Stantec Consulting Services Inc.
1165 Scheuring Road, De Pere WI 54115-1001

March 3, 2020

Attention: Mary Gansberg
Wisconsin Department of Natural Resources
2984 Shawano Avenue
Green Bay, WI 54313-6727

Dear Ms. Gansberg,

Reference: Lakeshore Invasive Species Management Area Phragmites and Japanese Knotweed Management Plan

On behalf of Lakeshore Natural Resource Partnership (LNRP), Stantec Consulting Services Inc. (Stantec) is providing you the attached Lakeshore Invasive Species Management Area Phragmites and Japanese Knotweed Management Plan detailing proposed treatment strategies to control target non-native invasive species with a four-county region including Manitowoc, Kewaunee, Fond du Lac, and Calumet counties. Upon Wisconsin Department of Natural Resources (WDNR) approval, LNRP and partners intend to apply for Aquatic Invasive Species Control (Established Infestation Control) grant funding to fulfill the goals and objective set forth in the attached Plan. The intent is to apply for WDNR funding annually to initiate or continue control efforts.

As required by WDNR, LNRP has taken the necessary steps to gather public comment on the draft Plan. On December 2, 2019 the draft Plan was posted to the LNRP website (https://www.lnrp.org/lismaplan) and email notifications to request comments on the Plan were sent on December 3, 2019 to the LNRP listserve. Additional requests for comment were posted on the Kewaunee and Calumet County websites and a LNRP facebook post was sent on December 12. **No comments were received on the draft Plan, except for comments received from WDNR.**

WDNR comments were incorporated into the plan and a final version was provided to WDNR on January 30, 2020. LNRP approved and adopted the final Plan at a board meeting on February 13, 2020.

If you have any questions on the Plan or supporting documents, please contact me at melissa.curran@stantec.com or Jim Kettler at jim@lnrp.org. We look forward to working with you on this exciting project.

Regards,

STANTEC CONSULTING SERVICES INC.

Melissa Curran

Melissa Curran
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Attachments: Lakeshore Invasive Species Management Area Phragmites and Japanese Knotweed Management Plan

c. Jim Kettler (jim@lnrp.org)

Lakeshore Invasive Species Management Area Phragmites and Japanese Knotweed Management Plan

Prepared for:

Lakeshore Natural Resource Partnership, Inc.
P.O. Box 358
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Prepared by:

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January 31, 2020

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INTRODUCTION

On behalf of Lakeshore Natural Resource Partnership, Inc. (LNRP) and other project partners, Stantec Consulting Services Inc. (Stantec) drafted this Management Plan detailing proposed treatment strategies to control target non-native invasive species using a county-wide eradication approach within the four-county region encompassed by Lakeshore Invasive Species Management Area (LISMA). Many Wisconsin Department of Natural Resource (DNR)-owned and protected state parks, state natural areas, wildlife areas and easements fall under this plan. LNRP will work closely with all DNR land managers to assist with identification, mapping, and treatment but will rely on DNR or partner organizations to complete reconnaissance on DNR-owned properties.

LISMA is a broad-based coalition that promotes efficient and effective management of invasive plant and animal species throughout a four-county region including Manitowoc, Kewaunee, Fond du Lac, and Calumet counties (the "Project Area"). LISMA provides the opportunity for partners to share and leverage limited resources, raise awareness about invasive species problems, and collaboratively reduce the impact of invasive species on both public and private lands. The mission of LISMA is to educate the public and protect biodiversity and ecological function throughout the region.

LNRP and other project partners have identified goals for LISMA, which include: raising public awareness about invasive species in the Project Area; preventing their introduction and spread through early detection and rapid response; addressing known populations of invasive species utilizing Integrated Invasive Species Management methods where appropriate; considering invasive species during restoration projects; and continually working to enhance collaboration among all stakeholders. The strategy is to build strong, local partnerships and implement effective and long-term control strategies for the target invasive species across a regional landscape. Possible partners and affiliates that will advance the proposed activities set forth in this Management Plan, include, but are not limited to:

Kewaunee County
Manitowoc County
Calumet County
Fond du Lac County
Stantec Consulting Services, Inc.
Wisconsin DNR
University/Research Partners
U.S. Department of Agriculture - Natural Resources Conservation Service (NRCS)
U.S. Fish and Wildlife Service
Partner non-profits

This Management Plan targets the invasive common reed grass (*Phragmites australis* subsp. *australis*), commonly referred to as *Phragmites*, and Japanese knotweed *(Fallopia japonica;* synonyms: *Reynoutria japonica, Polygonum cuspidatum)*.

Although there is a native subspecies of *Phragmites* that occurs naturally within Wisconsin wetlands, that is abundant within the Project Area, this management plan focuses on the extremely aggressive, non-native subspecies that has invaded roadsides, wetlands, and shorelines across the Great Lakes region. The spread and colonization of this species has severe consequences to native ecosystems, reduces access to recreational opportunities, degrades viewsheds and aesthetic appeal of beaches and shorelines, and has negative economic impacts including reduced property values, with an associated reduction in property tax revenues. Japanese knotweed is also a highly aggressive, invasive species that typically colonizes roadsides, railroad and other embankments, riverbanks, woodland edges, and wetlands throughout the region. Japanese knotweed forms extensive colonies of shrub-like stems up to 10 ft. tall and can aggressively outcompete native vegetation.

The objectives of this Management Plan are to: 1) update and improve the monitoring and mapping of established *Phragmites* and Japanese knotweed populations within the LISMA region; 2) establish a rapid response reporting and treatment protocol to address emergent infestations; 3)reduce percent cover of established populations of *Phragmites* and Japanese knotweed where treatment practices are not currently in place; 4) perform retreatments until the population is eradicated; 5) minimize the spread to un-infested areas; 6) educate and provide private landowners with the ability to control the target invasive species on their respective properties; 7) collaborate with local nonprofits, municipalities, federal and state agencies, research institutions and private individuals actively controlling *Phragmites* and/or Japanese knotweed populations to maximize efficiency; and 8) develop and expand the highly successful, sustainable, long-term control strategy initiated in Manitowoc County and replicate across the Project Area.

PROJECT AREA

The Project Area is located in the Central Lake Michigan Coastal and Southeast Glacial Plains Ecological Landscapes of Wisconsin. The four counties cover a combined area of 3,741 square miles (2,394,240 acres). At the time of the first European settlement, the area was predominately a mesic forested landscape dominated by sugar maple (*Acer saccharum*), American basswood (*Tilia americana*) and American Beech (*Fagus grandifolia*). Western portions of the Project Area are located in the Southeast Glacial Plains and were characterized by a rolling landscape with a mix of oak savanna, oak forest, prairie, and wetland. Euro-American settlers cut down forests for lumber, cleared uplands and drained wetlands to create farmland. The Central Lake Michigan Coast has suffered an overwhelming loss of mesic forest cover with only a small percentage (14% versus 96% historically) remaining. Almost all the savanna and prairie in the Southeast Glacial

Plains have been converted to agricultural use, and with scattered woodlots and wetland areas separated by cropland and pasture.

Along with loss of native forest cover, other significant vegetation changes have occurred because of hydrological disruption, fragmentation and isolation of remnant forests and open wetlands, grazing, and an increase in invasive plants and plant pathogens affecting remaining native vegetation communities. Anthropogenic activities associated with agriculture, transportation, industrial activity and commercial and residential development are the primary disturbances in the Project Area. Changes in land use have indirectly and negatively affected water quality, disturbed or eliminated habitats, altered natural disturbance regimes, and increased flood frequency due to loss of wetlands.

Agriculture is the dominant land use by area with several small and medium-sized cities and some large, forested wetlands. Current forest vegetation includes a mix of species including sugar maple, American basswood, white ash (*Fraxinus americana),* red maple (*Acer rubrum*), northern white-cedar (*Thuja occidentalis*), lowland hardwood species including green ash (*Fraxinus pennsylvanica),* black ash (*Fraxinus nigra*), swamp white oak (*Quercus bicolor*), and eastern cottonwood (*Populus deltoides*). Significant wetland ecosystems, such as marshes, wet meadows, sedge meadows, hardwood swamps, and conifer swamps, contain plants of both northern and southern distribution.

The four-county Project Area is primarily located within the Lake Michigan basin. It includes five DNR Water Management Units (WMUs): Manitowoc-Sheboygan, reaching up into southern Manitowoc County; Upper Fox in eastern Calumet and Fond du Lac counties; Lower Fox in northern Calumet County, and Twin-Door-Kewaunee in Manitowoc and Kewaunee counties. Runoff from point and non-point sources, sedimentation and nutrient-enriched runoff from agricultural and stormwater sources, contaminated lake and river sediments from industry, habitat degradation (e.g., channelization, dams, ditching, tiling and draining of wetlands for cultivation) have degraded water quality throughout much of these watersheds.

The Project Area lies along the Niagara Escarpment stretching from eastern Wisconsin through Michigan's Upper Peninsula, across Ontario, Canada, and on through the Niagara Falls in New York. The escarpment was originally deposited as lime mud on an ancient sea floor about 430 million years ago and has since undergone uplift, weathering, and erosion. It is home to over 240 different rare, threatened, or endangered plant and animal species, including northern white-cedar trees that are more than 1,000 years old, and is an important source for groundwater recharge.

Brillion, Collins Marsh, Killsnake, and Eldorado Wildlife Areas are all significant conservation areas in the inland portion of the Project Area and contain emergent marsh and wet meadow wetland communities that support many migratory birds and wildlife habitats. Killsnake and Collins Marsh support extensive areas of shrub-carr wetlands, and along with Brillion Wildlife Area, support areas of high-quality southern hardwood swamp. Additionally, the 31,000-acre Horicon

marsh is located just south of the Project Area and is a major breeding and migration stopover habitat for waterfowl. Other notable, significant State Natural Areas include Oakfield Ledge and Spruce Lake Bog in Fond du Lac County, Calumet County Park and High Cliff Escarpment State Natural Area along the Lake Winnebago shoreline, and Woodland Dunes Nature Center and Preserve, a 1,500-acre property containing hardwood and conifer forests, wetlands and prairies in Manitowoc County, are all benefited from invasive species control projects.

The WDNR owned Point Beach State Forest in Manitowoc County lies along six miles of the Lake Michigan coast. This 2,900-acre Significant Natural Area includes forest and beach wildlife habitats, campsites, picnic areas, and eleven miles of hiking/skiing trails. The Lake Michigan Shoreline has been particularly affected by aggressive, invasive species such as *Phragmites.* Approximately 35 miles of shoreline in Manitowoc County and 28 miles in Kewaunee County are addressed and protected as part of this Management Plan. Undeveloped shoreline habitats of Lake Michigan are highly significant to migratory birds and shorebirds including many endangered, threatened, and special concern species that benefit from invasive species control efforts.

HISTORICAL CONTROL ACTIONS

The Project has achieved many milestones and measurable results in invasive species reduction, which vary by county and level of partner involvement. The Project is supported by stakeholders including private landowners; local, county, state, and federal agencies and highway departments; and non-profit organizations, but the level of support and coordination varies by county and funding level. Counties where funding has been secured, generally have a more robust team that coordinates regularly. Throughout the Project Area, LNRP and partners have accomplished the following:

- Created a GIS-based mapping platform to document *Phragmites* and Japanese knotweed populations, treatment results, landowner parcels and access permission, aerial photography, roads, waterways, and WDNR-mapped wetlands.
- Established the first accurate data set of the extent and distribution of *Phragmites* and Japanese knotweed across the Project, shared data with partner organizations, agencies, and basin wide invasive species control consortiums.
- Secured permission to treat *Phragmites* and Japanese knotweed on thousands of parcels.
- Secured multiple grants from federal, state and local sources to map and treat target invasive species.
- Enhanced public awareness of the impact of invasive species on Great Lakes ecosystems.
- Increased capacity of concerned citizens to conduct invasive species management.

- Treated 708 acres of *Phragmites* at least once.
- Project actions completed to date have enhanced, restored and protected aquatic, wetland and shoreline habitats.

Historical control actions for *Phragmites* and Japanese knotweed within the four-county area are depicted on Figures 1—4 and can be viewed in more detail on the projects public web map: http://bit.ly/InvasiveWebMap. The purpose of this public web map is to allow landowners and the public to verify target species location, track treatment progress, verify their enrollment in the program and report new populations. Limited information is available on the public web map. The project team and partners maintain an internal web map accessible only by authorized users to record a variety of field data. A summary of historic control actions is presented below by county.

