333	5/19/2025	Other	Bittersweet nightshade
P-334	6/27/2024	Other	mugwort
P-335	6/27/2024	Oriental bittersweet	Single, 5 stems
P-336	6/27/2024	Oriental bittersweet	Large cluster, 10 stems
P-337	5/19/2025	Other	Mugwort
P-338	6/27/2024	Japanese Knotweed	N/A
P-339	5/19/2025	Other	Bittersweet nightshade
P-340	6/27/2024	Japanese Knotweed	N/A
P-341	6/27/2024	Japanese Knotweed	N/A
P-342	6/27/2024	Spotted knapweed	N/A
P-343	6/27/2024	Japanese Knotweed	N/A

Vegetation point Number	Date	Dominate Species	Notes
P-344	6/27/2024	Spotted knapweed	Clustered together
P-345	6/27/2024	Spotted knapweed	Clustered together
P-346	6/27/2024	Oriental bittersweet	Cluster, 15 stems
P-347	5/19/2025	Purple loosestrife	4 stems
P-348	5/19/2025	Japanese Knotweed	One plant
P-349	5/19/2025	Other	Mugwort
P-350	6/27/2024	Purple loosestrife	2 clumps, 6 stems
P-351	6/27/2024	Tree-of-heaven	N/A
P-352	6/27/2024	Purple loosestrife	3 clumps 12 stems
P-353	6/27/2024	Purple loosestrife	4 stems
P-354	5/19/2025	Other	Mugwort
P-355	5/19/2025	Other	Mugwort
P-356	6/27/2024	Oriental bittersweet	Large cluster, 20
P-357	6/27/2024	Oriental bittersweet	Small cluster, 10
P-358	6/27/2024	Oriental bittersweet	Large cluster, 25
P-359	5/19/2025	Other	Mugwort
P-360	6/27/2024	Oriental bittersweet	Small cluster, 10
P-361	5/19/2025	Japanese Knotweed	Small cluster
P-362	6/27/2024	Spotted knapweed	N/A
P-363	6/27/2024	Japanese Knotweed	N/A
P-364	6/27/2024	Oriental bittersweet	Large cluster down canal wall, 25 or more stems
P-365	6/27/2024	Oriental bittersweet	Small cluster, 10 stems
P-366	6/27/2024	Oriental bittersweet	Large cluster, 25 or more stems
P-367	6/27/2024	Oriental bittersweet	Scattered, 20 different stems for 5 or more feet
P-368	6/27/2024	Tree-of-heaven	N/A
P-369	6/27/2024	Oriental bittersweet	We've clusters along gate
P-370	6/27/2024	Oriental bittersweet	All along the gate
P-371	6/27/2024	Oriental bittersweet	Large clusters along the canal wall, 25 or more stems
P-372	6/27/2024	Oriental bittersweet	Small cluster, 10+ next to car bridge
P-373	6/28/2024	Other	Common mugwort, 5 stems on wall, could be more on wall side
P-374	6/28/2024	Oriental bittersweet	Small cluster, 10 stems
P-375	5/20/2025	Tree-of-heaven	Sprouting from cut stem
P-376	6/28/2024	Glossy buckthorn	N/A
P-377	6/28/2024	Other	common mugwort, 4 large stems, could be more along wall
P-378	6/28/2024	Other	Common mugwort, 3 tall stems
P-379	6/28/2024	Other	Common mugwort, 3 stems on wall could be more under
P-380	6/28/2024	Other	Common mugwort, scattered, 5 stems
P-381	6/28/2024	Spotted knapweed	N/A
P-382	6/28/2024	Oriental bittersweet	Scattered, 20 stems
P-383	5/20/2025	Other	Mugwort - multiple plants
P-384	5/20/2025	Japanese Knotweed	Multiple young plants sprouting from mowed hillside
P-385	6/28/2024	Oriental bittersweet	Small cluster, 5 stems

Vegetation point Number	Date	Dominate Species	Notes
P-386	6/28/2024	Japanese Knotweed	Small plant, 10 stems
P-387	6/28/2024	Oriental bittersweet	Small cluster, 5 stems
P-388	6/28/2024	Other	Common mugwort, scattered, 20 stems
P-389	6/28/2024	Glossy buckthorn	N/A
P-390	5/20/2025	Spotted knapweed	Multiple plants
P-391	6/28/2024	Oriental bittersweet	Small cluster, 3 stems
P-392	5/20/2025	Other	Tragopogon dubius - yellow salsify - four plants
P-393	5/20/2025	Other	Mugwort - multiple plants
P-394	5/20/2025	Spotted knapweed	Multiple plants
P-395	6/28/2024	Glossy buckthorn	N/A
P-396	6/28/2024	Glossy buckthorn	N/A
P-397	6/28/2024	Other	Common mugwort, small cluster, 20 stems
P-398	5/20/2025	Other	Japanese creeper along 10 ft of canal wall.
P-399	6/28/2024	Spotted knapweed	Multiple clusters, scatter +20
P-400	6/28/2024	Glossy buckthorn	N/A
P-401	6/28/2024	Spotted knapweed	Multiple plants
P-402	6/28/2024	Other	Common mugwort, clusters of 10
P-403	6/28/2024	Other	Common mugwort, scattered, 10 stems
P-404	6/28/2024	Other	Common mugwort, 5 stems
P-405	6/28/2024	Oriental bittersweet	1 small plant
P-406	6/28/2024	Spotted knapweed	Multiple plants
P-407	6/28/2024	Glossy buckthorn	N/A
P-408	5/20/2025	Tree-of-heaven	One branch growing from cut stump.
P-409	5/20/2025	Oriental bittersweet	Multiple plants in canal wall
P-410	5/20/2025	Spotted knapweed	Multiple plants
P-411	6/28/2024	Other	Common mugwort, scattered, 10 stems
P-412	6/28/2024	Glossy buckthorn	N/A
P-413	6/28/2024	Glossy buckthorn	N/A
P-414	5/20/2025	Oriental bittersweet	Multiple plants growing in dilapidated structure
P-415	5/20/2025	Other	Mugwort- Multiple plants growing on dilapidated structure
P-416	5/20/2025	Spotted knapweed	Multiple plants growing on dilapidated structure
P-417	6/28/2024	Other	Common mugwort, 1 stem
P-418	5/20/2025	Other	Mugwort
P-419	5/20/2025	Other	Mugwort
P-420	6/28/2024	Oriental bittersweet	Small, single stem
P-421	6/28/2024	Spotted knapweed	N/A
P-422	6/28/2024	Oriental bittersweet	Small cluster, 10 stems
P-423	5/20/2025	Other	Mugwort
P-424	6/28/2024	Glossy buckthorn	N/A
P-425	6/28/2024	Oriental bittersweet	Small cluster, 10 stems
P-426	5/20/2025	Other	Mugwort
P-427	6/28/2024	Oriental bittersweet	Scattered, small clusters
P-428	5/20/2025	Other	Bittersweet nightshade
P-429	6/28/2024	Other	Common mugwort, 10 stems, 2 different root stems

Vegetation point Number	Date	Dominate Species	Notes
P-430	6/28/2024	Spotted knapweed	N/A
P-431	6/28/2024	Other	Common mugwort, single cluster
P-432	6/28/2024	Oriental bittersweet	Scattered, small clusters
P-433	6/28/2024	Other	Common mugwort, scattered, 10 stems
P-434	6/28/2024	Oriental bittersweet	Small cluster, 10 stems
P-435	5/20/2025	Other	Bittersweet nightshade
P-436	6/28/2024	Other	Common mugwort, scattered 10 stems
P-437	6/28/2024	Glossy buckthorn	N/A
P-438	6/28/2024	Other	Common mugwort, 3 stems
P-439	6/28/2024	Oriental bittersweet	Large grouping scattered
P-440	5/20/2025	Other	Bittersweet nightshade - Multiple stems
P-441	6/28/2024	Glossy buckthorn	N/A
P-442	5/20/2025	Oriental bittersweet	Multiple stems
P-443	5/20/2025	Oriental bittersweet	Multiple stems
P-444	6/28/2024	Black locust	N/A
P-445	6/28/2024	Other	Common mugwort, 3 stems
P-446	5/20/2025	Oriental bittersweet	Multiple stems
P-447	6/28/2024	Tree-of-heaven	3 stems
P-448	6/28/2024	Tree-of-heaven	5 stems
P-449	6/28/2024	Black locust	Confirmed during spring survey
P-450	5/19/2025	Oriental bittersweet	Confirmed polygon of OBS
P-451	5/19/2025	Other	Mugwort
P-452	6/28/2024	Purple loosestrife	1 clump, 3 stems
P-453	5/19/2025	Other	Bittersweet nightshade / oriental bittersweet
P-454	6/28/2024	Tree-of-heaven	1 stem
P-455	6/28/2024	Black locust	Confirmed during spring survey
P-456	6/28/2024	Tree-of-heaven	1 small clump, also Jap Knot
P-457	6/28/2024	Oriental bittersweet	Small cluster, 10 stems, confirmed during spring survey
P-458	5/20/2025	Black locust	Confirmed polygon
P-459	6/28/2024	Tree-of-heaven	1 clump, confirmed during spring survey
P-460	6/28/2024	Black locust	Confirmed during spring survey
P-461	6/28/2024	Black locust	Confirmed during spring survey
P-462	5/20/2025	Black locust	Confirmed polygon

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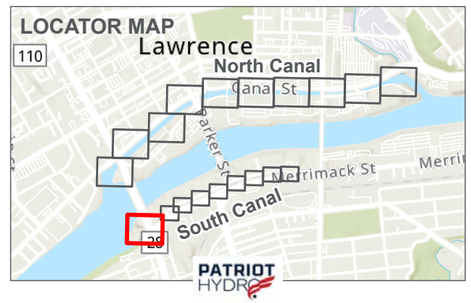
Invasive Species Type
- Black locust
- Glossy buckthorn
- Oriental bittersweet
- Other
- Purple loosestrife
- Spotted knapweed
- Tree-of-heaven

Invasive Species Type
- Oriental bittersweet
- Spotted knapweed
- Tree-of-heaven

Invasive Species Type
- Black locust
- Oriental bittersweet
- Other
- Spotted knapweed

Map provides compiled results from multiple vegetation surveys through the growing season



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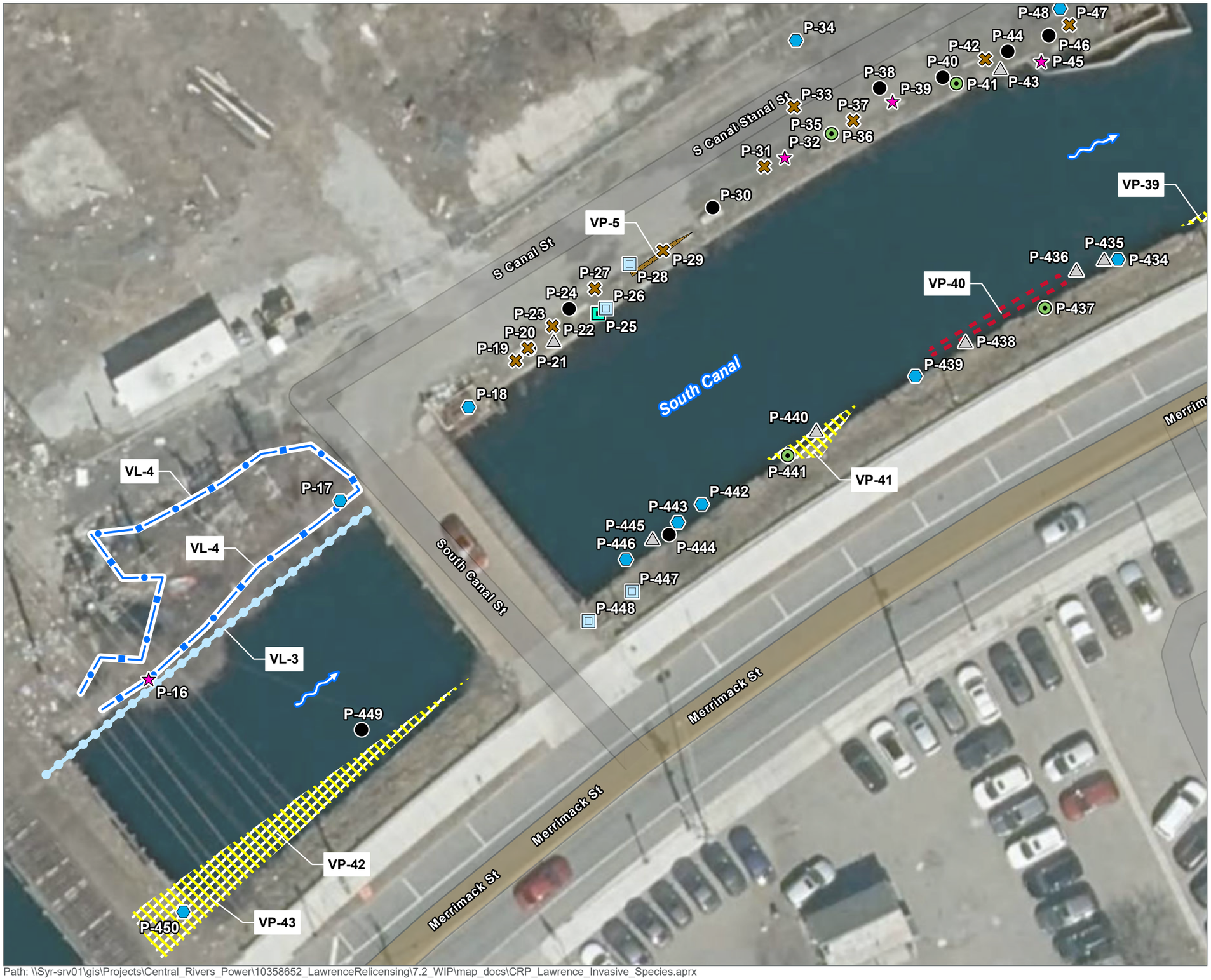
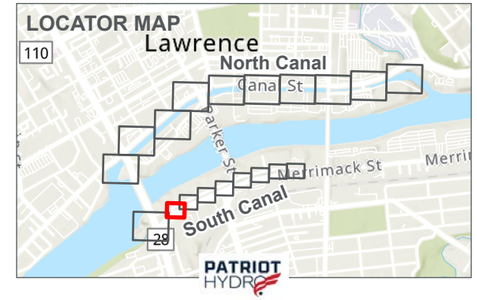