Manitowoc County

The following summarizes historical and on-going control projects in Manitowoc County, which are also displayed on Figure 1:

- Woodland Dunes Nature Center and Preserve treated *Phragmites* within and adjacent to their property from 2007 to 2018. The East Twin River and West Twin River were a primary focus of their efforts, which were funded by the WDNR.
- LNRP received state funding to treat *Phragmites* within the City of Manitowoc park properties adjacent to the Little Manitowoc River. State funding was used to treat *Phragmites* from 2013-2015.
- UW-Green Bay treated *Phragmites* at their Kingfisher Farm natural area along the Lake Michigan shoreline. Several adjacent individual landowners also manage their infestations. Private property initiatives are important but represent only a small fraction of the Lake Michigan shoreline.
- In 2013, LNRP and partners collaborated on a treatment along one mile of contiguous, private Lake Michigan shoreline properties in Newton. This treatment was intended to establish the effectiveness of treating infestations in differing beach and bluff conditions, as well as to alert landowners to the problems of invasive species and the intended remedial efforts.
- In 2015 LNRP received WDNR funding to treat the six-mile segment of Lake Michigan shoreline within the Point Beach State Forest. Follow-up treatments occurred in 2016 and 2017.
- In 2015 LNRP received WDNR funding to treat a significant portion of the Lake Michigan shoreline where landowner permission was granted. Follow-up treatments in 2016 focused on approximately nine miles of shoreline within the City of Two Rivers and City of Manitowoc. Follow-up treatments occurred in 2016 and 2017.

- In 2017 and 2018, NRCS treated roughly 100 patches of *Phragmites*, totaling about 50 acres, on 8 parcels of land enrolled in NRCS conservation programs across Manitowoc and Calumet counties.
- In 2017, LNRP received WDNR funds to control *Phragmites* in the near lakeshore townships of Centerville, Newton, Manitowoc Rapids, Two Rivers, Two Creeks and Mishicot. Treatments were performed from 2017 to 2019 on all participating parcels.
- In 2017, LNRP was awarded federal funding to control *Phragmites* across all of Manitowoc County. First year or follow-up control was performed in 2018 and 2019 on all participating parcels.
- In 2019, LNRP received WDNR funds to control *Phragmites* in the western townships of Cooperstown, Gibson, Maple Grove, Franklin, Kossuth, Rockland, Cato, Eaton, Liberty, Schleswig and Meeme. Treatments were performed in 2019 and will continue as funding allows.
- In 2019, LNRP received federal funding to perform follow-up control on all treatment sites in Manitowoc and Sheboygan counties. Treatments will occur during the growing seasons in 2020 and 2021.
- The following table provides a snapshot of the treatment results from 2019.

Table 1. Manitowoc County 2019 Treatment Results

Municipality	Total # of Parcels with Phragmites	Permission Not Granted	# of Parcels Treated as of 9/30/19	# of Phragmites Polygons Treated as of 9/30/19	Acreage of Phragmites Treated as of 9/30/19
CITY OF KIEL	1	1	0	0	0.00
CITY OF MANITOWOC	57	33	22	40	3.79
CITY OF TWO RIVERS	104	36	70	116	29.70
TOWN OF CATO	48	12	28	41	12.20
TOWN OF CENTERVILLE	83	25	53	59	22.63
TOWN OF COOPERSTOWN	119	19	86	126	27.15
TOWN OF EATON	43	6	30	30	12.97
TOWN OF FRANKLIN	82	25	58	65	18.96
TOWN OF GIBSON	124	43	75	121	25.37
TOWN OF KOSSUTH	85	27	61	87	18.86
TOWN OF LIBERTY	79	13	57	70	81.50
TOWN OF MANITOWOC	38	6	26	35	5.02
TOWN OF MANITOWOC RAPIDS	82	35	54	83	12.02
TOWN OF MAPLE GROVE	80	18	52	67	11.01
TOWN OF MEEME	40	11	23	33	6.13
TOWN OF MISHICOT	81	24	60	138	21.86
TOWN OF NEWTON	85	27	39	54	10.47
TOWN OF ROCKLAND	34	16	17	39	16.71
TOWN OF SCHLESWIG	21	9	14	16	4.73
TOWN OF TWO CREEKS	45	19	34	45	5.20
TOWN OF TWO RIVERS	203	100	148	292	84.71
VILLAGE OF CLEVELAND	21	9	10	7	4.08
VILLAGE OF FRANCIS CREEK	5	2	2	2	0.31
VILLAGE OF KELLNERSVILLE	5	2	1	1	0.03
VILLAGE OF MARIBEL	3	2	1	1	0.13
VILLAGE OF MISHICOT	3	2	3	1	0.55
VILLAGE OF ST NAZIANZ	3	1	2	5	1.88
VILLAGE OF VALDERS	4	0	1	1	0.01
VILLAGE OF WHITELAW	1	0	0	0	0.00
TOTAL:	**1579**	**523**	**1027**	**1575**	**437.97**

In addition to the treatments listed above, LNRP hosts annual educational trainings, workshops, and provides landowners with updates on treatment progress. All treatment areas are monitored each year using GIS mapping data on a web-enabled ArcGIS platform (web map), which manages treatment information, restoration success and other Project information. Monitoring details are collected by field staff and include last treatment date, annual percent cover, initial percent cover, Right of Way (ROW) status, annual status (complete/incomplete), method of treatment, population acreage, and notes for field crews for each individual population mapped.

Kewaunee County

In 2018, The U.S. Environmental Protection Agency awarded the Bay-Lake Regional Planning Commission nearly $600,000 in Great Lakes Restoration Initiative (GLRI) funding to manage at least 1,000 acres of invasive *Phragmites*, wild parsnip and Japanese knotweed in Kewaunee County. Beginning in summer 2019, this two-year control program expands upon work initiated by Bay-Lake along the Green Bay shoreline.

Kewaunee County has many treated *Phragmites* populations (Figure 2) along County roads such as WI-42, WI-54, WI-29 and WI-57, the Green Bay shoreline, as well as scattered populations throughout the county. Few dispersed populations of Japanese knotweed have been identified in Kewaunee County with most receiving previous treatments.

Fond du Lac County

Road corridors such as I-41, US-151 and US-45 surrounding the City of Fond du Lac and along the Lake Winnebago shoreline have been previously treated, where heavy concentrations of *Phragmites* have been identified (Figure 3). Scattered *Phragmites* throughout the County have also been targeted for treatment in the past. There are no identified Japanese knotweed populations that have been previously treated in Fond du Lac County.

Calumet County

Some *Phragmites* populations in the Cities of Chilton and Brillion have been previously treated as well as along many road corridors such as US-10, US-151, and WI-55 (Figure 4). Scattered *Phragmites* populations throughout the County have also been targeted for treatment in the past. There are no identified Japanese knotweed populations that have been previously treated in Calumet County. In 2017 and 2018, NRCS treated roughly 100 patches of *Phragmites*, totaling about 50 acres, on 8 parcels of land enrolled in NRCS conservation programs across Manitowoc and Calumet counties.

PRIORITY TREATMENT AREAS

This Management Plan will be implemented in phases pending funding availability. Priority will be given to counties where limited control actions have been initiated and where local groups have organized to support control efforts. However, supplemental funding may be needed in counties with on-going control as multiple years of repeated treatments are needed to eradicate populations. When funding is secured for a given area, treatment sites will be prioritized based on a set of criteria and protocols: , which include, but are not limited to:

1. Position within a watershed - Infestations residing in and/or near headwater areas of a watershed and/or within water bodies such as lakes or streams are important to identify as high priorities for treatment. These locations facilitate the propagation and spread of *Phragmites* and Japanese knotweed along waterways to downstream wetlands, water bodies, and riparian areas, further impacting both natural and developed landscapes.
2. Feasibility of Control - The larger the infestation, the greater the costs of eradication, both in funding and in time. Infestations that meet the criteria for monotypic infestations, and do not meet criterion 1), are considered a low priority for treatment.
3. Assurance of Long-Term Management - LNRP partners with organizations, agencies and local units of government that will commit to long-term abatement practices. LNRP has already prepared a resolution for local governments within Manitowoc County who have verbally agreed to contribute staff and equipment towards the proposed management objectives. The lakeshore town governments of Two Creeks, Mishicot, Two Rivers, Manitowoc Rapids, Newton and Centerville, and Manitowoc County, have agreed to sign the resolution. LNRP will work with the townships in the western portions of the county to encourage similar participation for long-term and comprehensive control of *Phragmites* across Manitowoc County.
4. Proximity to Natural and Native Communities - The presence and diversity of intact native plant communities are indicators of overall environmental quality, resiliency and function. They harbor some of our most valued and sensitive plant and wildlife species, and the highest quality examples may be designated as State Natural Areas by the WDNR Bureau of Natural Heritage Conservation. Infestations within or near native communities of high quality pose a direct threat to their continued existence and are therefore considered high priority areas for treatment.
5. Connectivity - Those areas in which invasive species are more likely to be introduced and spread are a high priority for this Project. These areas include riparian corridors, waterways, roadside and/or drainage ditches, road crossings over riparian corridors, culverts, public access points (e.g., boat launches, public fishing access, parking areas, beaches), recreational areas, shorelines and floodplain systems.

LONG-TERM CONTROL STRATEGY

LISMA partner's community engagement focus includes multiple partnerships working toward *Phragmites* and Japanese knotweed control. Partners will continue to engage the local community through educational trainings, workshop, meetings and conferences. Where feasible, partner organizations/entities will be encouraged to assist with long-term management and control commitments.

Partners will use the following educational opportunities to highlight the need for invasive species control and prevention and advance best available adaptive management practices for long-term control of *Phragmites* and Japanese knotweed:

- Host invasive control and restoration field days
- Work with partners to develop stewardship and educational materials
- Collaborate with research institutions on mapping, adaptive management and building a treatment model
- Engage youth through a variety of educational programs
- Facilitate workshops and trainings focused on invasive species control and BMPs
- Work with local watershed partners on training through the Riverine Early Detectors volunteer program (Project RED)
- Share the GIS mapping data on a web-enabled platform providing treatment information, restoration success and other Project information with partners and others to inform invasive species management across the region

This Project partners with organizations, agencies, local units of government and private landowners that will commit to long-term monitoring and management of their sites to maintain habitat value and continued control of *Phragmites* and Japanese knotweed. Partners have already secured resolutions or verbal commitments from all townships in Manitowoc County, and county governments in Manitowoc County have committed to contribute staff and equipment towards long-term management strategies supporting the Project's management objectives. The partners will work with the townships and county governments to train highway department staff on implementing effective invasive control BMP's and to encourage cooperation between local and county units of government for long-term sustained control. Landowners will be offered training on identification and management of invasive species on their lands and funds will be available to support revegetation where needed. Data collected on species populations throughout the Project will be available to support and prioritize ongoing treatment and restoration efforts and to inform long-term adaptive management. LNRP is in the process of establishing a management fund with support from town governments, county, businesses and private citizens

to provide long-term financial support for re-treatments when all grant funding has been used, until populations have been eradicated.

Landowners with documented *Phragmites* and/or Japanese knotweed populations will be provided with educational material and will receive a Landowner Participation form which will authorize the contractor to provide treatment on their property. LISMA partners will continue to identify additional *Phragmites* and Japanese knotweed treatment sites throughout the Project in part relying on citizen science volunteers documenting infestations on their own land or in their neighborhoods. Once verified, and pending receipt of a signed Landowner Participation form, verified infestations will be prioritized for control. Verified populations will be added to the Project GIS dataset and shared with regional invasive species management partners.

THREATS TO AQUATIC ECOSYSTEMS

Biological and Ecological Threat

Invasive *Phragmites* is a perennial wetland grass introduced from Europe that grows 12—15 feet, occasionally to 20 feet tall. It is distinct from the American subspecies, and can be identified by its dulled, slightly ridged, stiff, and hollow stems and distinct purple-brown seed head with feathery plumes. *Phragmites* colonies expand via underground rhizomes and above ground runners or stolons, and can spread quickly to new areas by plant fragments that disperse by natural and human transport: in contaminated soil on construction and agricultural equipment; stem fragments (from mowing, often along highway ditches); seeds, transported by wind or in contaminated soil, that germinate readily in disturbed ground or exposed lakebeds; and via stolon or rhizome fragments, transported on water by wave action, currents, or boats. *Phragmites* has spread rapidly through coastal and interior wetlands, riparian corridors, roadside ditches and other disturbed areas within the Great Lakes basin.

Japanese knotweed has hollow, smooth, purple to green colored stems up to 1 inch in diameter. The hollow jointed stems have reddish-brown solid nodes surrounded by a papery sheath (stipule). The herbaceous stems die back to the ground each fall and the dead stalks remain standing over the winter. Numerous new stems emerge in the spring from the over-wintering root system. Japanese knotweed grows rapidly; stems can grow up to 3 inches per day. The plant can grow more than 3 ft. in height in three weeks, with the mature plant reaching full height by the end of July. Japanese Knotweed quickly spreads and forms dense colonies by extensive underground stem (rhizome) systems which account for two thirds of its total mass. The rhizomes can extend more than 6 ft. deep and 60 ft. in length and can spread outwards at a rate of about 20 inches a year in optimal conditions. Due to this extensive underground biomass, Japanese knotweed is a very persistent plant. Stem/rhizome fragments can produce new plants within six days if they are submerged in water.

Japanese knotweed forms dense thickets of bamboo-like vegetation that aggressively outcompete native plants, and negatively impacts wetland and riparian areas. It grows in a wide range of habitats including riparian areas, wetlands, roadsides, ditches, utility right of ways and fence lines. This invasive species is often found around old homesteads where it may have been originally planted as an ornamental. It spreads along riparian areas or ditches where plant and rhizome fragments can be dispersed in moving water (i.e. along ditches, beaches, streams and rivers). Japanese knotweed can also be spread along roadsides by moving machinery or equipment with soil containing plant parts. Seeds (if produced) are spread mainly by wind.