Invasive Species Type
- Black locust
- Glossy buckthorn
- Japanese knotweed
- Oriental bittersweet
- Other
- Purple loosestrife
- Spotted knapweed
- Tree-of-heaven

Invasive Species Type
- Oriental bittersweet
- Tree-of-heaven

Invasive Species Type
- Oriental bittersweet
- Other
- Spotted knapweed

Map provides compiled results from multiple vegetation surveys through the growing season



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SOUTH CANAL
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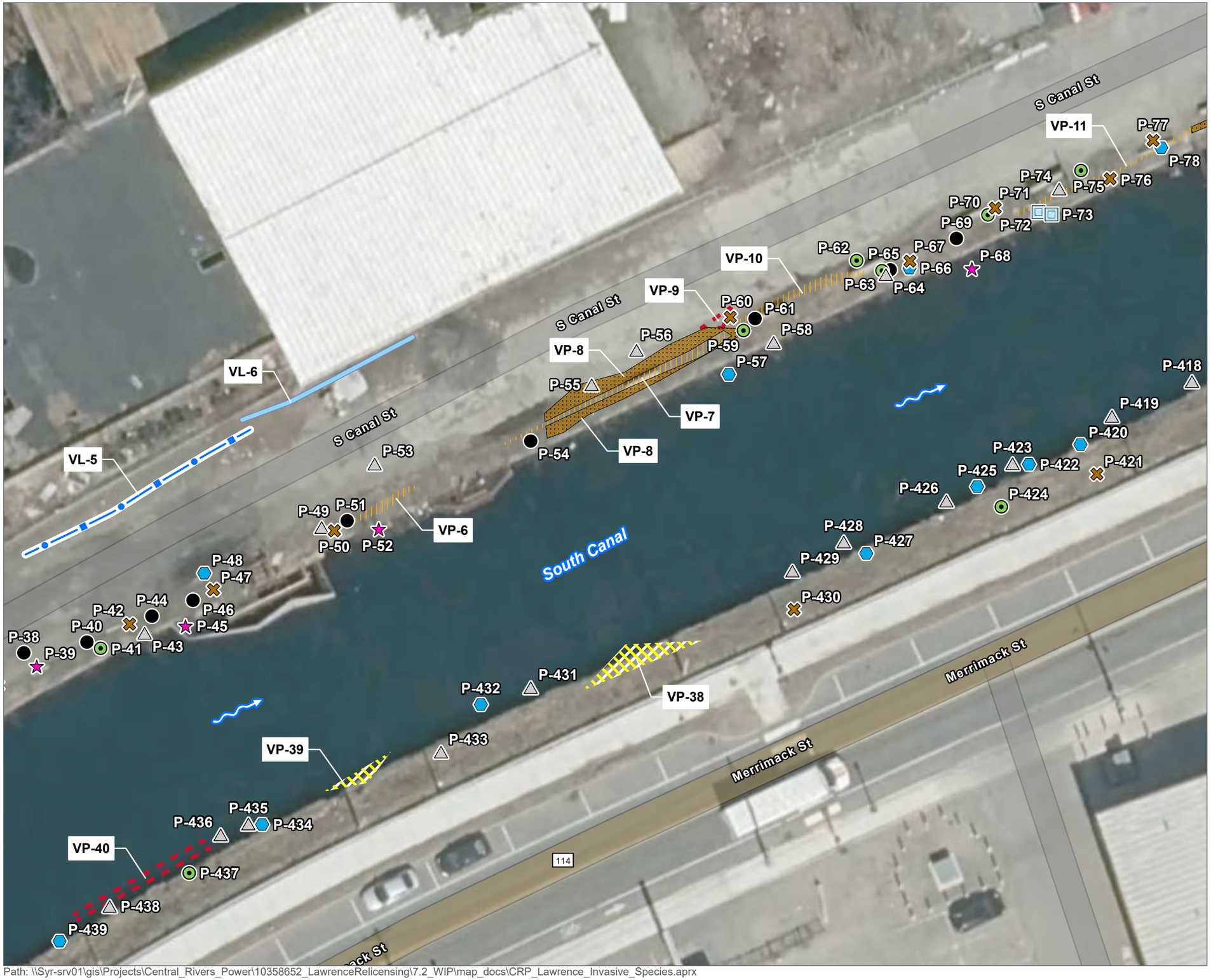

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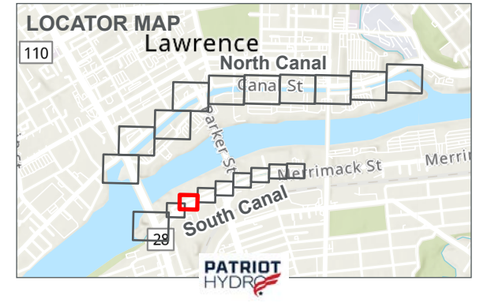
Invasive Species Type
- Black locust
- Glossy buckthorn
- Oriental bittersweet
- Other
- Purple loosestrife
- Spotted knapweed
- Tree-of-heaven

Invasive Species Type
- Japanese knotweed
- Oriental bittersweet

Invasive Species Type
- Black locust
- Oriental bittersweet
- Other
- Spotted knapweed

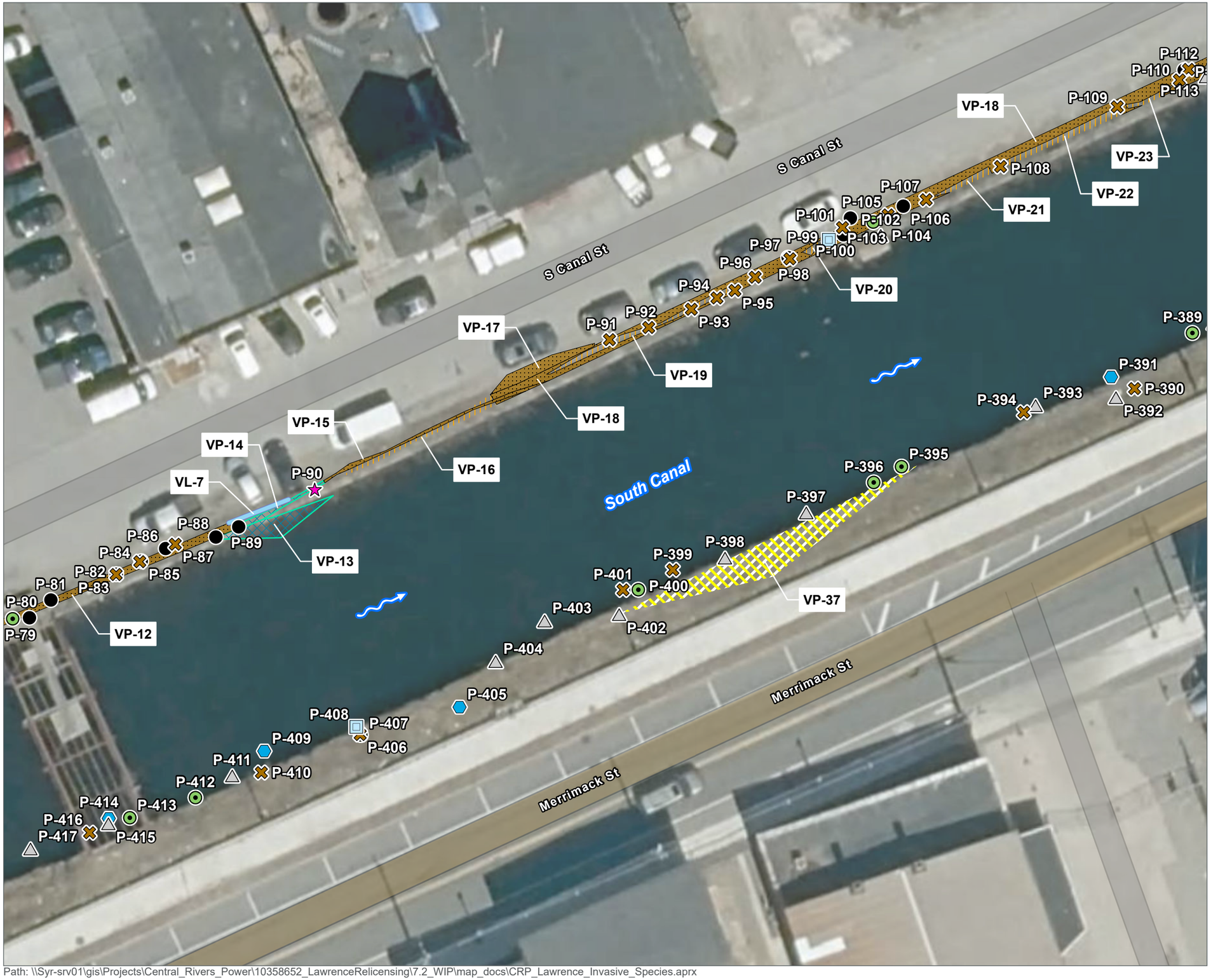
Map provides compiled results from multiple vegetation surveys through the growing season



HDR

0 20 Feet

LAWRENCE HYDROELECTRIC PROJECT
FERC NO. 2800
INVASIVE SPECIES SURVEY

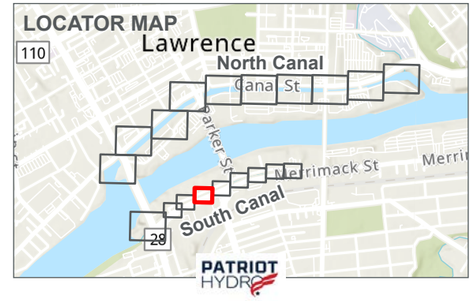


Invasive Species Type
- Black locust
- Glossy buckthorn
- Oriental bittersweet
- Other
- Purple loosestrife
- Spotted knapweed
- Tree-of-heaven

Invasive Species Type
- Japanese knotweed

Invasive Species Type
- Black locust
- Japanese knotweed
- Oriental bittersweet
- Spotted knapweed

Map provides compiled results from multiple vegetation surveys through the growing season



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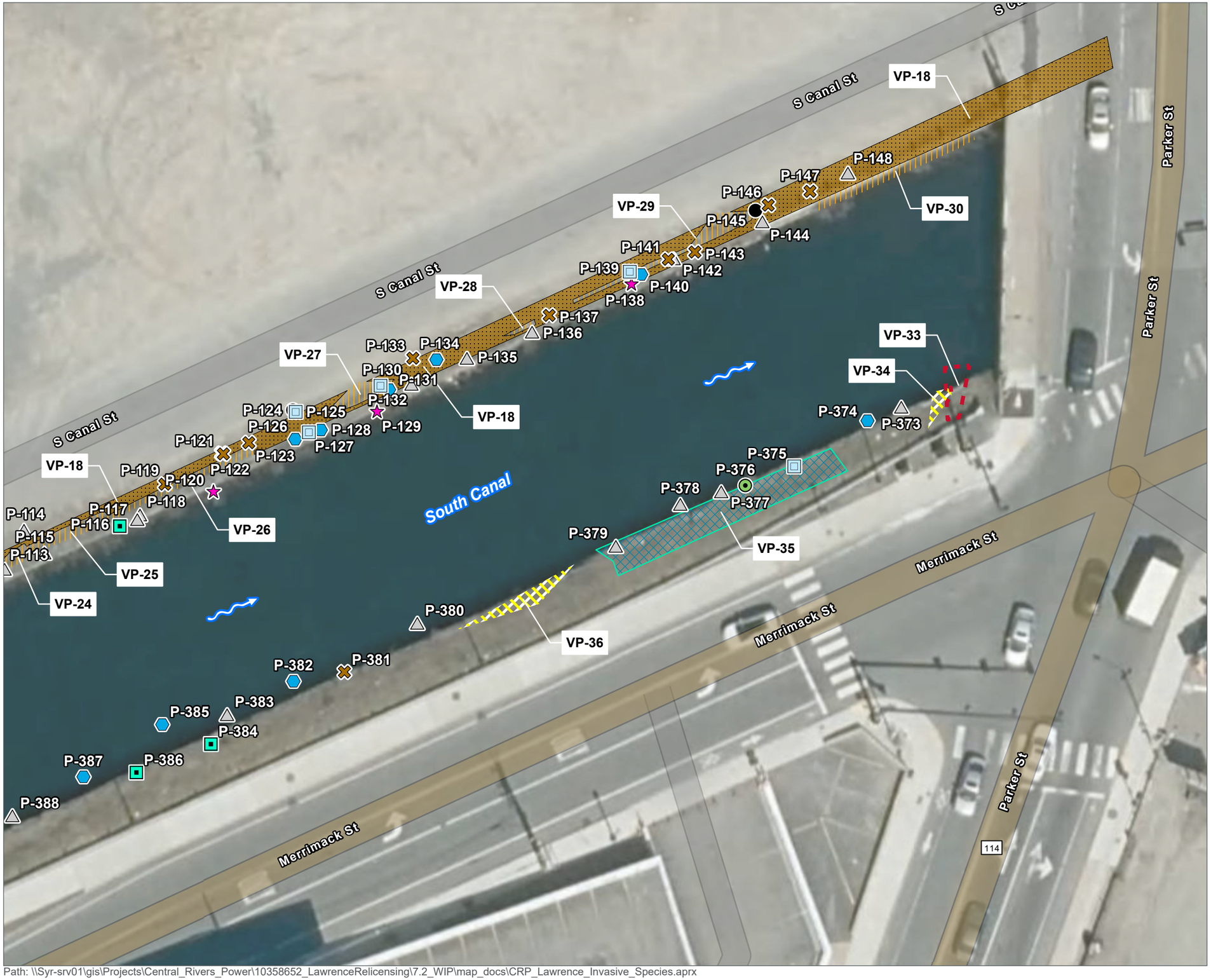
LAWRENCE HYDROELECTRIC PROJECT
FERC NO. 2800
INVASIVE SPECIES SURVEY

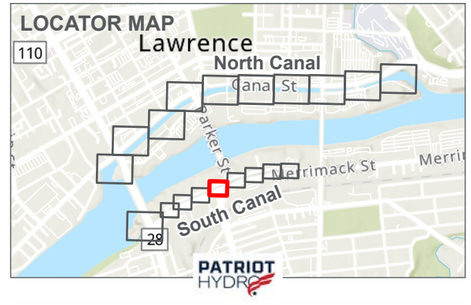
SOUTH CANAL
PAGE 5 OF 9



Invasive Species Type
- Black locust
- Glossy buckthorn
- Japanese knotweed
- Oriental bittersweet
- Other
- Purple loosestrife
- Spotted knapweed
- Tree-of-heaven

Invasive Species Type
- Black locust
- Japanese knotweed
- Oriental bittersweet
- Other
- Spotted knapweed

Map provides compiled results from multiple vegetation surveys through the growing season



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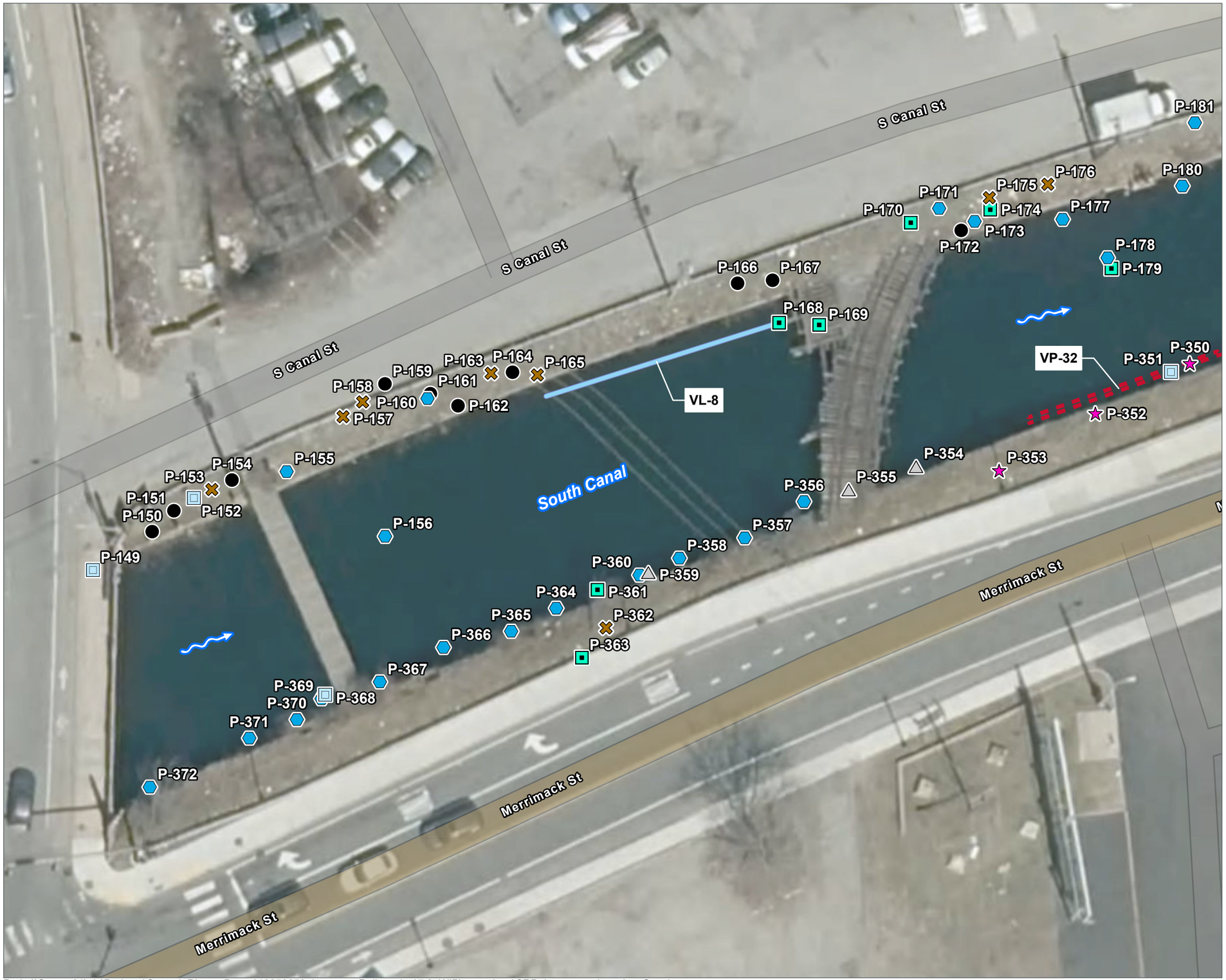
LAWRENCE HYDROELECTRIC PROJECT
FERC NO. 2800
INVASIVE SPECIES SURVEY

SOUTH CANAL
PAGE 6 OF 9

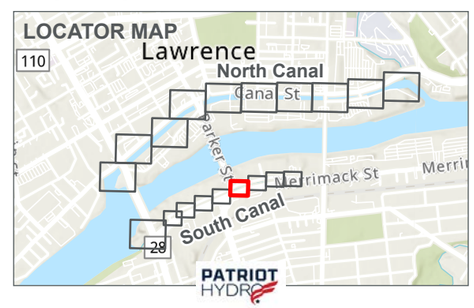


Invasive Species Type
- Black locust
- Japanese knotweed
- Oriental bittersweet
- Other
- Purple loosestrife
- Spotted knapweed
- Tree-of-heaven

Invasive Species Type
- Japanese knotweed

Invasive Species Type
- Other

Map provides compiled results from multiple vegetation surveys through the growing season



HDR

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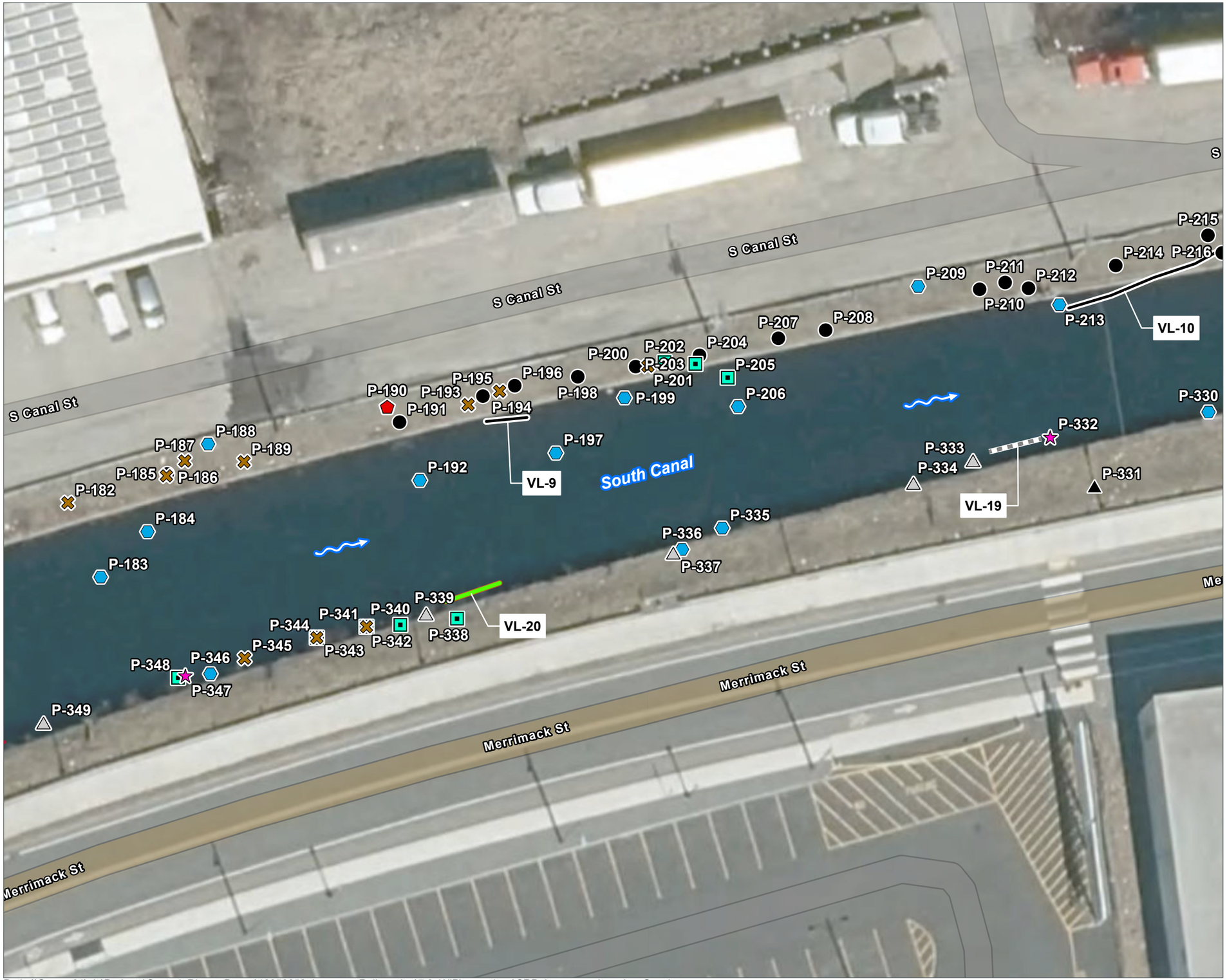
Path: \\Syr-srv01\gis\Projects\Central_Rivers_Power\10358652_LawrenceRelicensing\7.2_WIP\map_docs\CRP_Lawrence_Invasive_Species.aprx

LAWRENCE HYDROELECTRIC PROJECT
FERC NO. 2800
INVASIVE SPECIES SURVEY

SOUTH CANAL
PAGE 7 OF 9

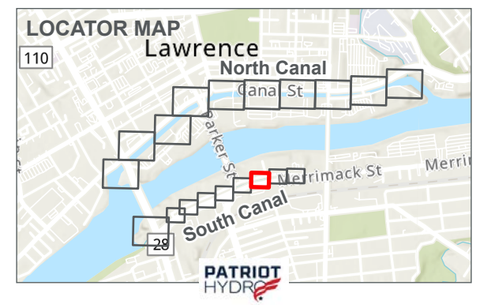


Invasive Species Type
- Black locust
- Black swallow-wort
- Japanese knotweed
- Multiflora rose
- Oriental bittersweet
- Other
- Purple loosestrife
- Spotted knapweed

Invasive Species Type
- Black locust
- Other
- Poison ivy

Invasive Species Type
- Other

Map provides compiled results from multiple vegetation surveys through the growing season