Phragmites and Japanese knotweed form tall, dense stands that choke out native vegetation, forming monocultures that result in reduced plant species diversity and wildlife habitat quality. Dense stands are inhospitable to native birds, have lowered invertebrate densities and reduce the ecological value of shorelines. Dense stands can also impact the hydrologic regime of wetlands by increasing evaporation and trapping sediment

Social, Recreational and Economic Impacts

The spread of *Phragmites* and Japanese knotweed in the Project Area, and throughout the region, has reduced access to beaches and riverfronts for recreational activities such as swimming and fishing, restricted lakefront views, and caused damage to walkways and structures along the beach front. The density of the infestations, which extend to the waterline, have made public beaches inaccessible. Likewise, riparian access along streams and tributaries is precluded by infestations, rendering these public waters unusable for recreational fishing and use by the general public.

Lake access is a prime contributor to the value of shoreline properties, and when blocked by invasive species, reduces property values substantially (Isely et al., 2017). While such losses are obviously difficult for the individual homeowner, they impact the public through loss of tax revenue, because lakefront property contributes an outsize share to local taxes.

Currently, scattered to large populations of *Phragmites* and Japanese knotweed occur on roadsides, shorelines and wetlands across the four-county region. If left untreated, scattered small populations can develop into dense stands that are considerably more difficult to control. Control actions are needed to address large stands where native habitats have been significantly impacted by invasion. Early detection and control of small populations is critical to preventing further spread and avoid significantly greater treatment expense once large populations become established. Lake Michigan water levels have rebounded from a 14-year low period, exceeding long term average levels since 2014. These higher water levels have likely helped control *Phragmites* populations along the shoreline by drowning them out. Storm events can break apart rhizome masses and redistribute them along the shoreline. While historic control efforts have proven successful, new colonies are likely to propagate at increasing distances from existing

infestations, and over time, untreated populations may expand and increase in density if left unchecked. Continued and diligent control efforts are needed to ensure long-term control.

HISTORICAL AND CURRENT CONDITION

Manitowoc County

Manitowoc County is located on the western shore of Lake Michigan. The County contains 589 square miles. Original vegetation maps prepared from US land survey notes indicate that Manitowoc County was primarily forested with beech, sugar maple and basswood. Parts of the County (especially near Point Beach State Forest) had a higher percentage of conifers including hemlock (*Tsuga canadensis*) and pine (*Pinus* spp.). The ridge-and-swale complex at Point Beach contains the largest area of Great Lakes coastal forest remaining within the county (with associated wetlands, dunes, and beaches) and constitutes a regionally significant repository of biodiversity.

Today's landscape, by contrast, is largely agricultural. As is common throughout southern Wisconsin, the remaining forested acres are highly fragmented, with most woods in parcels of 40 acres or less. Because *Phragmites* prefers open wetlands without canopy cover, the existing modified landscape offers ample opportunities for *Phragmites* to invade agricultural ditches, waterways and connected wetlands.

There are approximately 35 miles of Lake Michigan shoreline in the county and almost all of it is susceptible to erosion. Nearly half the lakeshore is sand and cohesive bluffs (45%), with the remainder comprised of low banks (28%) and sand beaches (23%). Approximately 4% is artificial waterfront, mostly in the City of Manitowoc. Wave action prevents the bluff and low banks from ever reaching a state of equilibrium. Wave action cuts through the slumped material at the base of the bluff, causing undercutting and eventual slumping or slope failure.

Bluff height varies from 60 feet in the southern extent at the Manitowoc-Sheboygan county line to 40 feet in north-central Manitowoc County. The steep bluffs are continuous except where interrupted by valleys containing perennial to intermittent waterways. Manitowoc County’s bluffs erode more rapidly in response to lake level, wave action and precipitation patterns than the higher bluffs found to the south. Generally, low bluffs that experience erosion at the base have no trees and very little vegetation due to the short “cycle” time of the slope failures. The predominant slope processes of low bluffs are shallow slumps, translational slides, and face degradation.

Bluff recession rates are moderately high for much of the Manitowoc County shoreline and are between 0.7 and 1.6 feet per year. At the most northern part of the county recession rates are significant at 2.4 to 3.3 feet per year. Most of the Manitowoc County shoreline has little or no

shore protection, which has resulted in a lack of vegetation due to bank slumping along a significant portion of the shoreline.

Targeted control efforts since 2013 have addressed many of the *Phragmites* populations within the county (Figure 1). Prior to 2013, *Phragmites* occurred as scattered to dense colonies along the shoreline and adjacent tributaries, as isolated pockets along inland waterways and/or wetlands and along local, county or Interstate roadways. The Interstate 43 corridor was perhaps the most infested road corridor in the county. Significant progress has been made in the county using funds from state, federal and local sources, but continued control is needed to treat new infestations where permission was not yet secured, early stage infestations, or support on-going control efforts for challenging or large treatment sites. Diligent and repeated efforts to locate and treat resprouts is needed to sustain control efforts long term. Eradication is possible for many of the treatment sites including populations along the Lake Michigan shoreline where the beach is no longer present due to high water levels and populations where 0% cover is monitored and documented for at least three consecutive years. *Phragmites* has been treated in Manitowoc County for over a decade, and based on monitoring efforts, *Phragmites* has not returned to treated areas with multiple years of control. Continual monitoring is needed to ensure long-term success. Japanese knotweed is located in scattered locations throughout the county. No treatments have been completed for this species.

Kewaunee County

Kewaunee County is located on the western shore of Lake Michigan, just north of Manitowoc County, and has a small extent of frontage along the eastern shore of Green Bay. The County contains 343 square miles and 28 miles of Lake Michigan shoreline. Historic vegetation included maple-basswood-beech forest, hemlock-hardwood forest, northern white-cedar swamp, hardwood-conifer swamp, wet meadows, and coastal marshes. Conifer dominated upland forests that resemble the boreal forest were present along Lake Michigan and contained a significant component of white spruce (*Picea glauca*) and balsam fir (*Abies balsamea*). Emergent marshes and wet meadows were common in and adjacent to Green Bay, while Lake Michigan shoreline areas featured beaches, dunes, interdunal wetlands, marshes, and highly diverse ridge and swale vegetation. Small patches of prairie and oak savanna were present in the southwestern portion of this landscape.

Existing vegetation in this area consists of predominately agricultural crops, with smaller amounts of grassland, wetland, shrubland, and urbanized areas. Forested lands are dominated by maple-basswood, with smaller amounts of lowland hardwoods, aspen-birch, and lowland conifers. Because of the frequent wetlands lacking canopy cover in the county, the existing modified landscape offers ample opportunities for *Phragmites* to invade agricultural ditches, waterways and connected wetlands.

Currently, the target invasive species occur as scattered to dense colonies along the shoreline and adjacent tributaries, as isolated pockets along inland waterways and/or wetlands and along local, county or Interstate roadways (Figure 2). Major road corridors, particularly WI-42, WI-29, WI-54, and WI-57, are where most populations of *Phragmites* have been identified in Kewaunee County. Many *Phragmites* populations have also been recognized near waterways, especially along the Kewaunee River and other streams including Rio Creek, Black Creek, Silver Creek and Tisch Mills Creek. A few scattered Japanese knotweed populations have been identified in this county with most of the populations in the northeast part of the county. Based on past experience and success in areas with widespread *Phragmites* populations, it is necessary to begin control immediately in Kewaunee County.

Fond du Lac County

Fond du Lac County is located on the southern shore of Lake Winnebago with an area of 719 square miles. The County lies within two Water Management Units (WMU), the Upper Fox Basin and Manitowoc Basin, and within the Southeast Glacial Plains Ecological Landscape. This Ecological Landscape covers a large portion of southeastern and south-central Wisconsin. It is also home to some of the world's most unique glacial landscapes such as drumlins, eskers, kettle lakes, kames, ground and end moraines.

Historically, Fond du Lac County was a mix of prairie, oak forest, and oak savanna, and maple-basswood forests. Wetlands, including wet-mesic prairies, southern sedge meadows, emergent marshes, calcareous fens, and tamarack swamps were also common. Expansion of agriculture and urban environments drastically changed the ecology of the landscape. Current vegetation consists primarily of agricultural cropland, willow, soft maple, box-elder, ash, and elm, large acreages of marsh and wet meadow. Emergent marsh dominated by cattails and mixed broad-leaved sedges, degraded wet meadows dominated by reed canary grass, forested wetlands, and shrub swamps are the most common wetland communities.

Phragmites populations are most dense along the I-41, US-151, and WI-23 corridors surrounding the City of Fond du Lac (Figure 3). The Eldorado Marsh Wildlife Area, a WDNR owned property in central Fond du Lac County, is a significant wetland community severely disturbed by invasive species such as *Phragmites*. Infested waterways include Sevenmile Creek in the western part of the County and the Lake Winnebago shoreline in the north-central part of the County.

Currently, few Japanese knotweed populations have been identified in Fond du Lac County and are confined to the City of Fond du Lac. Like Kewaunee County, the amount of Japanese knotweed at present makes it the ideal time for control.

Calumet County

Calumet County is located on the eastern shore of Lake Winnebago atop the Niagara Escarpment, and has total area of 318 square miles. Prior to settlement, Calumet County was primarily forested. Upland mesic forests including sugar maple, basswood, and white ash dominated the vegetation. Uplands included oaks, hickory, ash, and other hardwoods. In lowland swamps, black and green ash, elm, soft maple, swamp white oak, white cedar, and tamarack were common. Remaining woodland areas include DNR owned public lands, including the Brillion, Killsnake, and Kiel Marsh Wildlife Areas, Stockbridge Ledge Natural Area, and High Cliff State Park. Due to draining or filling, the total area of wetlands in the county is less than half of what it was in the mid-1800's. The historical loss of wetlands has resulted in negative impacts to other natural resources such as loss of habitat, flooding, stream bank erosion, and degraded surface water and groundwater quality.

Current vegetation in Calumet County is predominately agricultural with about 13% of the land in woodland and another 13% wetland. The County is home to four state owned park and recreation sites including High Cliff State Park, Brillion State Wildlife Area, Killsnake Marsh State Wildlife Area, and Kiel Marsh State Wildlife Area.

Phragmites populations in Calumet County have been mainly identified along road corridors such as US-10, County Rd E, WI-57 and WI-55 (Figure 4). Spring Creek running through the City of Brillion and the Lake Winnebago shoreline in the western part of the County have several known *Phragmites* populations as well. Areas in and surrounding the Brillion and Killsnake Wildlife Areas on the border of Calumet and Manitowoc Counties are *Phragmites* hotspots and likely significant vectors for spreading invasive species between the two counties.

Identified Japanese knotweed populations in Calumet County are found in the City of Chilton and scattered populations between the Lake Winnebago shoreline to the west and WI-32 to the east. The densest populations are found in the northwestern portion of the county particularly along the Lake Winnebago shoreline.

FISHERY, WILDLIFE, AND AQUATIC PLANT COMMUNITY

Manitowoc County

The Manitowoc-Sheboygan watershed covers all of Manitowoc County, and portions of adjacent Sheboygan, Calumet, Brown, Kewaunee, Milwaukee and Ozaukee counties. Totaling 1,652 square miles, the Manitowoc-Sheboygan Watershed includes the Branch River, the North and South Branches of the Manitowoc River, the Lower Manitowoc River, Sevenmile and Silver Creeks (all in the Manitowoc sub-watershed), Sauk and Sucker Creeks, the Black River, the Sheboygan River, the Onion River, the Mullet River, and the Pigeon River (in the Sheboygan

River sub-watershed). Runoff from specific and diffuse sources, contaminated sediments, habitat degradation (e.g., channelization, dams) have degraded water quality throughout the watershed. The 2018 Wisconsin DNR list of impaired waters under 303(d) of the Clean Water Act in Manitowoc County include the Branch River, Manitowoc River, Lake Michigan, Bullhead Lake, Calvin Creek, Carstens Lake, English Lake, Gass Lake, Harpt Lake, Hartlaub Lake, Meeme River, Molash Creek, Mud Creek, Pine Creek, Silver Creek, Silver Lake, Two Rivers Harbor, West Twin River, Weyers Lake, and the Pigeon River.

Some streams throughout the watershed support trout populations and have spring and fall runs of stocked steelhead and salmon. Other fishing opportunities exist in rivers and harbors for northern pike, smallmouth bass, and yellow perch. Portions of the following waterbodies within Manitowoc County are listed as impaired according to an EPA 2006 report: Branch River, Bullhead Lake, East Twin River, West Twin River, Manitowoc River, Pigeon Lake, Warm Water Beach, Two Rivers Harbor and several beaches along Lake Michigan (YMCA Beach, Point Beach State Forest Beach, Red Arrow Park Beach, Memorial Drive Wayside Beach, Neshotah Beach, Fischer Park Beaches and Hika Park Bay).