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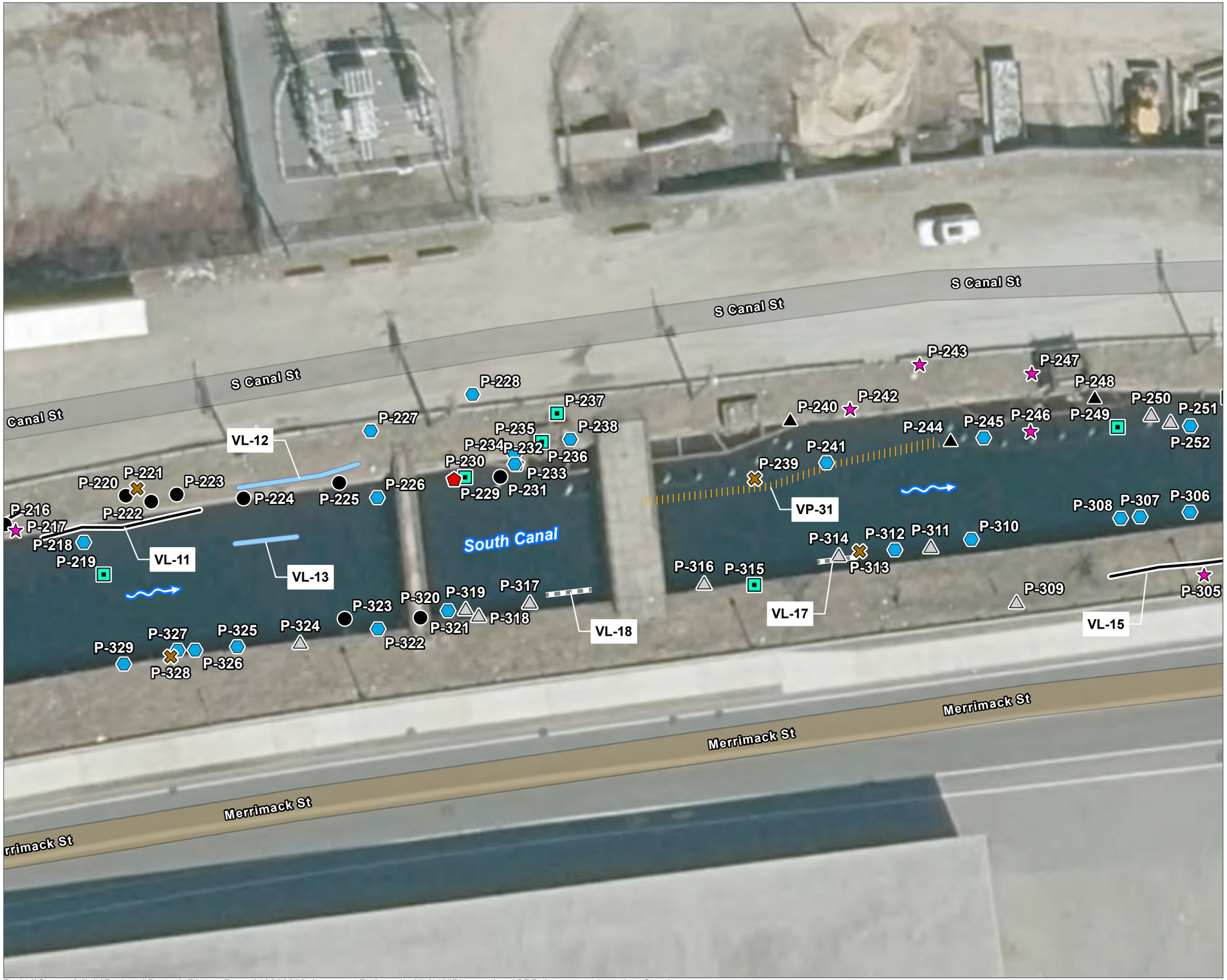
LAWRENCE HYDROELECTRIC PROJECT
FERC NO. 2800
INVASIVE SPECIES SURVEY

SOUTH CANAL
PAGE 8 OF 9

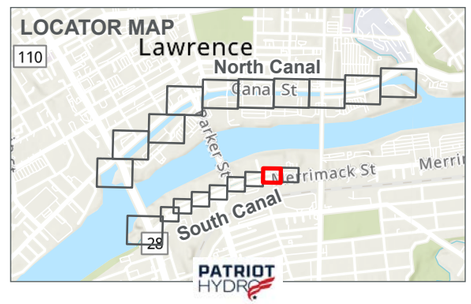


Invasive Species Type
- Black locust
- Black swallow-wort
- Japanese knotweed
- Multiflora rose
- Oriental bittersweet
- Other
- Purple loosestrife
- Spotted knapweed

Invasive Species Type
- Black locust
- Japanese knotweed
- Other

Invasive Species Type
- Black locust

Map provides compiled results from multiple vegetation surveys through the growing season



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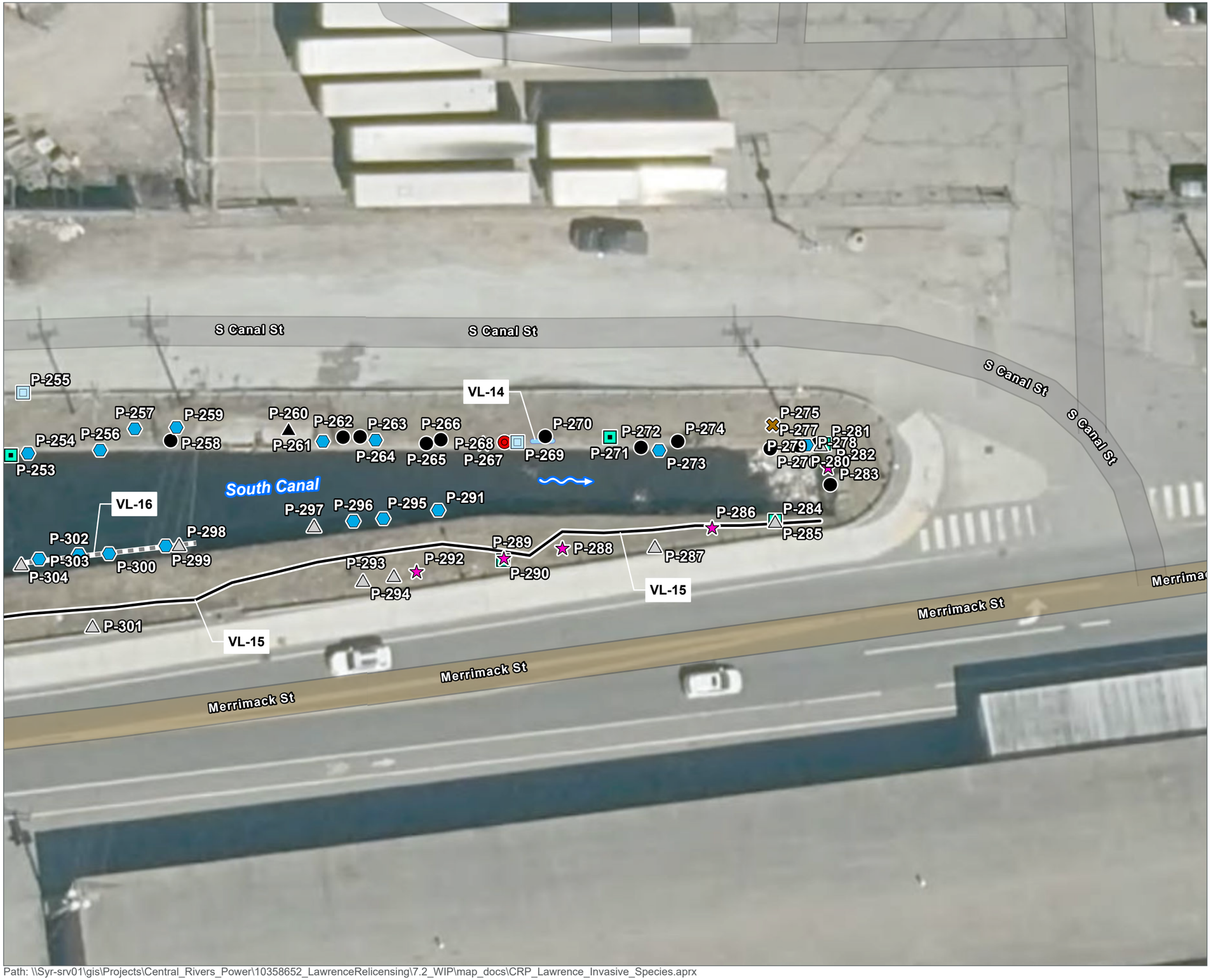
LAWRENCE HYDROELECTRIC PROJECT
FERC NO. 2800
INVASIVE SPECIES SURVEY

SOUTH CANAL
PAGE 9 OF 9



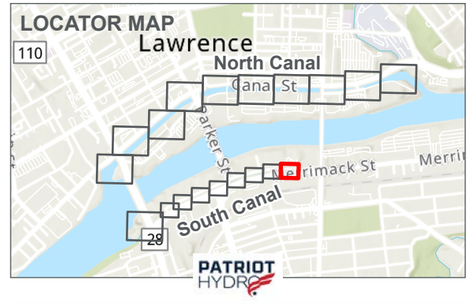
Invasive Species Type

- Black locust
- Black swallow-wort
- Common mugwort
- Japanese knotweed
- Oriental bittersweet
- Other
- Purple loosestrife
- Spotted knapweed
- Tree-of-heaven

Invasive Species Type

- Black locust
- Japanese knotweed
- Other

Map provides compiled results from multiple vegetation surveys through the growing season



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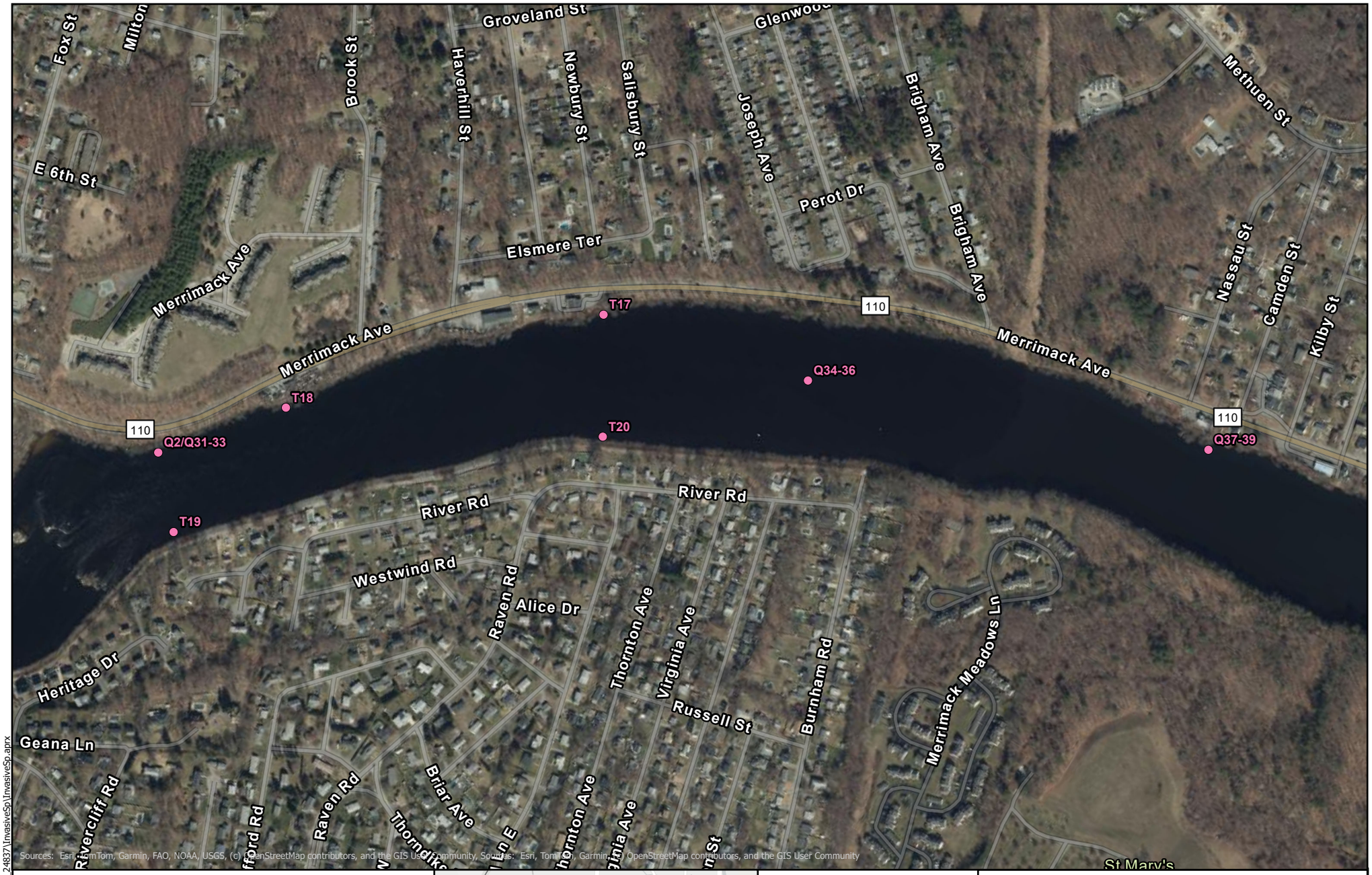
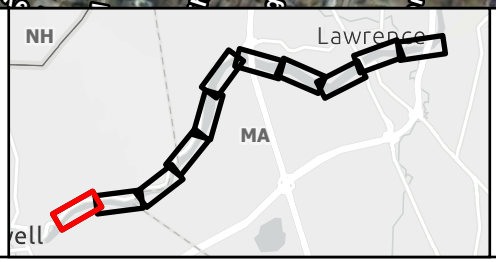
Appendix J