Characteristic wildlife includes white-tailed deer, ring-necked pheasant, waterfowl, Canada geese, gray and flying squirrels, raccoons, woodcock, a variety of hawks, songbirds, and shorebirds. The National Heritage Inventory has documented 10 endangered, 20 threatened, and 37 special concern plant and animal species, and 24 rare aquatic and terrestrial communities within the Manitowoc-Sheboygan Watershed. Migratory birds utilize Manitowoc County's large wetland areas that provide habitat for numerous amphibians, reptiles, and fish.

The Nature Conservancy has identified critical habitats of Black Ash – Mixed Hardwood Swamp, Great Lakes Dune Pine Forest, Great Lakes Hemlock – Beech – Hardwood Forest, Great Lakes Beachgrass Dunes, and Great Lakes Beach as well as baymouth/barrier beaches with sand near the shore at Point Beach State Forest. In addition, Pitcher's Thistle and the Piping Plover have been identified as critical species at Point Beach State Forest.

Kewaunee County

Kewaunee County is home to the Door-Kewaunee Watershed in the northern two thirds of the County and the Manitowoc Watershed in the southern third of the County. The County is bordered by Green Bay to the west and Lake Michigan to the east with all waterbodies draining into Lake Michigan. Like several counties in the area, urban and agriculture expansion in the past several decades have degraded water quality in many of the County's waterbodies. The 2018 Wisconsin DNR list of impaired waters of Kewaunee County include: Green Bay, Kewaunee River, Neshota River, School Creek, Stony Creek, Casco Creek, East Alaska Lake, East Twin River, Jambo Creek, Krok Creek, Red River, Silver Creek, and Black Creek.

Extensive agricultural lands across the county have created a productive habitat for white-tailed deer and wild turkey. Migratory birds utilize Kewaunee County's large wetland areas which provide habitats for numerous amphibians, reptiles, and fish. Kewaunee County is also home to the federally-threatened northern long-eared bat and the federally-endangered Hine's emerald dragonfly. Thirty-seven rare animal species are known from the Door-Kewaunee watershed including one State Endangered (also Federally Endangered), two State Threatened, and 34 Special Concern species. Twenty-two rare plant species are known including two State Endangered, three State Threatened (one of which is Federally Threatened), and 17 Special Concern species. Rare terrestrial snails, some of which found on the Niagara Escarpment and nowhere else in the world and date back to the last Ice Age, are also found in this County.

Fond du Lac County

Like surrounding counties, agriculture and urban expansion has severely degraded water quality in the waters of Fond du Lac County. The 2018 Wisconsin DNR list of impaired Waters for Fond du Lac County include: Kiefer Creek, West Branch Rock River, West Branch Milwaukee River, Anderson Creek, Campground Creek, De Neveu Creek, East Branch Fond Du Lac River, Fond Du Lac River, Forest Lake, Mauthe Lake, Mosher Creek, Mosher Creek, Parsons Creek, Sevenmile Creek, Silver Creek, South Branch Rock River, West Branch Fond Du Lac River, Willow Creek, South Branch Rock River, and the Grand River.

Southern Fond du Lac County is home to a portion of the US Fish and Wildlife Service's Horicon Marsh National Wildlife Refuge. Horicon Marsh offers habitat for almost three hundred fifty species of birds including herons, egrets, and numerous songbirds. White-tailed deer and other small game animals are abundant, as well as hundreds of thousands of Canada geese for which the marsh is a major staging area for migration. Migratory birds utilize Fond du Lac County's large wetland areas that are homes for numerous amphibians, reptiles, and fish. The Eldorado Marsh Wildlife Area situated west of the City of Fond du Lac is a 6,000-acre, State-owned property containing important wildlife habitats. The wildlife area consists of significant expanses of wetland, small oak openings, shrub land, grasslands and agricultural land. The West Branch of the Fond du Lac River flows through the wildlife area.

Fond du Lac County is home to the federally-threatened Northern long-eared bat, and the federally-endangered Rusty patched bumble bee. Many rare animal and plant species are known from the county.

Calumet County

Calumet County falls entirely within the Lake Michigan Basin, within four sub-basins (Upper Fox River Basin, Lower Fox River Basin, Sheboygan River Basin, and Lakeshore Basin), and two ecological landscapes (Southeast Glacial Plains and Central Lake Michigan Coastal). Pollutants

like fertilizer, animal waste, and other runoff from both agricultural and urban sources have degraded water quality over time. According to the 2018 Wisconsin DNR list of impaired waterbodies, impaired waters in Calumet County include: the East River, Plum Creek, Becker Lake, Jordan Creek, Killsnake River, Mud Creek, North Branch Manitowoc River, Pine Creek, Round Lake, South Branch Manitowoc River, Boot Lake, Garners Creek, Kankapot Creek, and Lake Winnebago.

The various vegetative communities in Calumet County provide habitat for several upland and wetland wildlife species. White-tail deer and wild turkey are common in the areas of cropland. Migratory birds utilize Calumet County's large wetland areas that are habitats for numerous amphibians, reptiles, and fish. Additionally, Lake Winnebago and connected lakes support the largest self-sustaining population of lake sturgeon in the world. Calumet County is home to the federally-threatened Northern long-eared bat, an experimental population of whooping cranes. Many rare animal and plant species are known from the county.

PROJECT PURPOSE AND NEED

The purpose of treating invasive *Phragmites* and Japanese knotweed in the LISMA region is for county-wide eradication. In doing so, the project will conserve healthy shorelines and surface waters for the recreational enjoyment of the public; to sustain a thriving regional economy and a quality of life made possible by a clean and healthy environment; and to protect and enhance waterways, shorelines and wetland habitats for vibrant plant and animal communities.

The non-native subspecies of *Phragmites* and Japanese knotweed are established species within the past few decades. Efforts to prevent their establishment and spread within the Lake Michigan basin will help prevent many of our inland lakes and wetlands from encountering the problems related to serious infestations of Great Lakes shorelines, such as those occurring along the shore of the Bay of Green Bay in Brown, Oconto and Marinette counties.

The most cost-effective way to address invasive species treatment is to prevent the spread and establishment of large and dense infestations. Controlling as many populations as possible prevents spreading these species because it prohibits the opportunity for continued spread through common vectors such as road ROW's and waterways. Partners will work closely with ROW managers and other organizations to treat common vectors and continue education and outreach efforts on how *Phragmites* and Japanese knotweed are spread. WDNR has an active AIS program and protocols that work to prevent the spread of invasive species with data collected in the SWIMS database. Partners and DNR staff have agreed the vast amount of data and method for collection and management cannot easily transfer into the SWIMS database. Instead, this project uses a robust monitoring and reporting system provided by a project-specific web map to communicate findings and results with project partners. Project partners actively coordinate with WDNR and provide data collected as requested.

Because invasive species are already establishing within these counties, management programs to monitor and minimize their spread are necessary. Monitoring and mapping efforts to date by several project partners (Figures 1-4) have increased awareness of the problem and demonstrated the need for coordinated, large scale-treatment initiatives.

The proposed control efforts are consistent with other management plans adopted for the region. The following are management plans and/or reports applicable to the project area which address the need for removal of exotic/problem species:

- Wisconsin's Wildlife Action Plan recommends: management of Great Lakes beach and dune habitat as part of a vegetation mosaic that includes forested ridge and swale, interdunal wetland, shrub-carr, and swamp conifer forest with older age classes. Promote concentrated public access points, limited recreational activities in areas where Species of Greatest Conservation Need (SGCN) are present (particularly during breeding seasons), protecting site hydrology, **and management of invasive exotic species**.
- WI DNR "State of the Lakeshore Basin" (2001)
- EPA - Great Lakes Restoration Initiative Action Plan III (2020-2024)
- WI DNR – "Wisconsin's Nonpoint Source Program Management Plan" (FFY 2016-2020)
- WI DNR – Wisconsin Aquatic Invasive Species (AIS) Management Plan (2018)
- Fond du Lac Resource management - 2008 Integrated Resource Management Plan
- Fox-Wolf Watershed Alliance - Lake Management Planning Project – August 2018 update
- Calumet County Year 2025 Comprehensive Plan (2006-2025)
- Manitowoc County 20-Year Comprehensive Plan (2010-2030)
- Kewaunee County 20-Year Comprehensive Plan Update (2016-2036)
- Fond du Lac County Land and Water Resource Management Plan (2018-2028)

MANAGEMENT OBJECTIVES

The objective of *Phragmites* and Japanese knotweed management is to reduce populations to manageable levels and minimize spread to previously un-infested areas. The ideal goal is eradication of both species in the Project Area. Realistically, the goal is to reduce *Phragmites* and Japanese knotweed populations to the highest extent possible based on landowner participation,

how the species are spread, and available grant funding. Partners will continue to work with local communities to manage and seek additional grant funding for this project.

Landowners or property managers (e.g., private owners, local municipalities, land trusts, and WDNR) will be encouraged to fully participate in the treatment on their respective properties so that finite resources can be allocated elsewhere. Landowner education and outreach activities encouraging participation include presentations at town hall meetings, landowner workshops and trainings, educational materials and distribution of the public web map. To achieve this goal, all *Phragmites* and Japanese knotweed identified within areas prioritized for management (i.e., lakeshore and select inland waterways and adjacent wetlands) shall be targeted for consecutive years of treatment, pending landowner approval.

MANAGEMENT APPROACH

Treatments to invasive *Phragmites* and Japanese knotweed will utilize an adaptive management approach, incorporating targeted herbicide and mechanical methods, a range of specialized tools and equipment, appropriate seasonal timing, and experienced ecological staff. Successfully managing aggressive invasive plant species requires a combination of management approaches, often referred to as Integrated Management. Management options for this Project may include mechanical approaches (mowing and/or cutting) and chemical approaches (targeted application of herbicides). Project partners will reference integrated and adaptive management recommendations discussed throughout the Great Lakes *Phragmites* Collaborative network and will rely on the guidance of qualified contractors. Based on past experience with treating *Phragmites* and Japanese knotweed in the Project Area, LNRP expects control methods selected for a given site will vary depending upon the location, size/stage of the infestation, site dynamics, landowner concerns, presence of rare, threatened, or endangered plant or animal species, and resources available.

Alternative and Proposed Management Actions

Phragmites Control

Chemical Control

Based on past experience, chemical control is the most effective and efficient approach to control *Phragmites*. There are several methods of chemical (herbicide) control that are label-approved for use in aquatic habitats including glyphosate-based herbicides AquaNeat® and Roundup Custom mixed at 5%. Methodologies differ in the mode of application of the chemical agent to the plant and may require mechanical removal of plant material in preparation for application.

Ultra-low volume cut stump application is an effective method that may be appropriate for small, low density stands. Individual stems are cut, and a small amount of herbicide is applied to the

cut stems. This chemical method poses one of the lowest levels of risk to non-target plants but has the highest labor costs per unit area. It is appropriate for use in the most sensitive areas where chemical volume must be minimized, such as near known populations of rare or protected plants or animals.

Foliar application is a highly effective method for controlling invasive *Phragmites* and is used in several different treatment methodologies. Recommended foliar application techniques include low volume spraying using backpack sprayers, UTV (Utility Task Vehicle) mounted boom sprayers, or a UTV- or boat-mounted spray gun; and ultra-low volume wick application using backpacks.

Low volume spray application via backpack, boom or spray gun poses an increased risk of non-target plant damage and somewhat higher materials costs relative to other methods; however, it allows for treatment of large and dense infestations with greatest efficiency and lowest cost per unit area. This method is most appropriate for areas with dense infestations that typically have low plant diversity due to competitive exclusion of native vegetation.

Ultra-low volume wick application via backpack or UTV-mounted wick combines a reduced risk of non-target plant damage with a highly targeted and effective delivery of chemical. Wicking applies chemical directly to the leaves of invasive *Phragmites* through direct contact with the wick, using a higher concentration of chemical than used in spray application. Wicking reduces impacts to non-target native plants that may be damaged by foliar spray application. Wicking can be used effectively in stands of low- to moderate-density *Phragmites*, as is the case in many shoreline populations, and is especially well-suited to use in sensitive areas where off-target damage can be minimized, such as near known populations of rare or protected plants or animals.

Mechanical Control

Mechanical control techniques include mowing and burning. Mowing and/or burning alone will not control invasive *Phragmites* which re-sprouts vigorously after mowing; rather, mechanical control can be an effective preparation for chemical application. Mowing is most effective on large, dense stands in areas that permit access for a UTV- or tractor-mounted deck mower; small areas may be mowed with a handheld brush cutter. Burning may be used to prepare areas of *Phragmites* for chemical application; as well as promote regeneration of native herbaceous vegetation, suppress woody vegetation, and remove thatch and woody debris. Prescribed burning must be carefully planned and conducted by trained professionals. Burning may be advised in certain situations where mowing is impractical, and typically requires higher unit costs. Mechanical control methodologies are an option that may be implemented on a limited basis. Landowners will be encouraged to mow or burn their *Phragmites* stands after the initial treatment.

Biological Control

There is currently no biological control available for use on *Phragmites,* which appears to be resistant to damage from native fungal pathogens and insects.

Japanese knotweed Control

Control of Japanese knotweed is difficult and typically requires a combination of mechanical and chemical methods over a period of two or more growing seasons of treatment.

Mechanical Control

To effectively control established populations, mechanical control should be conducted twice during the growing season: in late spring, when the shoots reach 3 feet in height; and again, in late summer, when the plants flower. Mowing of large populations on areas permitting equipment access can be accomplished with a UTV- or tractor-mounted deck mower; small, steep or inaccessible areas may be mowed with a handheld brush cutter. Cut material can be scattered and laid flat onsite. Burning may be utilized in Japanese knotweed control as part of an overall land management approach, but typically requires higher unit costs than mowing.

Chemical Control

Chemical control is applied in the fall, following the second (late summer) mowing. Several methods of chemical application and several herbicide products may be used effectively. Products effective on Japanese knotweed, available in formulations that are approved for wetland use, include aminopyralid and glyphosate.

Ultra-low volume cut stump application is an effective method of control that may be appropriate for small, low density stands. A small volume of herbicide with a high concentration of active ingredient is applied to the individual cut stems, directly following mechanical treatment. This chemical method poses one of the lowest levels of risk to non-target plants but has the highest labor costs per unit area. It is appropriate for use in the most sensitive areas where chemical volume must be minimized, such as near known populations of rare or protected plants or animals.

Foliar application is a highly effective method for controlling Japanese knotweed and is applied when the re-sprouts reach 3 feet in height following late summer mechanical treatment. Herbicide is applied to the leaf surfaces until fully wetted. Recommended foliar application techniques include low volume spraying using backpack sprayers, UTV mounted boom sprayers, or a UTV-mounted spray gun.

Low volume spray application via backpack, boom or spray gun poses an increased risk of non-target plant damage and somewhat higher materials costs relative to other methods; however, it allows for treatment of large and dense infestations with greatest efficiency and lowest cost per unit area. This method is most appropriate for areas with dense infestations that typically have low plant diversity due to competitive exclusion of native vegetation. Foliar treatment is likely to be the most efficient treatment for most well-established populations of Japanese knotweed.

Biological Control

There is no available biological control for Japanese knotweed.

No Management

Failing to manage invasive *Phragmites* and Japanese knotweed populations would lead to increased degradation and loss of wetland and shoreline habitat within Manitowoc, Kewaunee, Fond du Lac, and Calumet counties, and would allow continued expansion and spread from existing populations to new areas. Failure to manage invasive species would be inconsistent with the shared interests and values of project partners and the community, to preserve and enhance the aesthetic and functional values of coastal resources, waterways and wetlands of this region.

MINIMIZATION OF ADVERSE IMPACTS

Potential adverse impacts resulting from chemical treatments include herbicide impacts to non-target plant species and creating temporarily unvegetated areas that could provide a niche for invasion by other invasive species. Herbicide drift will be minimized by utilizing best management practices and following the label instructions for the herbicide. Herbicide applications shall be timed to maximize favorable weather conditions. To mitigate drift and potential non-target impacts, herbicide shall not be applied during high winds, or as deemed unsuitable by a qualified, certified applicator. Other weather conditions that influence herbicide effectiveness include temperature, moisture, and humidity. Warm conditions are usually favorable for chemical application, although hot, dry conditions can slow plant metabolism and can make plants less susceptible to the herbicide. The length of time required between herbicide application and rainfall, referred to as the rainfast period, varies for different herbicides; the qualified applicator will also refer to the product-specific label for guidelines.

Seeding native plants subsequent to treatment will be conducted on an as-needed basis. Sites eligible for seeding must have 90% or greater control of the target species, have substrate suitable for seeding (i.e., no standing water) and contain sites conditions that warrant seeding. Small treatment sites typically do not require seeding.

These invasive species are highly aggressive, clonal species with no natural predators in North America. Removing large monocultures of *Phragmites* and Japanese knotweed in accordance with the proposed control actions listed above could create areas of bare ground that may be prone to erosion. For this reason, the need for native species plantings will be evaluated for larger treatment areas and may depend on factors such as topography, slope, hydrology, susceptibility to erosion, water levels, accessibility, existing plant community, and potential for success. Post treatment management will follow BMPs and adaptive management strategies. Monitoring of the treatment/seeded sites will occur each year to determine progress and make adjustments as needed. Monitoring and seeding will take place in late spring or fall.

RESTORATION AND RECOVERY

The proposed treatment strategies will result in new areas of exposed substrate that may be recolonized by native vegetation or return to a more dynamic state of exposure to the physical forces of wind and water. The root structure characteristic of long-established *Phragmites* and Japanese knotweed typically will decay three years after treatment.

The general timeline will include:

- Year 1 - monitoring and mapping to assess invasive population site characteristics, site preparations, and subsequent treatments during the appropriate time period;
- Year 2 – monitoring, post-treatment preparations (i.e., mowing, burning) and second year treatments; and
- Year 3 – monitoring, final treatment and restoration when appropriate.

It is anticipated that many areas will have minor regrowth (+/- 10%) following the first treatment period. Therefore, treatments during Years 2 and 3 will include control of modest regrowth, and the level of effort is expected to be less than during the first year.

The need for restoration will depend upon site characteristics, treatment methods and treatment success, and will be evaluated on a case by case basis. Treatment methods utilizing the wicking method are expected to have minimal impact on short-stature vegetation and other non-target plants, so the need for restoration may be minimal. Foliar application of small invasive species stands using back-pack sprayers or a UTV-mounted spray gun may also not require restoration given the small treatment zone.

Treatment of medium-large invasive species stands with non-target plant damage, where steep or unstable slopes occur, or where large areas of bare soil result, may benefit from restoration and reseeding. Restoration needs will depend upon site characteristics such as hydrology, community types, other invasive species pressure, seedbank response and adjacent vegetation and landowner preferences. An appropriate seed mix designed by plant community will be developed and installed according to site conditions. Native seed mixes generally contain a diverse mixture of sedges, grasses and forbs. Native seed installation shall occur during the fall dormant season or during the spring native seeding window. Seed mixes shall be installed using a no-till native seed drill or by broadcast methods with an appropriate cover crop to reduce erosion and suppress undesirable seed germination. Pending nursery availability and budget, live plugs may be used to supplement the native seed mixes.

If the restoration and recovery phase of the treatment protocol falls beyond the three-year treatment period, these efforts will be assigned to individual landowners and to partner organizations on their respective properties. Landowner education is critical to long-term invasive species control. The biggest gain in Manitowoc County has been landowner education, making

landowners aware of *Phragmites* and Japanese knotweed, and better equipping landowners to identify and control invasive populations on their properties. In each county, LNRP and partners will establish a local fund to help landowners continue to manage *Phragmites* and Japanese knotweed populations while being provided continued guidance and assistance in identifying populations and working with them to control more. This method has been proposed and agreed to by several Manitowoc County townships and will be proposed in other counties as well.

MONITORING AND PREVENTION STRATEGY

Control of existing populations of invasive *Phragmites* and Japanese knotweed, and preventing spread to new areas, will depend on coordination, collaboration and communication among project partners, landowners, land managers, and the public. As mentioned previously, landowners will be encouraged to fully participate in the treatment of invasive species on their respective properties so that finite resources can be allocated elsewhere. It is expected that landowners will have varying abilities and interest in participating in this project, but through education, the project partners will work to increase public awareness of the problem and provide the necessary resources for landowners to take responsibility for treating on their property.

LNRP developed a GIS based web-map specifically for this project. The web-map is used for streamlining data management, communication, progress tracking, and planning. Data layers are project-specific and include mapped locations of existing *Phragmites* and Japanese knotweed populations, treatment areas, and landowner parcels. The web-map is a useful tool that enables tracking and administering a complex project and maintaining a dynamic database that is accessible to project partners and will be continuously updated in real time by project staff across mobile and desktop interfaces. The web-map will be used to track on-the-ground efforts, manage progress of field crews, perform quality control of recorded data, update parcel access status when new permissions are received from landowners, assign treatment areas to field crews, record field data and treatment status, and manage herbicide treatment records. This web-map has proven effective in managing the control efforts to date and will facilitate implementation across the larger LISMA Project Area.

Applying a strategic and adaptive mapping and monitoring standard operation procedure will be imperative to monitoring the success and extent of the countywide treatment efforts. Phragmites mapping efforts have been underway in Manitowoc County for over a decade, starting with citizen-led efforts. This comprehensive mapping data collected by LNRP and Project partners will provide the necessary baseline documentation to measure treatment effectiveness. Post-treatment monitoring and mapping will be completed annually to evaluate the effectiveness of initial and subsequent treatment efforts and to inform an on-going adaptive management strategy. Results will be documented using the project-specific web map. The following information (Table 2) will be collected in the field and maintained in the web map for each *Phragmites* and Japanese knotweed population.

Table 2. Web-map Data Collection Schema

Polygon Information	
Field Name	Dropdown Options/Description
Feature ID	Varies - Unique Feature ID determined by GIS
Species	Varies by target species
Initial Percent Cover	0%
	<1%
	1-5%
	5-10%
	10-25%
	25-50%
	50-75%
	75-95%
	>95%
Initial Acreage	Varies - calculated by GIS
Location	Coastal
	Riparian
	Inland Wetland
	Adjacent to Agricultural
	ROW
Treatment Information (per Phragmites Polygon)	
Treatment Method	No Treatment
	Hand Wick
	UTV
	Backpack
	Truxor
	Mechanical
	Revegetation
	Other
Current Percent Cover	0%
	<1%
	1-5%
	5-10%
	10-25%
	25-50%
	50-75%
	75-95%
	>95%

Field staff will conduct onsite post-treatment monitoring assessments by accessing the web map from the field. A consistent areal coverage estimate approach will be used across all treatment areas, to ensure an accurate and representative measurement of treatment results is obtained.

The cover class system (Table 2) will be used to categorize percent cover of *Phragmites* and Japanese knotweed, determined by visual assessments in combination with georeferenced photographs. Treatment sites will receive post-treatment monitoring during the subsequent growing season, concurrent or prior to conducting follow-up treatments. Photographs will be used to document treatment progress and may also be used to document other features such as high-quality natural communities, disturbances, or future threats.

Monitoring objectives include the following:

1) Verify pre-existing data on invasive species locations within the Project Area. Update location information and/or collect new location data as needed.
2) Verify any data collected from volunteers and other Project partners, for location accuracy, and accuracy of species identification.
3) Survey for, and document invasive plants within inaccessible areas (e.g., shoreline and larger waterways).
4) At least 90% of treatment sites treated each year will receive post-treatment monitoring during the subsequent growing season.

CONTINGENCY STRATEGY

Monitoring of the treatment areas will be an important component of the long-term management strategy. Monitoring pre- and post-treatment will be coordinated and completed by LNRP, with assistance from partner organizations, landowners and volunteers. Monitoring protocols will be established, and efforts reported to the appropriate partner organizations to facilitate treatments. Monitoring and mapping may consist of driving, walking, and/or boating along the treatment areas and visually assessing the location, size, and density of invasive *Phragmites* and/or Japanese knotweed stands. Mapping efforts already underway will be supplemented by mapping of additional areas, utilizing GPS and GIS to identify the extent of infestation within priority areas. Infestations will be revisited after treatment and a visual inspection will be performed to search for surviving stems.

Any new infestations encountered through monitoring efforts will be controlled as soon as possible after discovery. If new infestations are discovered in between treatment periods, treatment will occur during the next treatment window.

In 2019, LNRP partnered with Fox Valley Technical College for a summer internship program anticipating continuation of the program in forthcoming years. Interns were focused on treatment of small, second and third-year re-treatments using backpack sprayers. This program allowed for a more cost-effective monitoring and control strategy by freeing up other project resources and

personnel to focus on larger, more challenging treatment areas. In the future, LNRP plans to continue and expand the partnership and internship program for this project.

PROJECT FEASIBILITY

LNRP has demonstrated that large-scale, region-wide control is feasible, but requires collaboration between local nonprofits, municipalities, federal and state agencies, research institutions and private individuals to leverage shared resources for a common goal of sustainable, regional-scale control. Multiple funding sources are required to provide the financial capacity to manage invasive species on a regional scale. Continual monitoring and the establishment of a local-led, rapid response team is required to sustain project benefits long-term. The intent of a rapid-response team is to provide cost-effective control long-term. LNRP has dedicated significant resources to date and intends to expand the treatment model across the LISMA Project Area and work with diverse partners who can build a successful project.