Aquatic Invasive Species Maps



- Sample Locations
- Incidental Observation



0 0.1 0.2
Kilometers

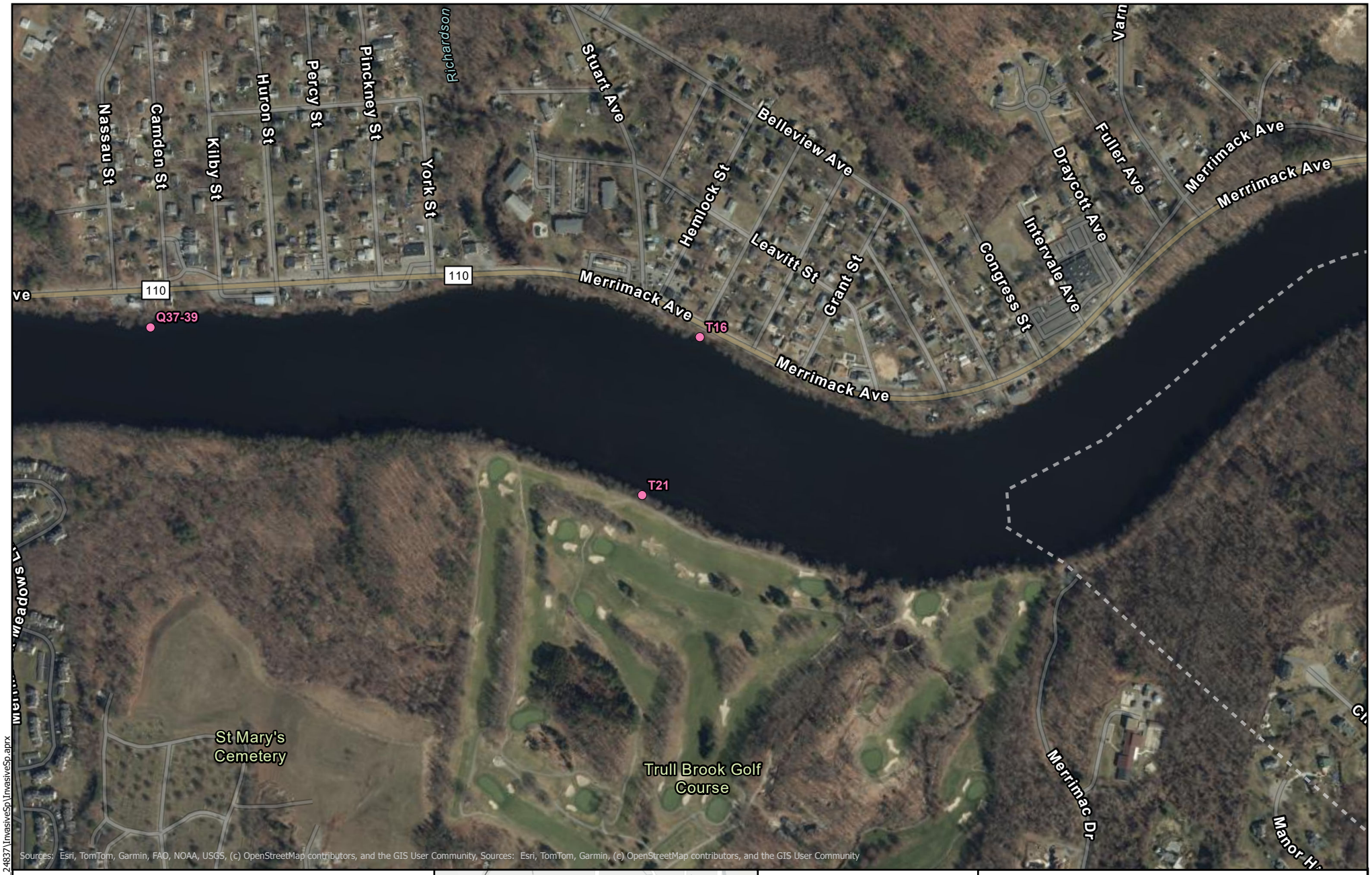
0 0.06 0.12
Miles

Aquatic Invasive Species
Lawrence Hydroelectric Project (FERC No. 2800),
Merrimack River
Lawrence, MA

NORMANDEAU ASSOCIATES
ENVIRONMENTAL CONSULTANTS

Path: J:\Projects\PatriotHydro_Lawrence_24837\InvasiveSp\InvasiveSp.aprx

2/19/2026



- Sample Locations
- Incidental Observation

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Kilometers

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Miles

Aquatic Invasive Species
Lawrence Hydroelectric Project (FERC No. 2800),
Merrimack River
Lawrence, MA

NORMANDEAU ASSOCIATES
ENVIRONMENTAL CONSULTANTS

Path: J:\Projects\PatriotHydro_Lawrence_24837\InvasiveSp\InvasiveSp.aprx

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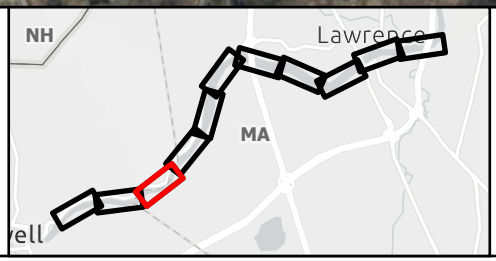
- Sample Locations
- Incidental Observation



0 0.1 0.2
Kilometers

0 0.06 0.12
Miles

Aquatic Invasive Species
Lawrence Hydroelectric Project (FERC No. 2800),
Merrimack River
Lawrence, MA

NORMANDEAU ASSOCIATES
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2/19/2026

- Sample Locations
- Incidental Observation

0 0.1 0.2
Kilometers

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Miles

Aquatic Invasive Species
Lawrence Hydroelectric Project (FERC No. 2800),
Merrimack River
Lawrence, MA

NORMANDEAU ASSOCIATES
ENVIRONMENTAL CONSULTANTS

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2/19/2026

- Sample Locations
- Incidental Observation

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Aquatic Invasive Species
Lawrence Hydroelectric Project (FERC No. 2800),
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2/19/2026

- Sample Locations
- Incidental Observation

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Kilometers
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Aquatic Invasive Species
Lawrence Hydroelectric Project (FERC No. 2800),
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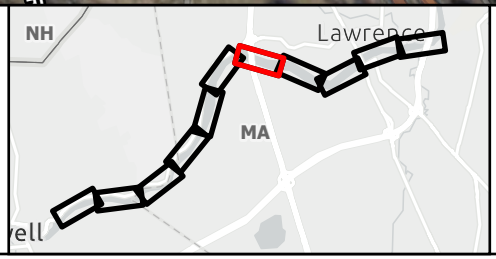
2/19/2026

- Sample Locations
- Incidental Observation



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Aquatic Invasive Species
Lawrence Hydroelectric Project (FERC No. 2800),
Merrimack River
Lawrence, MA

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ENVIRONMENTAL CONSULTANTS

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2/19/2026

- Sample Locations
- Incidental Observation

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Aquatic Invasive Species
Lawrence Hydroelectric Project (FERC No. 2800),
Merrimack River
Lawrence, MA

NORMANDEAU ASSOCIATES
ENVIRONMENTAL CONSULTANTS

Path: J:\Projects\PatriotHydro_Lawrence_24837\InvasiveSp\InvasiveSp.aprx

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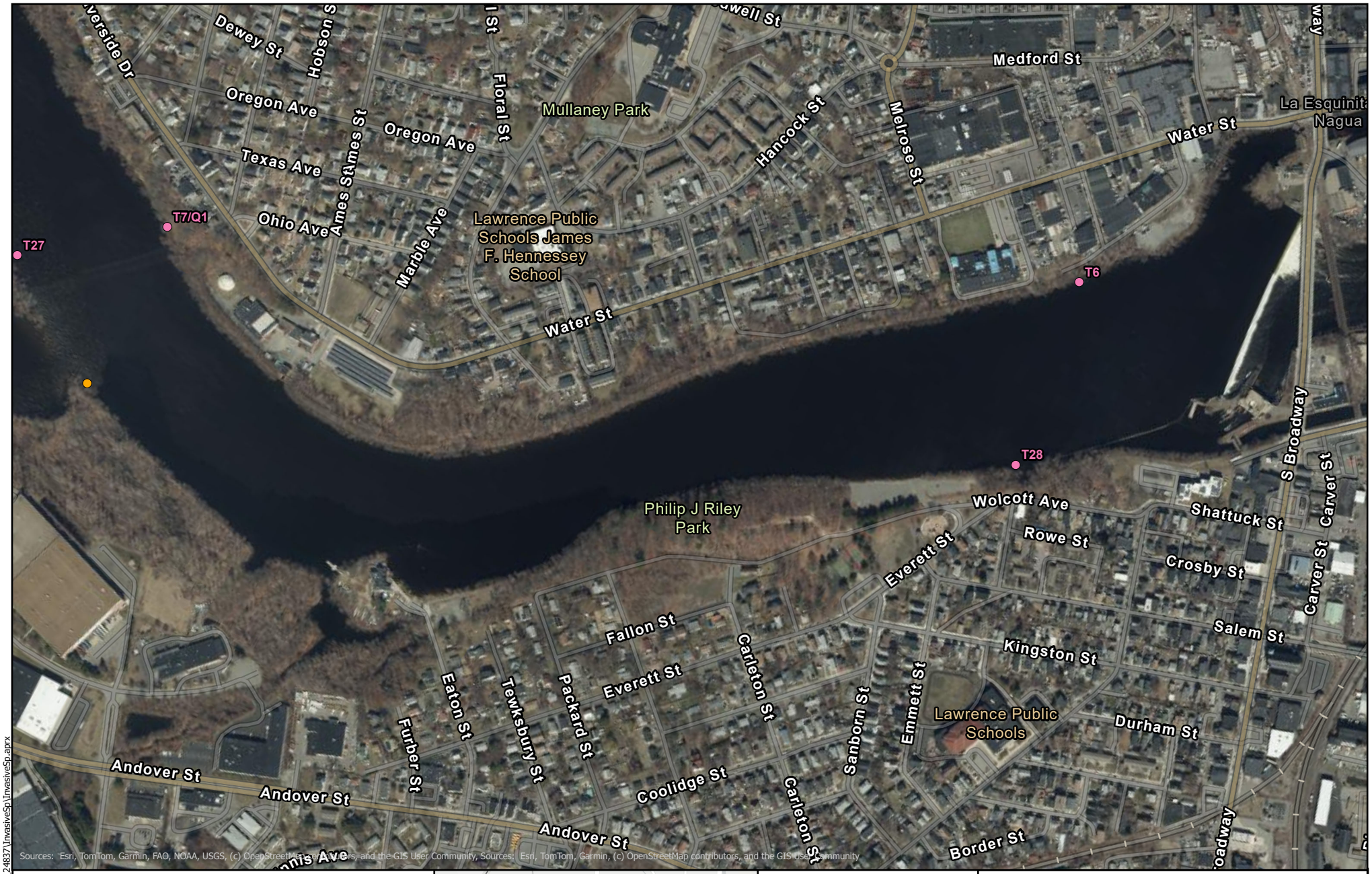

- Sample Locations
- Incidental Observation

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Kilometers

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Aquatic Invasive Species
Lawrence Hydroelectric Project (FERC No. 2800),
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Lawrence, MA

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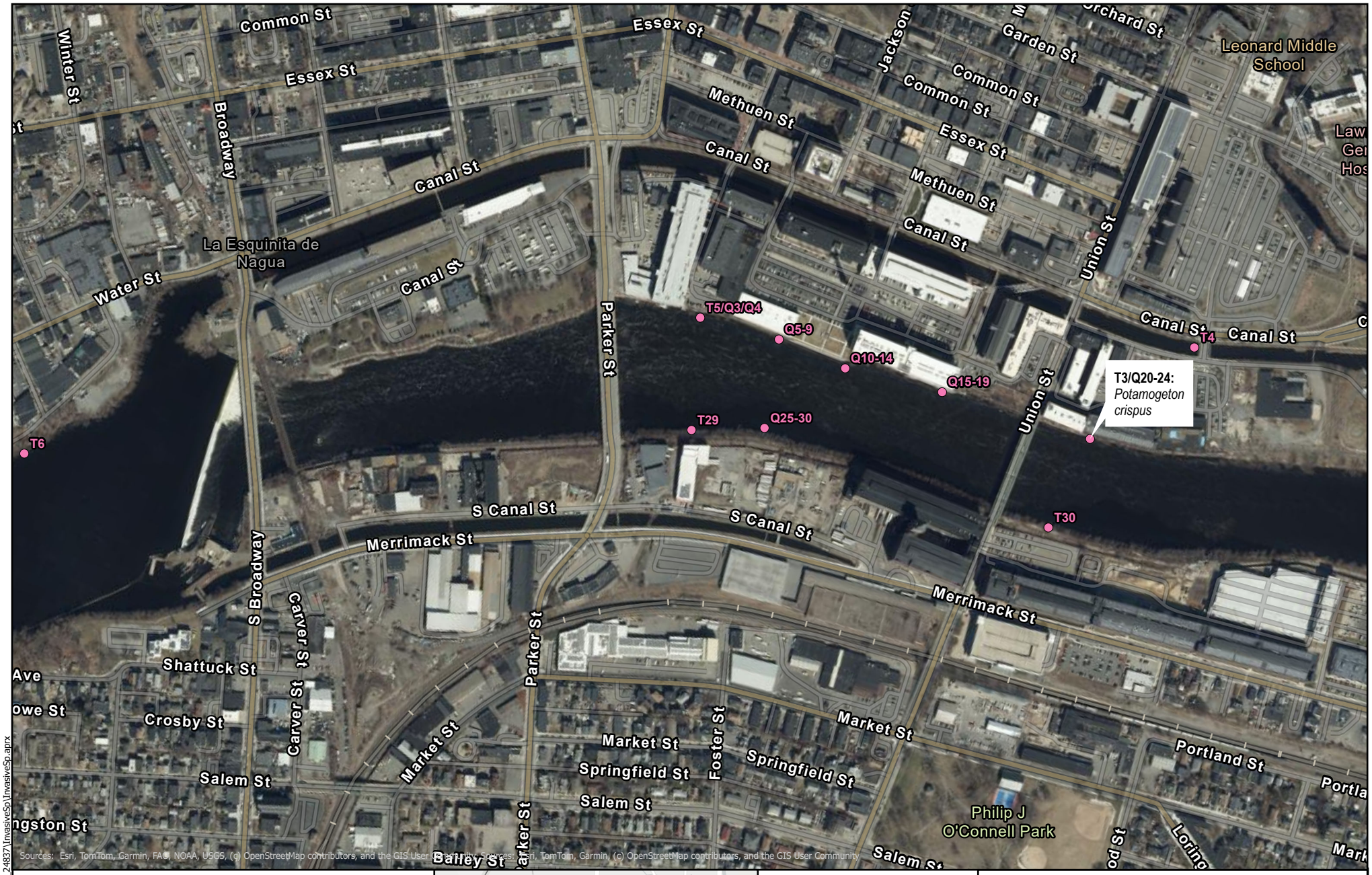

Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, (c) OpenStreetMap contributors, and the GIS User Community

Sources: Esri, TomTom, Garmin, (c) OpenStreetMap contributors, and the GIS User Community

- Sample Locations
- Incidental Observation

Aquatic Invasive Species
Lawrence Hydroelectric Project (FERC No. 2800),
Merrimack River
Lawrence, MA

NORMANDEAU ASSOCIATES
ENVIRONMENTAL CONSULTANTS

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- Sample Locations
- Incidental Observation

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Miles

Aquatic Invasive Species
Lawrence Hydroelectric Project (FERC No. 2800),
Merrimack River
Lawrence, MA

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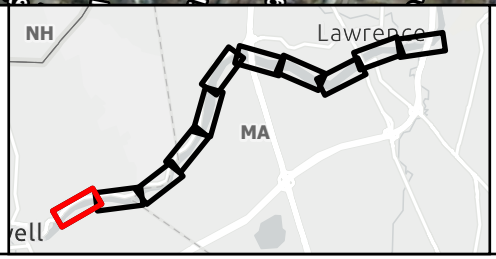
2/19/2026

Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, (c) OpenStreetMap contributors, and the GIS User Community, Sources: Esri, TomTom, Garmin, (c) OpenStreetMap contributors, and the GIS User Community

Survey Locations



N W E S

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Kilometers

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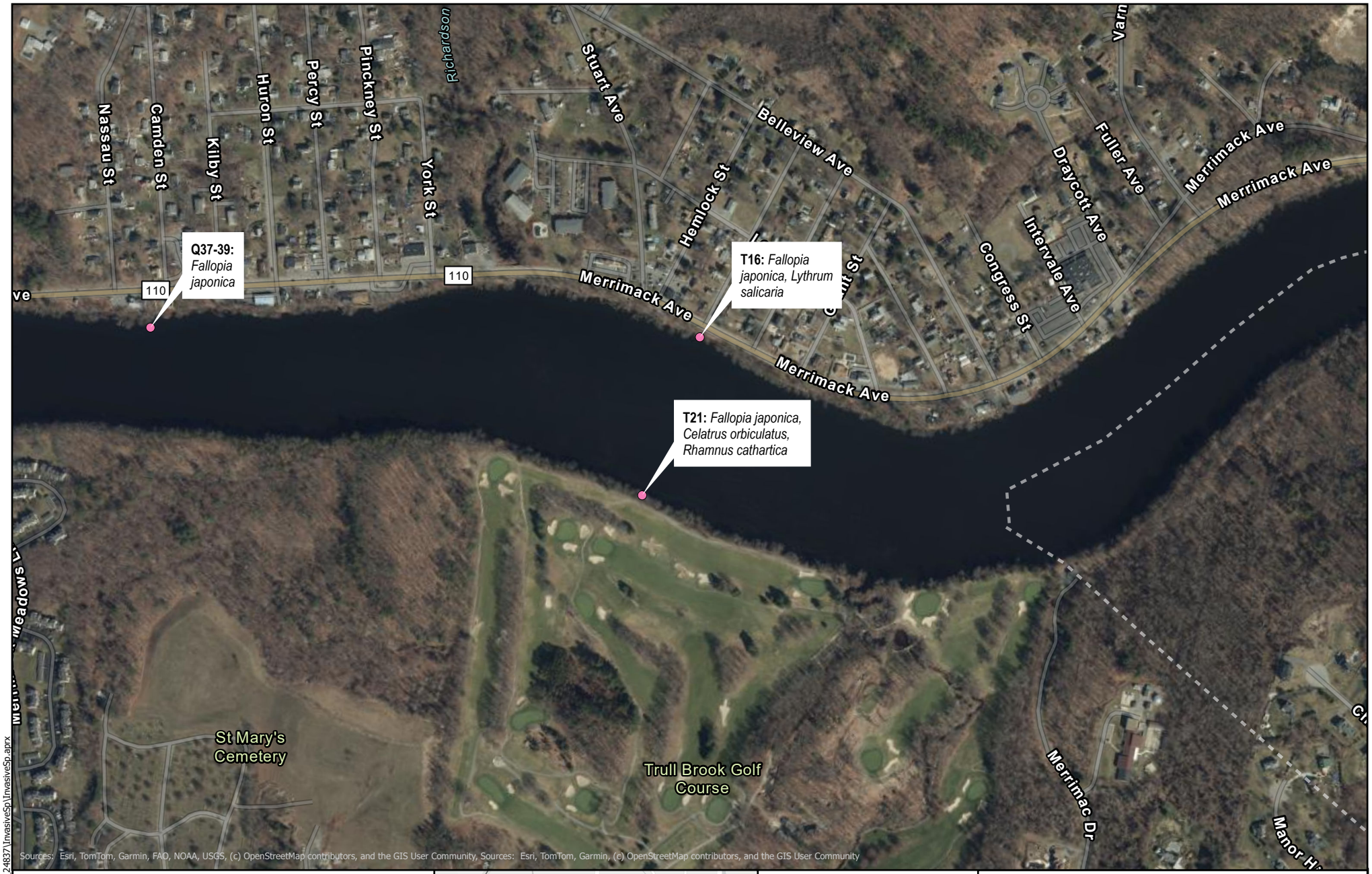
Miles

Terrestrial Invasive Species
Lawrence Hydroelectric Project (FERC No. 2800),
Merrimack River
Lawrence, MA

NORMANDEAU ASSOCIATES
ENVIRONMENTAL CONSULTANTS

Path: J:\Projects\PatriotHydro_Lawrence_24837\InvasiveSp\InvasiveSp.aprx

2/19/2026



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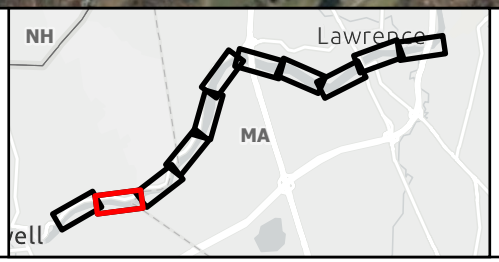

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Kilometers

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Miles

Terrestrial Invasive Species
Lawrence Hydroelectric Project (FERC No. 2800),
Merrimack River
Lawrence, MA

NORMANDEAU ASSOCIATES
ENVIRONMENTAL CONSULTANTS

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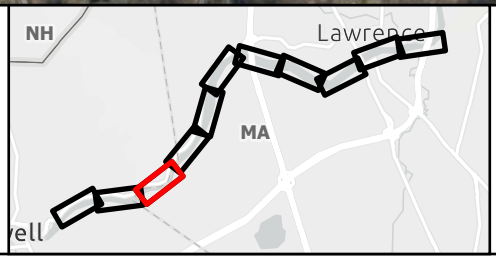
2/19/2026

Survey Locations



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Kilometers
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Terrestrial Invasive Species
Lawrence Hydroelectric Project (FERC No. 2800),
Merrimack River
Lawrence, MA

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Survey Locations

0 0.1 0.2
Kilometers
0 0.06 0.12
Miles

Terrestrial Invasive Species
Lawrence Hydroelectric Project (FERC No. 2800),
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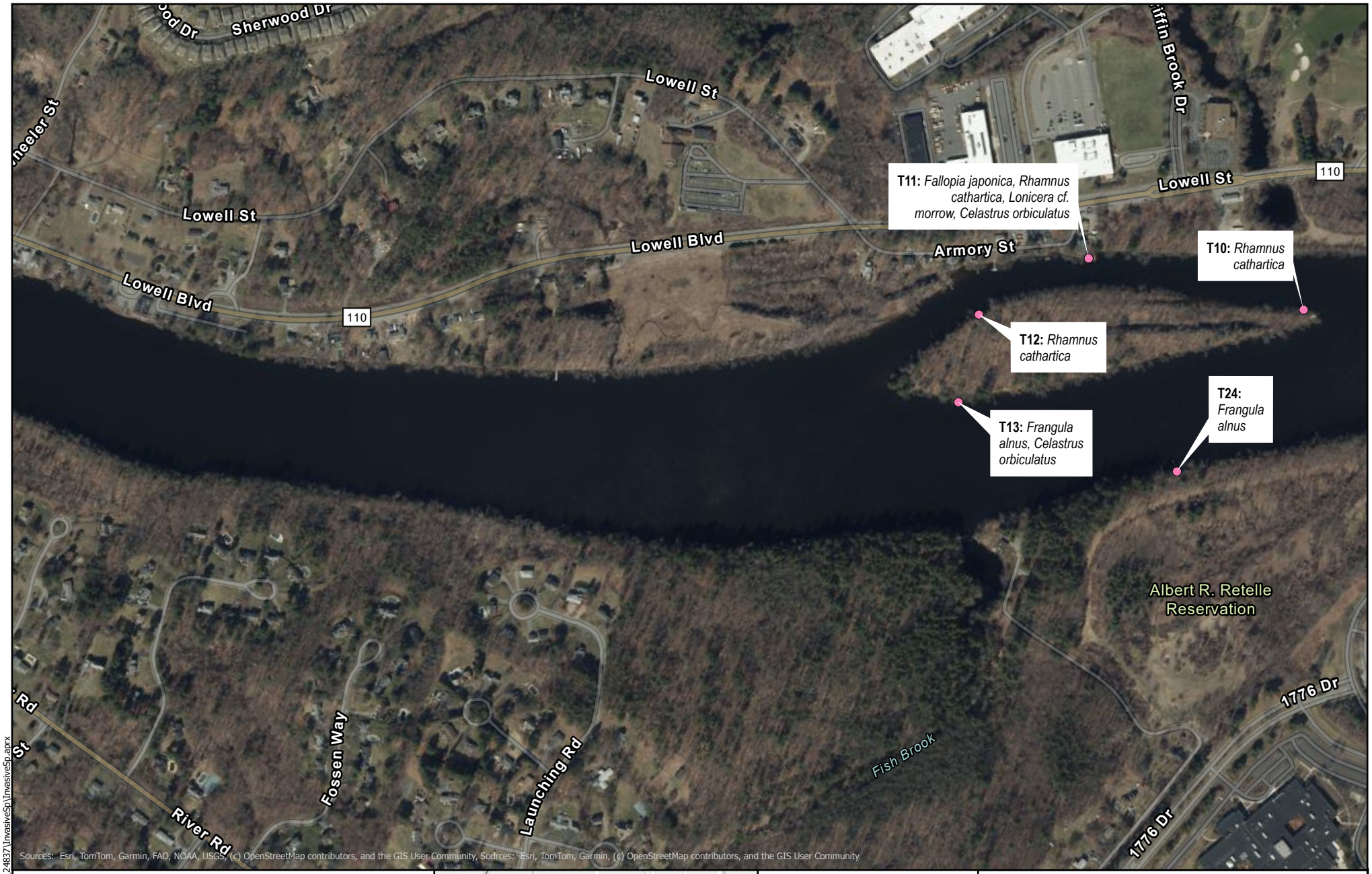