REFERENCES

Isely, P., Nordman, E. E., Howard, S., & Bowman, R. (2017). Phragmites Removal Increases Property Values in Michigan's Lower Grand River Watershed. Journal of Ocean and Coastal Economics, 4(1). doi: 10.15351/2373-8456.1076

ATTACHMENT A

Figure 1 - Manitowoc County Invasive Species Areas

Figure 2 - Kewaunee County Invasive Species Areas

Figure 3 - Fond du Lac County Invasive Species Areas

Figure 4 – Calumet County Invasive Species Areas

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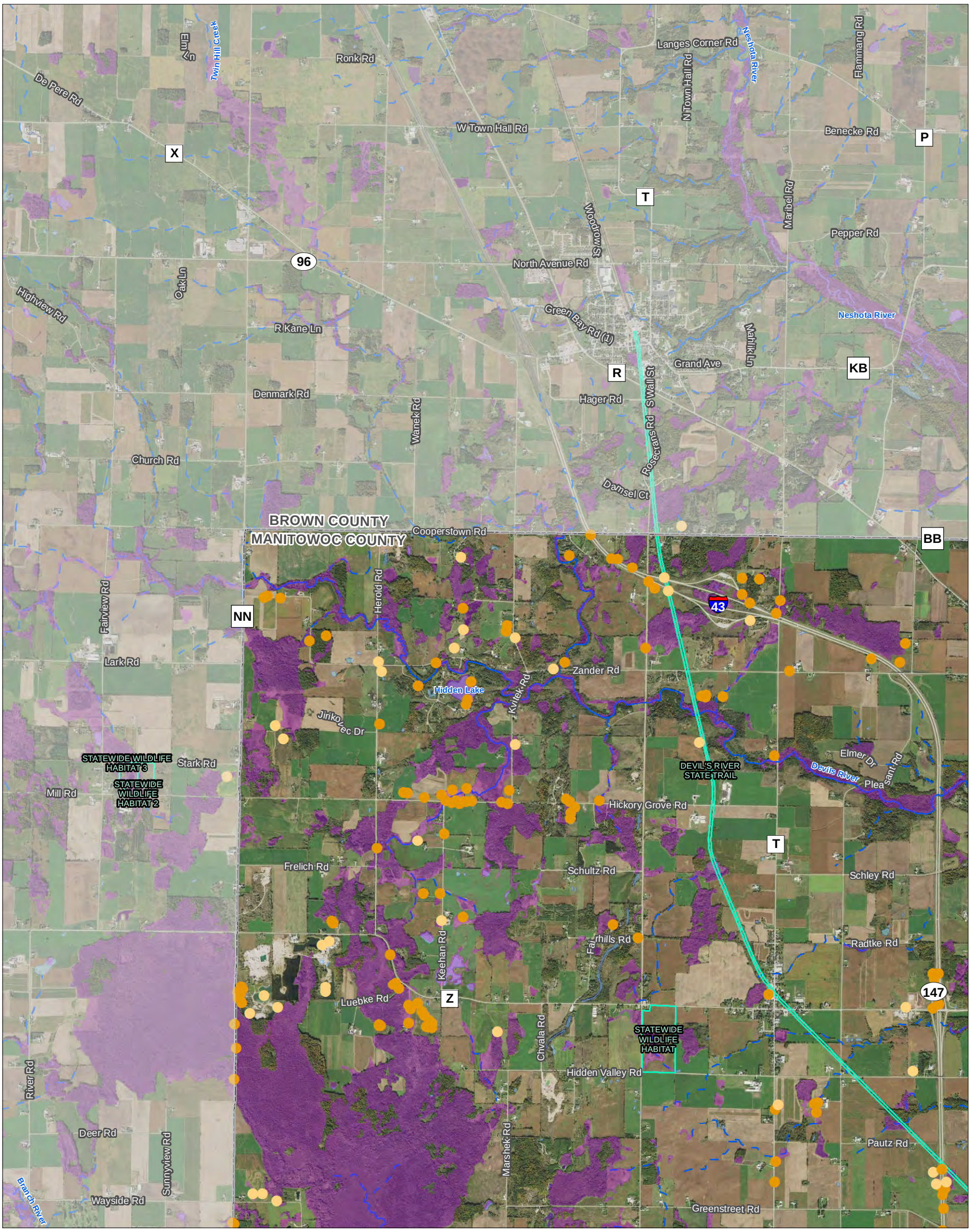

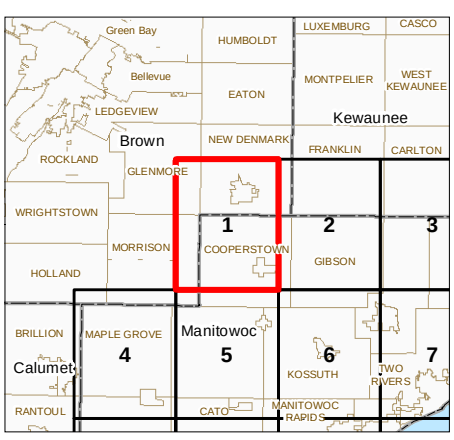

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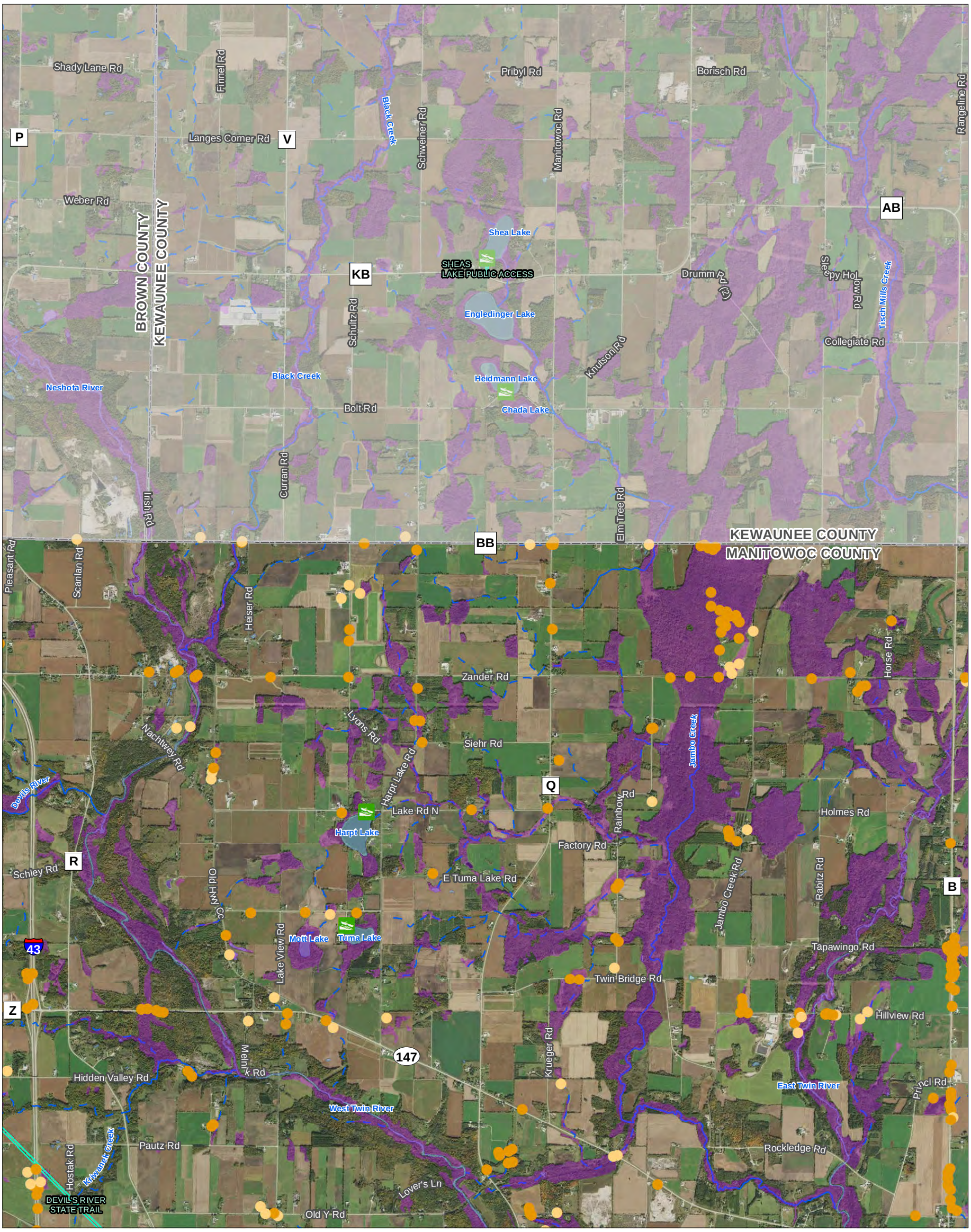

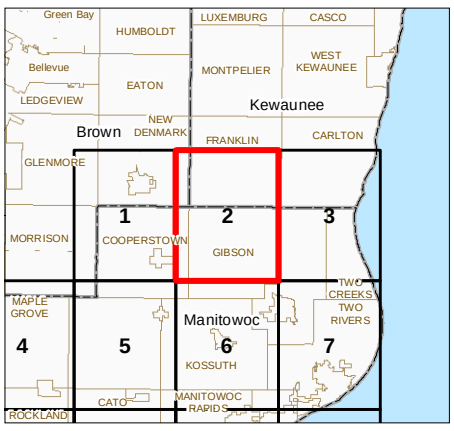

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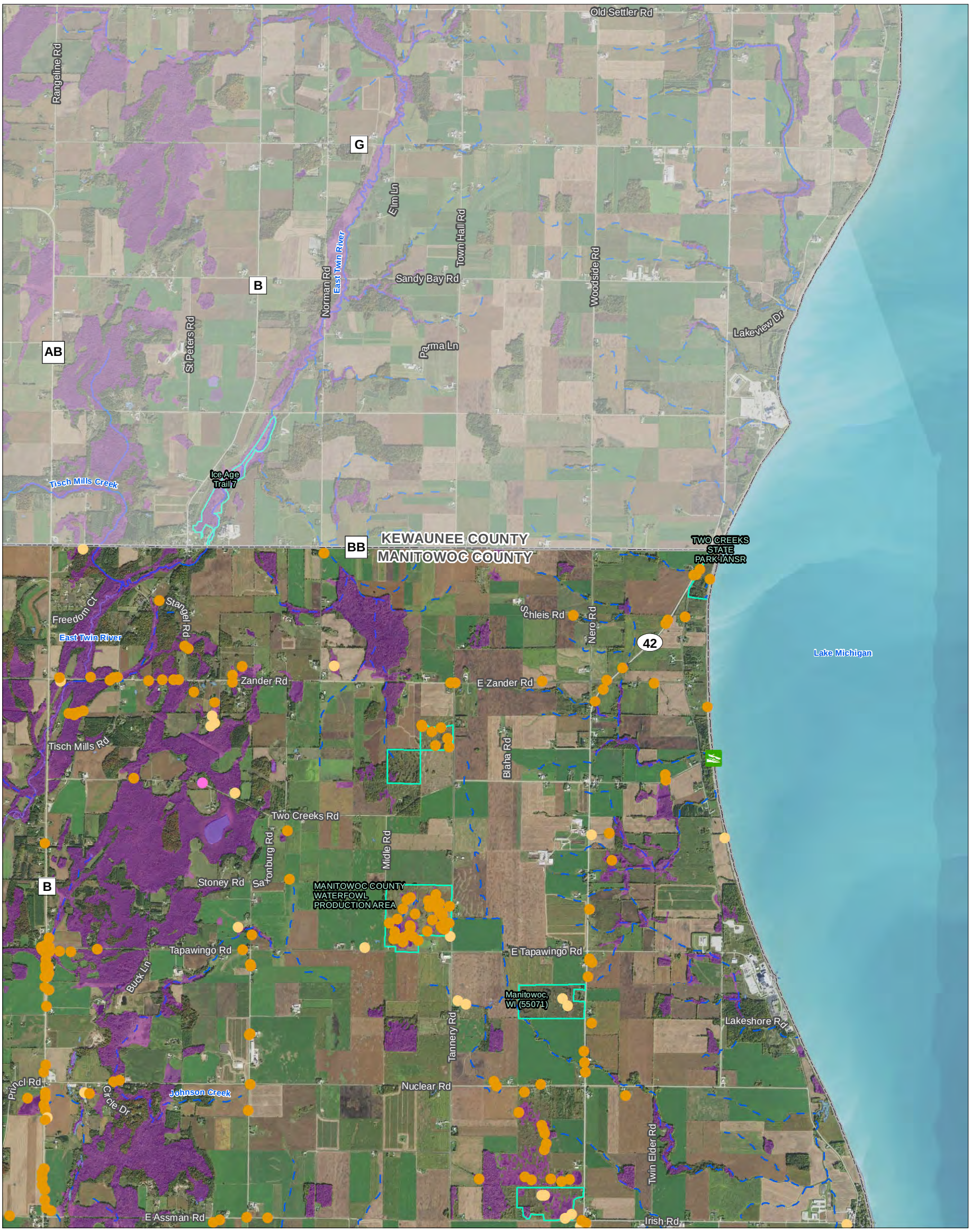