Survey Locations

0 0.1 0.2
Kilometers
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Terrestrial Invasive Species
Lawrence Hydroelectric Project (FERC No. 2800),
Merrimack River
Lawrence, MA

NORMANDEAU ASSOCIATES
ENVIRONMENTAL CONSULTANTS

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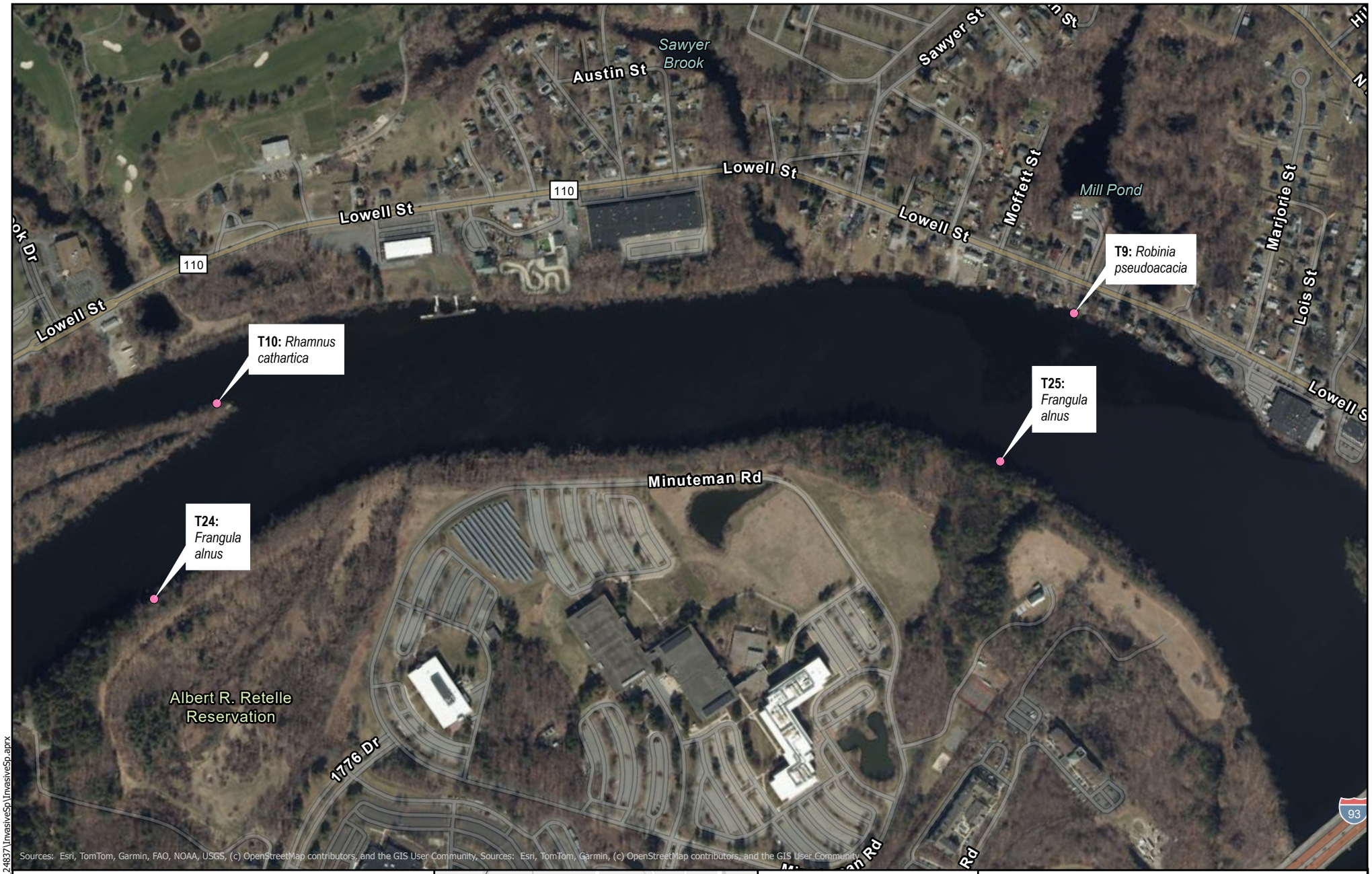

Survey Locations

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Kilometers
0 0.06 0.12
Miles

Terrestrial Invasive Species
Lawrence Hydroelectric Project (FERC No. 2800),
Merrimack River
Lawrence, MA

NORMANDEAU ASSOCIATES
ENVIRONMENTAL CONSULTANTS

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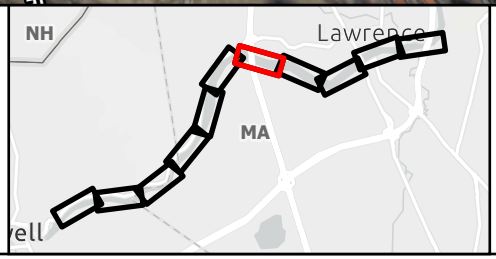
Survey Locations



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Kilometers

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Miles

Terrestrial Invasive Species
Lawrence Hydroelectric Project (FERC No. 2800),
Merrimack River
Lawrence, MA

NORMANDEAU ASSOCIATES
ENVIRONMENTAL CONSULTANTS

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2/19/2026

Survey Locations

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Kilometers

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Miles

Terrestrial Invasive Species
Lawrence Hydroelectric Project (FERC No. 2800),
Merrimack River
Lawrence, MA

NORMANDEAU ASSOCIATES
ENVIRONMENTAL CONSULTANTS

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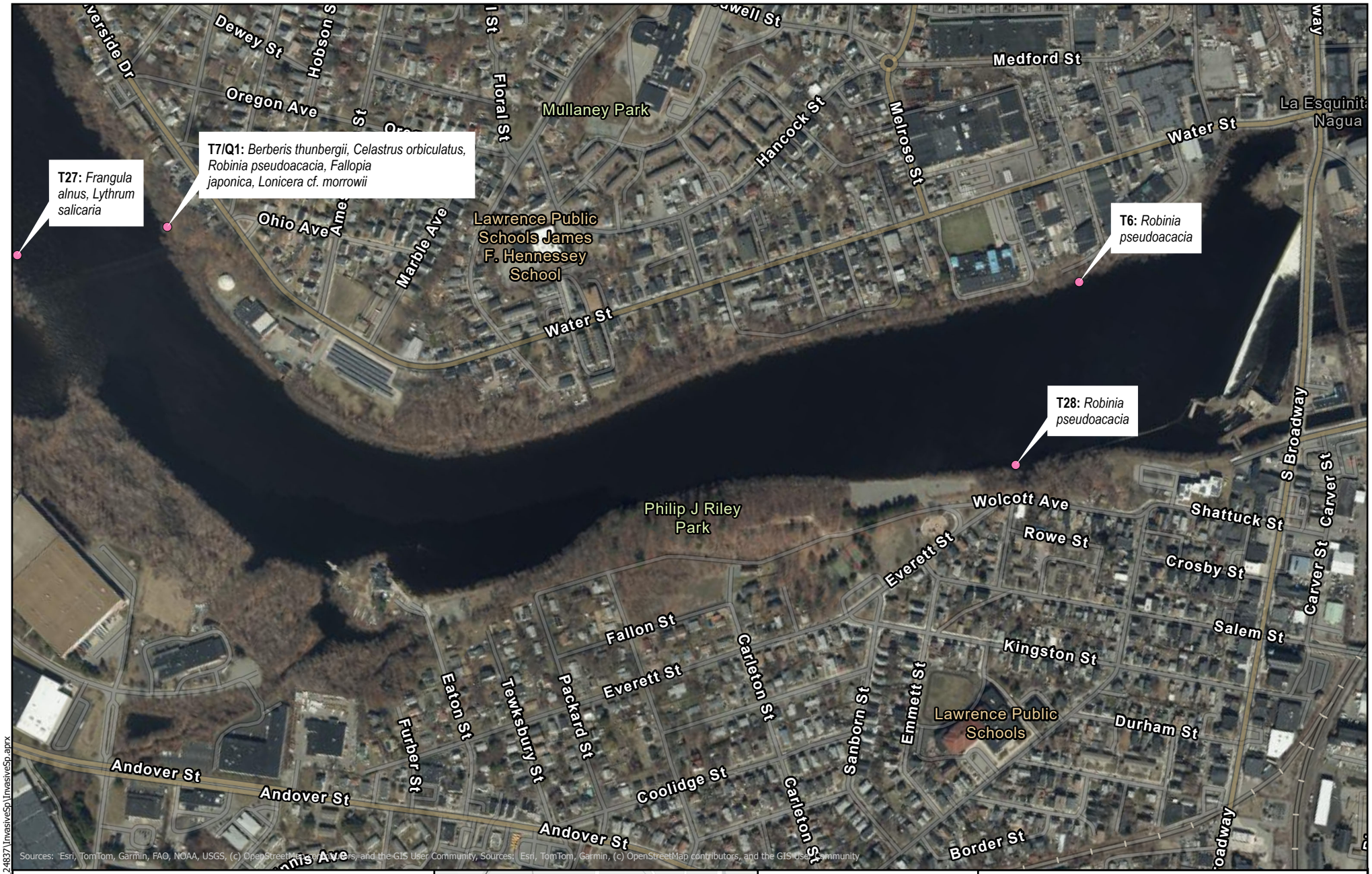

Survey Locations

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Kilometers
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Terrestrial Invasive Species
Lawrence Hydroelectric Project (FERC No. 2800),
Merrimack River
Lawrence, MA

NORMANDEAU ASSOCIATES
ENVIRONMENTAL CONSULTANTS

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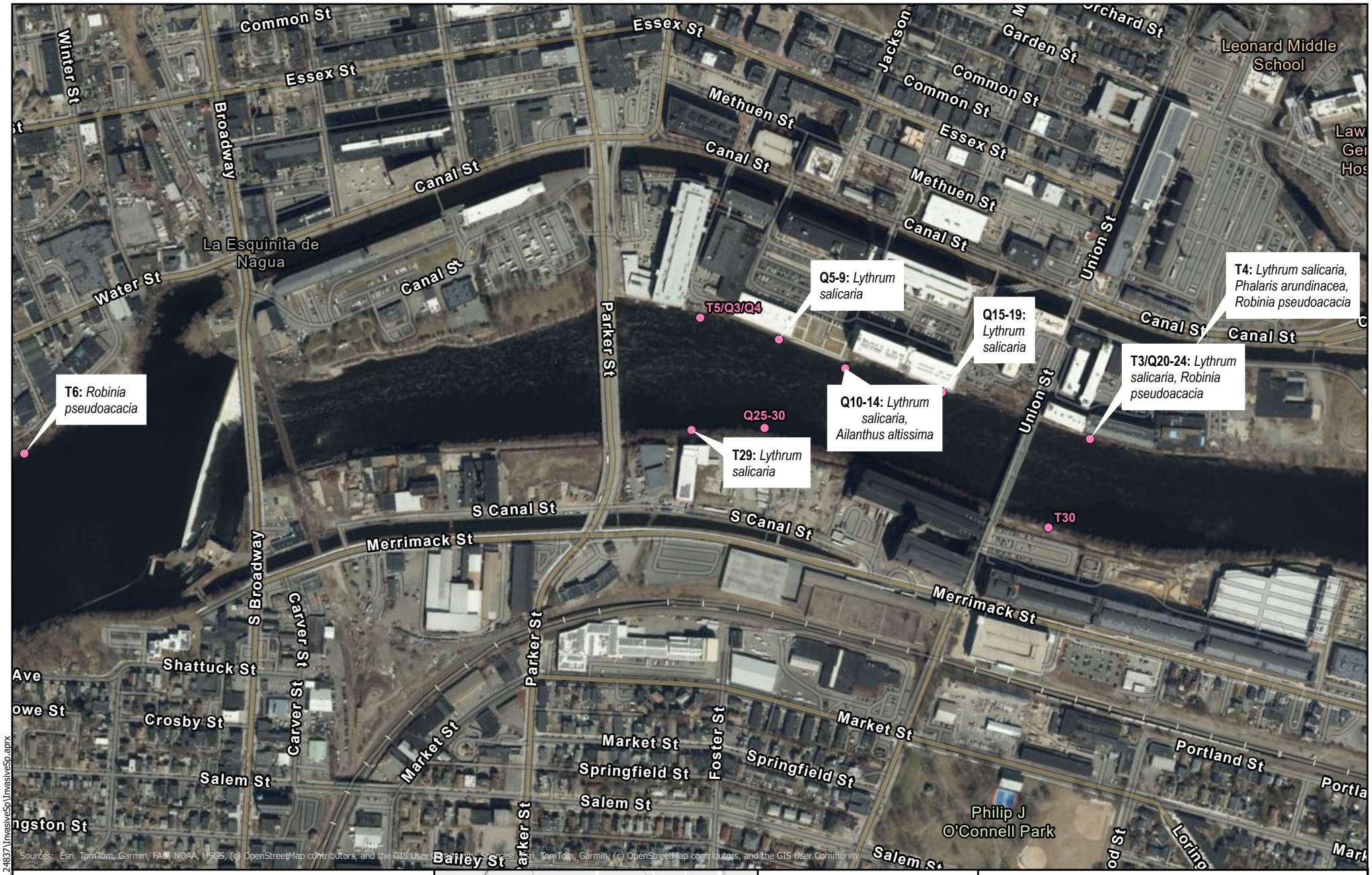
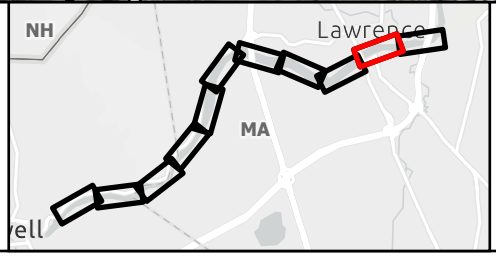


Survey Locations



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Kilometers

0 0.06 0.12
Miles

Terrestrial Invasive Species
Lawrence Hydroelectric Project (FERC No. 2800),
Merrimack River
Lawrence, MA

NORMANDEAU ASSOCIATES
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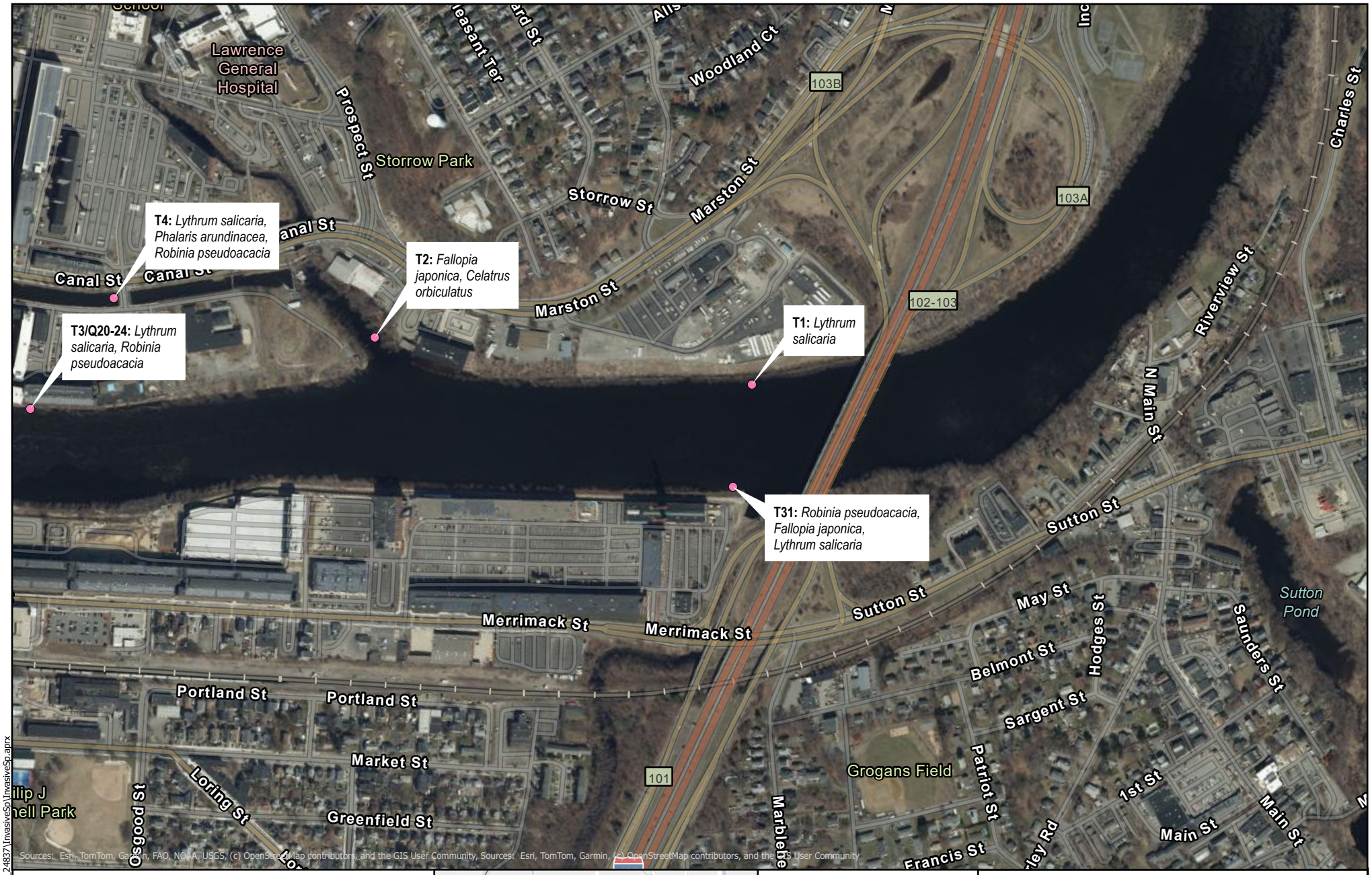

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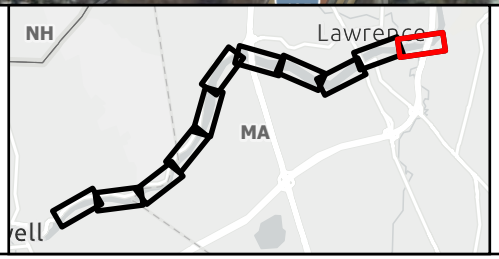

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Kilometers

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Miles

Terrestrial Invasive Species
Lawrence Hydroelectric Project (FERC No. 2800),
Merrimack River
Lawrence, MA

NORMANDEAU ASSOCIATES
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Appendix K

Aquatic Invasive Species Photolog

Photo 1. Bank vegetation at Study Location T1.

Photo 2. Bank vegetation at Study Location T2.

Photo 3. Bank vegetation at Study Location T3/Q20-24.

Photo 4. Bank vegetation at Study Location T4.

Photo 5. Bank vegetation at Study Location T5/Q3/Q4.

Photo 6. Bank vegetation at Study Location T6.

Photo 7. Bank vegetation at Study Location T7/Q1.

Photo 8. Bank vegetation at Study Location T8.

Photo 9. Bank vegetation at Study Location T9.

Photo 10. Bank vegetation at Study Location T10.

Photo 11. Bank vegetation at Study Location T11.

Photo 12. Bank vegetation at Study Location T11.

Photo 13. Bank vegetation at Study Location T12.

Photo 14. Bank vegetation at Study Location T12.

Photo 15. Bank vegetation at Study Location T13.

Photo 16. Bank vegetation at Study Location T14.

Photo 17. Bank vegetation at Study Location T15.

Photo 18. Bank vegetation at Study Location T16.

Photo 19. Bank vegetation at Study Location T17.

Photo 20. Bank vegetation at Study Location T17.

Photo 21. Bank vegetation at Study Location T18.

Photo 22. Bank vegetation at Study Location T19.

Photo 23. Bank vegetation at Study Location T19.

Photo 24. Bank vegetation at Study Location T20.

Photo 25. Bank vegetation at Study Location T21.

Photo 26. Bank vegetation at Study Location T22.

Photo 27. Bank vegetation at Study Location T23.

Photo 28. Bank vegetation at Study Location T24.

Photo 29. Bank vegetation at Study Location T25.

Photo 30. Bank vegetation at Study Location T26.

Photo 31. Bank vegetation at Study Location T26.

Photo 32. Bank vegetation at Study Location T27.

Photo 33. Bank vegetation at Study Location T28.

Photo 34. Bank vegetation at Study Location T29.

Photo 35. Bank vegetation at Study Location T30.

Photo 36. Bank vegetation at Study location T31 downstream of the wingwall.

Photo 37. Bank vegetation at Study Location T31 upstream of the wingwall.

Photo 38. Bank vegetation at Study Location T31.

Photo 39. Bank vegetation at Study Location Q2/Q31-33.

Photo 40. Bank vegetation at Study Location Q2/Q31-33.

Photo 41. Bank vegetation at Study Location Q2/Q31-33.

Photo 42. Bank vegetation at Study Location Q5-9.

Photo 43. Bank vegetation at Study Location Q10-14.

Photo 44. Bank vegetation at Study Location Q10-14.

Photo 45. Bank vegetation at Study Location Q15-19.

Photo 46. Bank vegetation at Study Location Q25-30.

Photo 47. Bank vegetation at Study Location Q37-39.

Photo 48. Bank vegetation at Study Location Q37-39.

Photo 49. *Potamogeton crispus* at Study Location T3/Q20-24

Photo 50. *Potamogeton crispus* at Study Location T3/ Q20-24

Photo 51. *Potamogeton crispus* at Study Location T3/Q20-24

Photo 52. *Potamogeton crispus* at Study Location T3/Q20-24

Photo 53. Fruit of *Trapa natans* incidentally observed in backwater.

Photo 54. *Trapa natans* incidentally observed near backwater.

Photo 55. *Najas minor, Trapa natans,* and *Myriophyllum heterophyllum* incidentally observed near backwater.

Photo 56. *Myriophyllum heterophyllum* incidentally observed near backwater.

Photo 57. *Najas minor* incidentally observed near backwater.

Photo 58. *Ceratophyllum demersum* at Study Location T4

Photo 59. *Najas* cf. *guadalupensis* at Study Location T10.

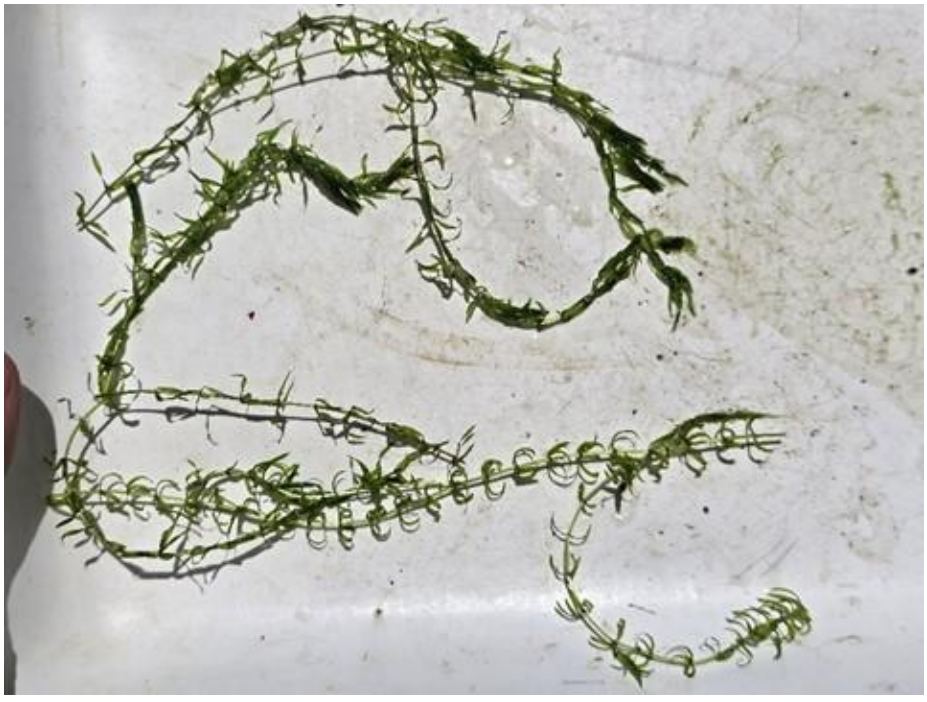

Photo 60. *Elodea nuttalli* at Study Location T12

Photo 61. *Fontanalis* sp. at Study Location T15.

Photo 62. *Najas* cf. *gracillima* at Study Location T17.

Photo 63. *Potamogeton epihydrus* at Study Location T19.

Photo 64. *Vallisneria americana* at Study Location T19.

Photo 65. *Potamogeton perfoliatus* at Study Location T16.

Photo 66. *Vallisneria americana* at Study Location T25.

Photo 67. *Vallisneria americana* at Study Location T26.

Photo 68. *Elodea nuttallii* and *Vallisneria americana* at Study Location Q2/Q31-33.

Photo 69. *Ceratophyllum demersum* at Study Location Q37-39.

Photo 70. *Ceratophyllum demersum* detail at Study Location Q37-39.