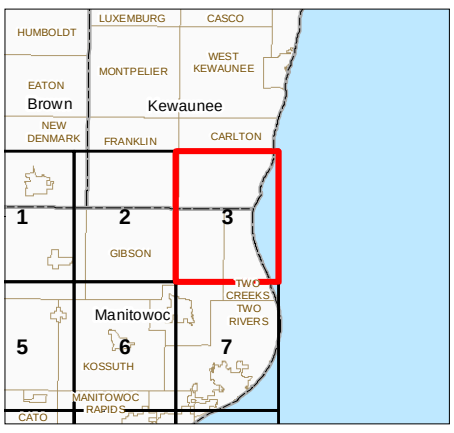

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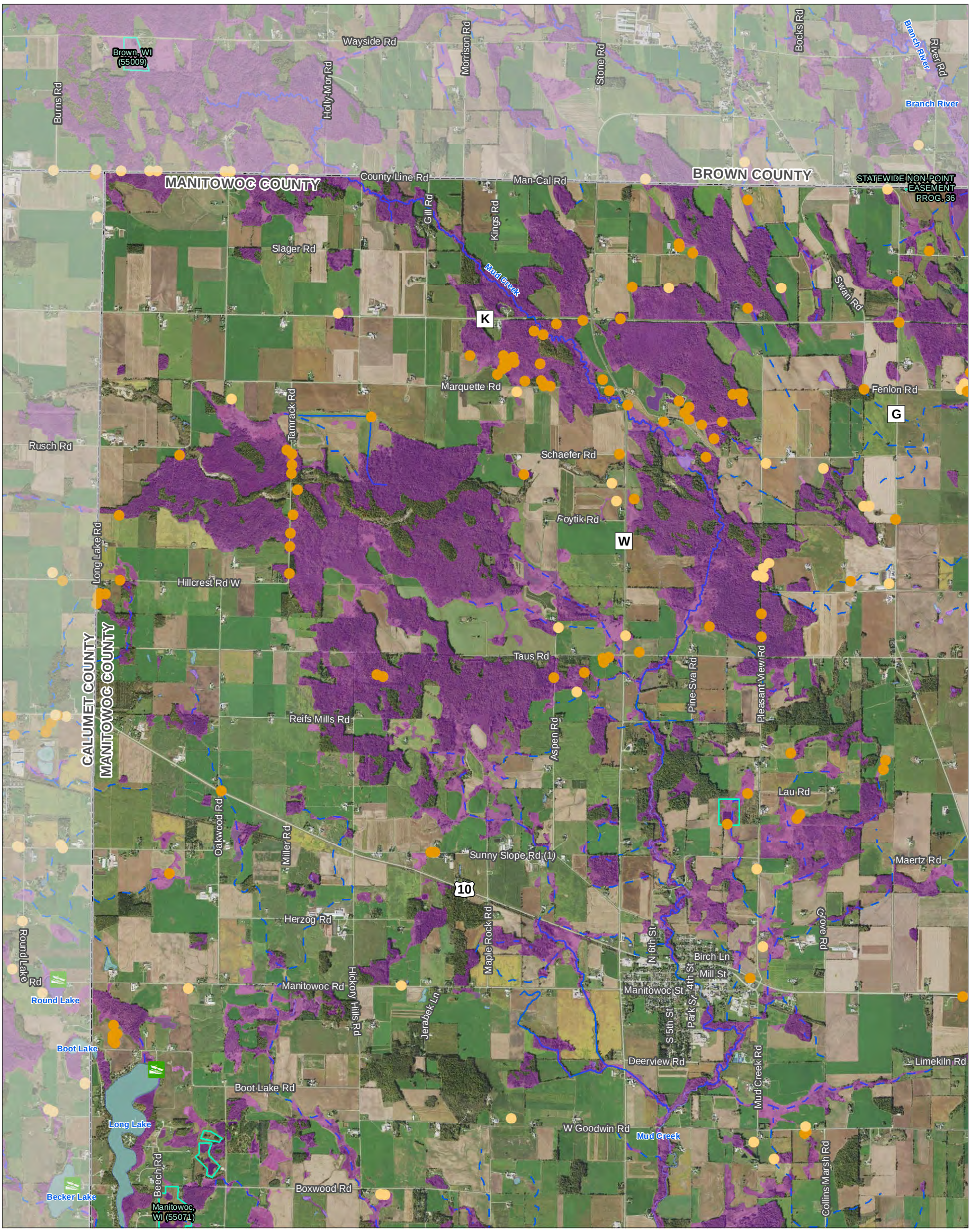

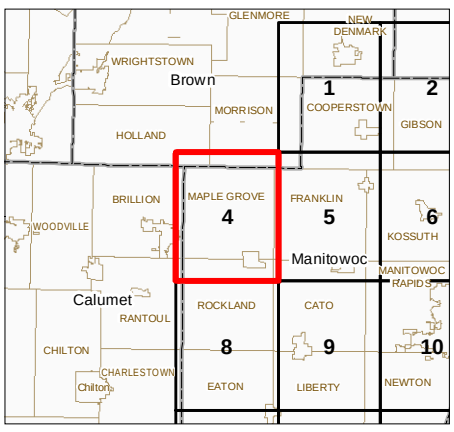

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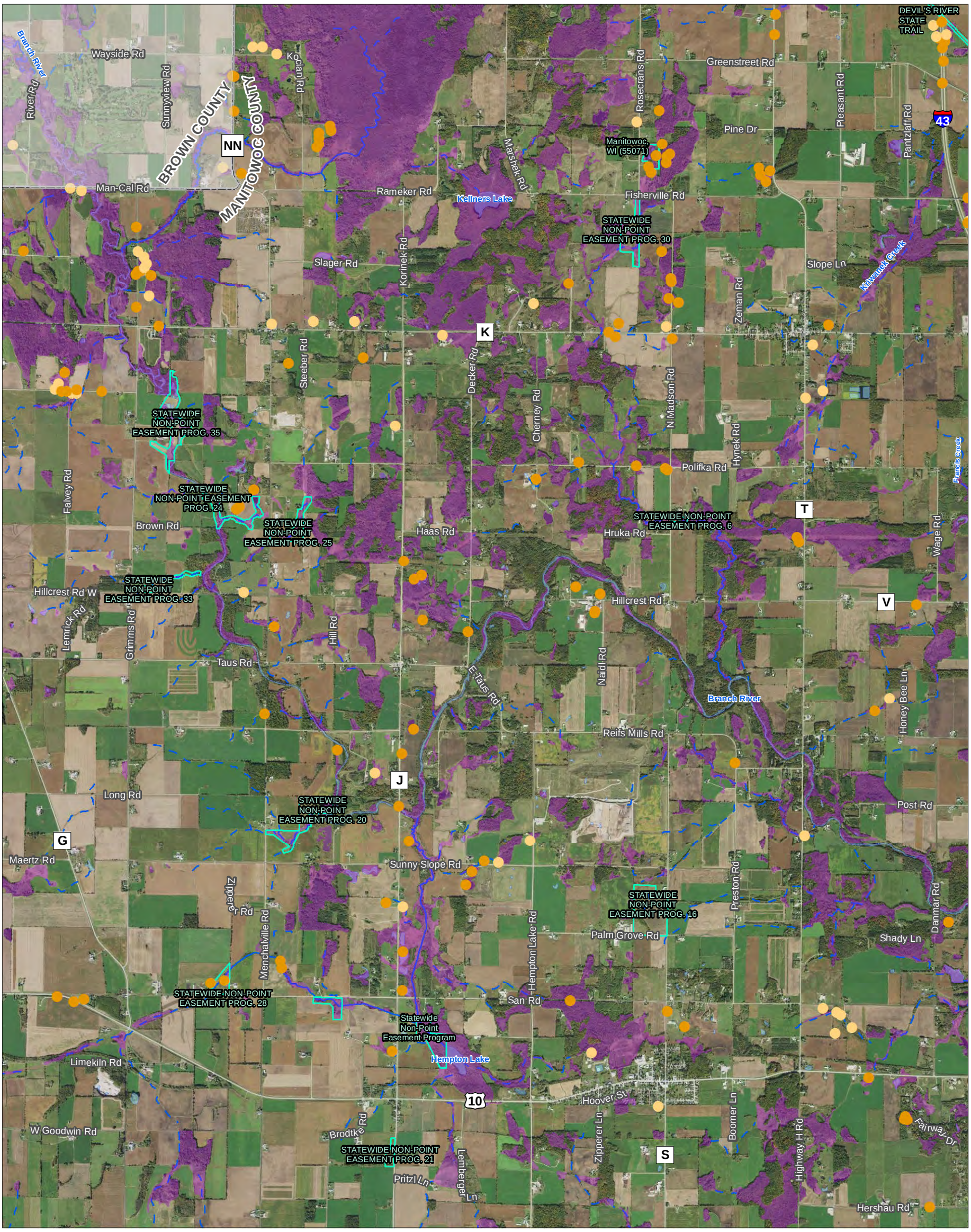

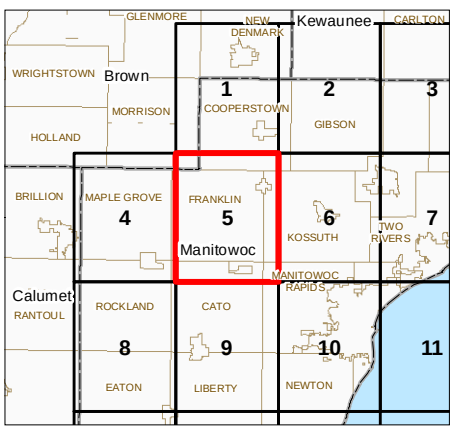

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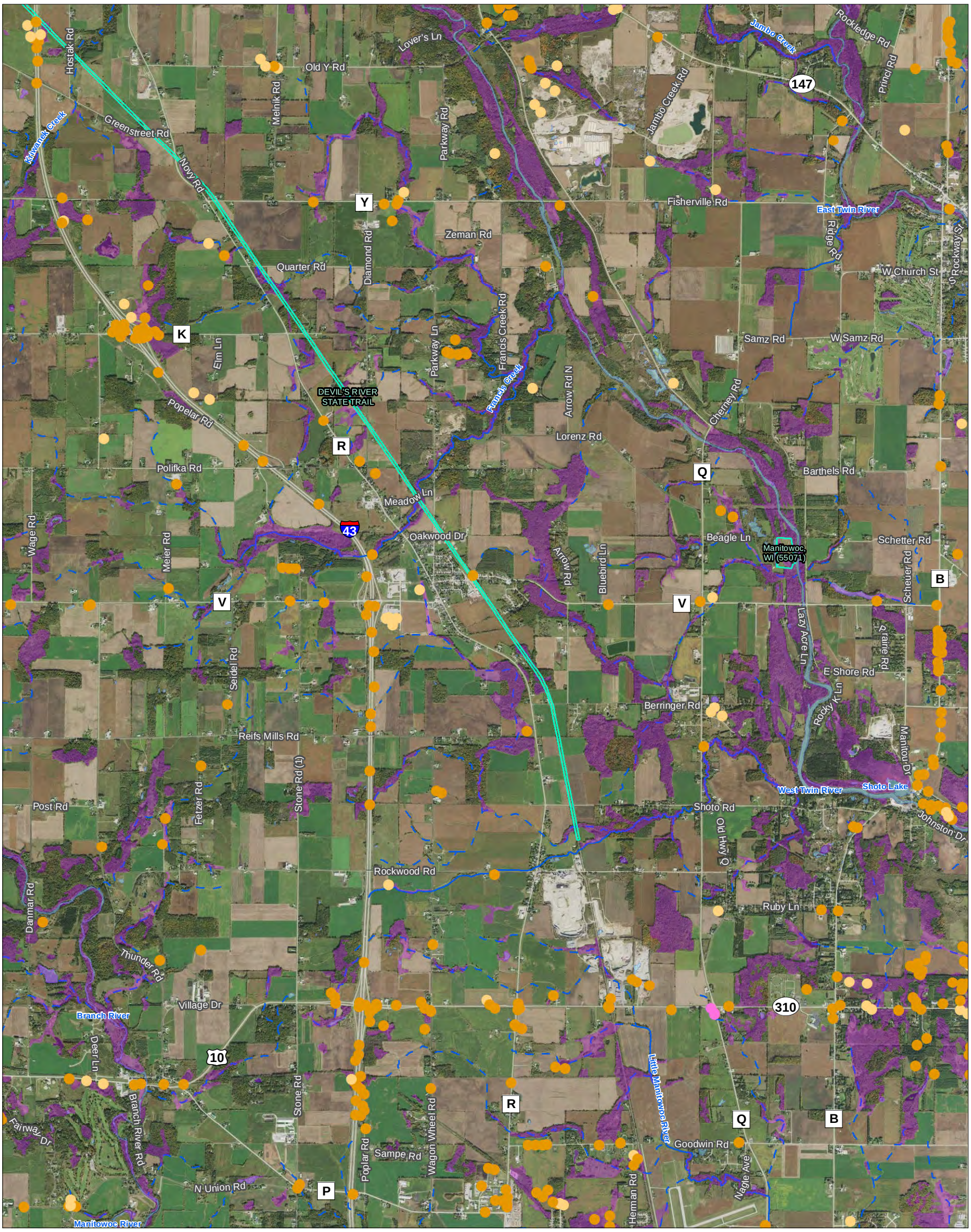

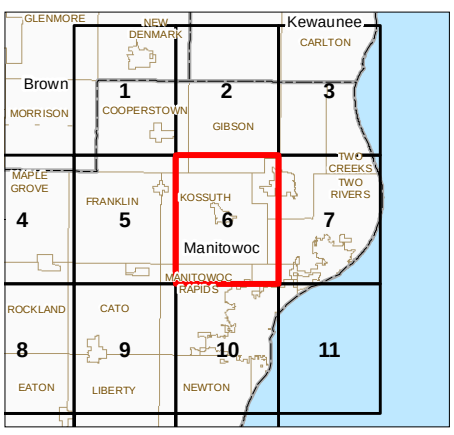

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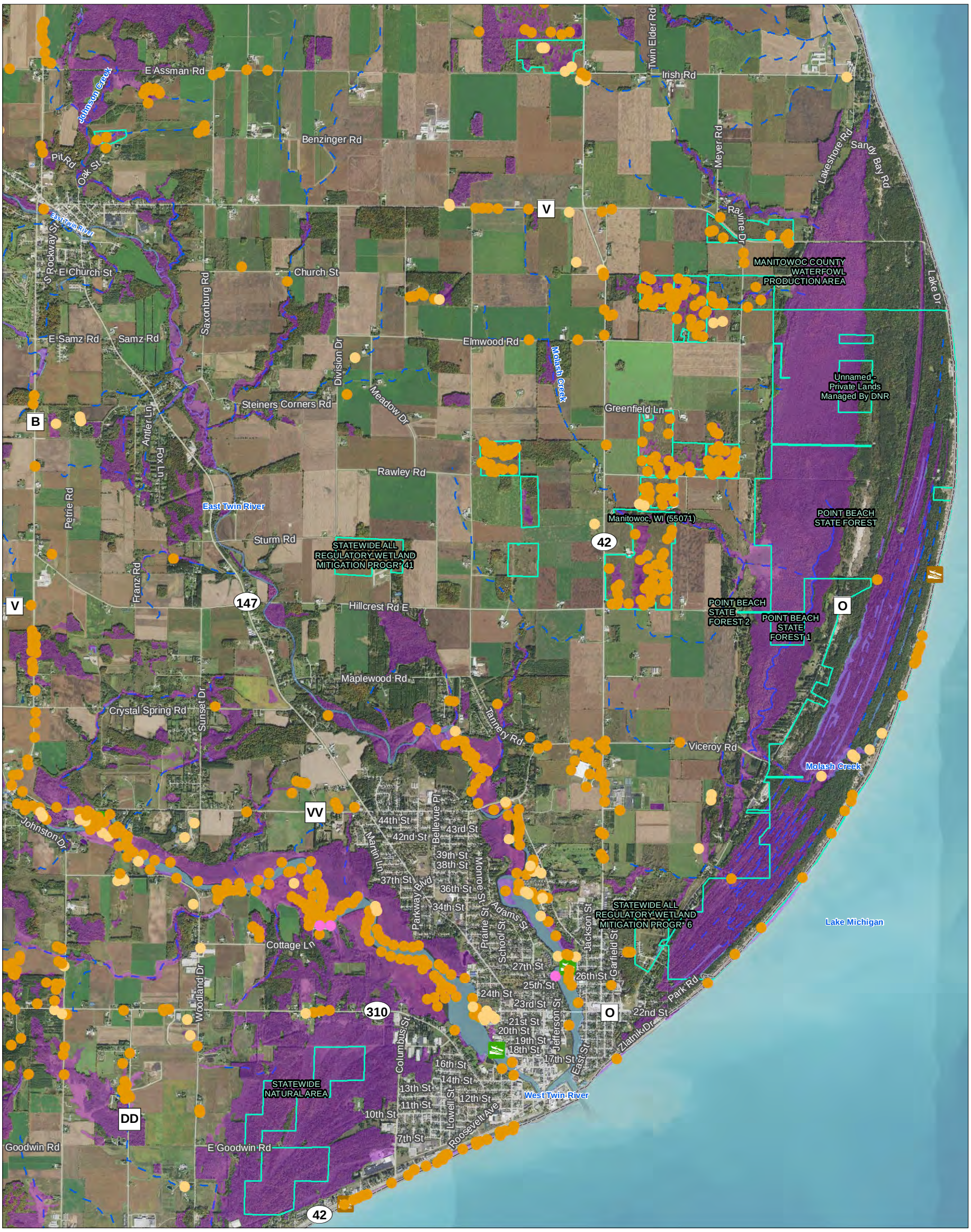

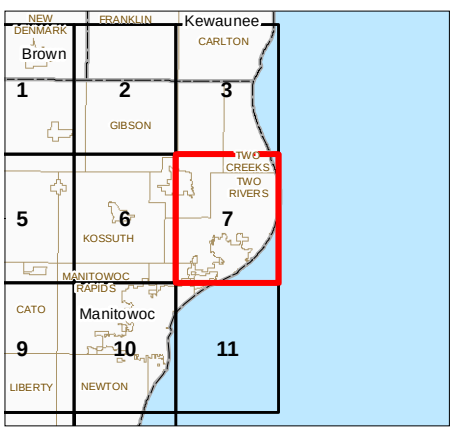

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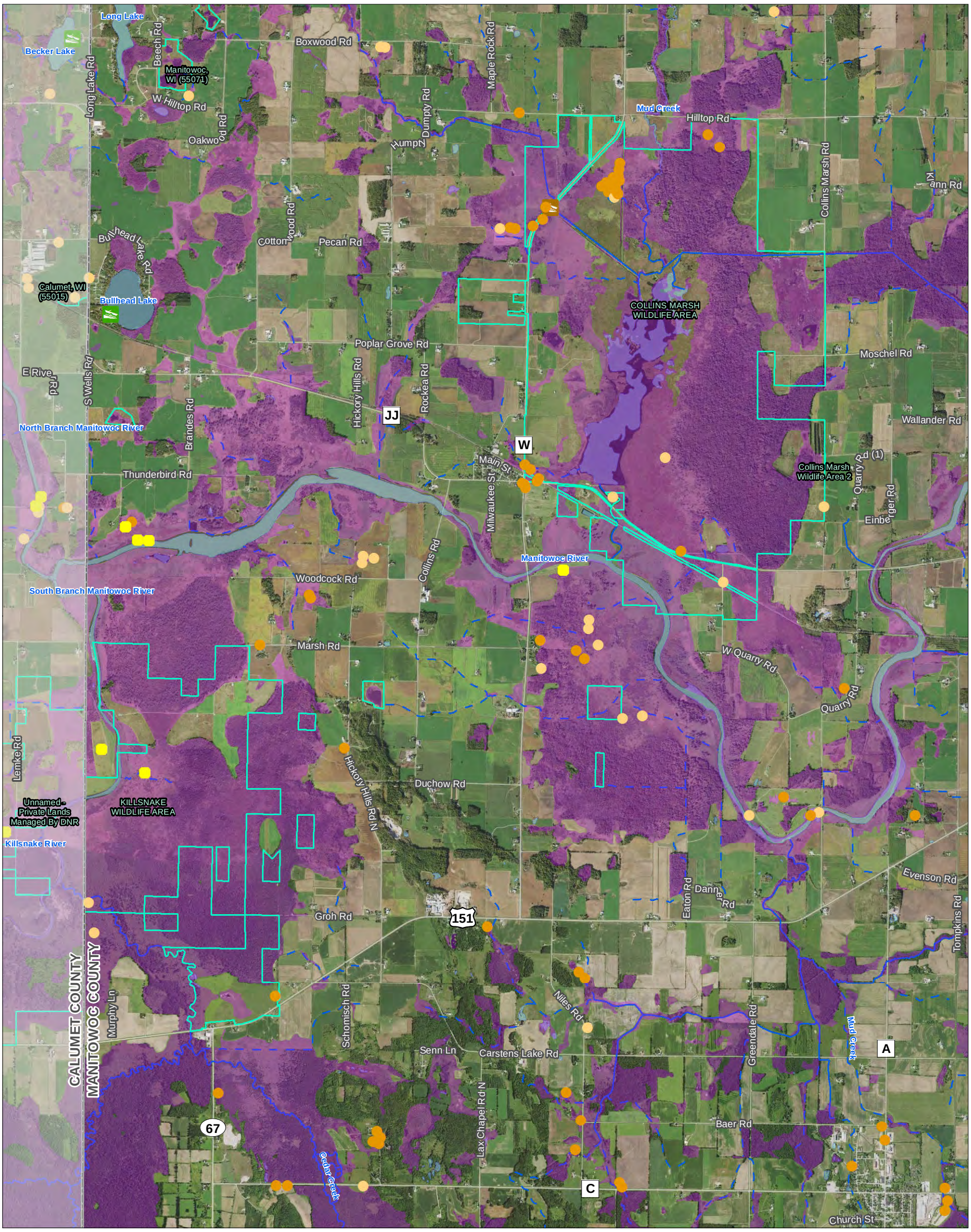

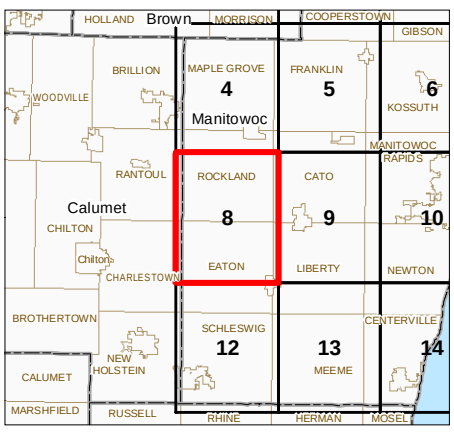

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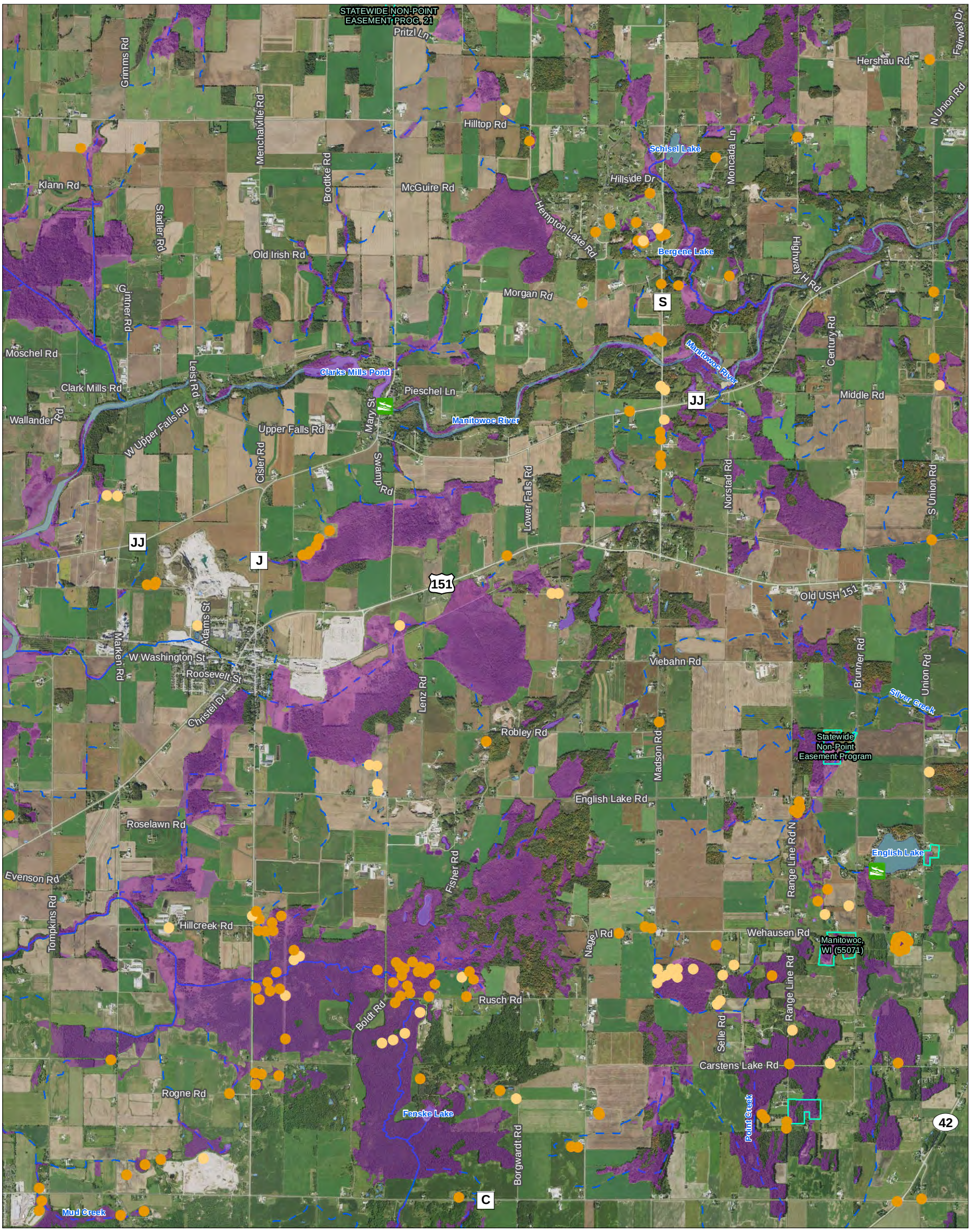

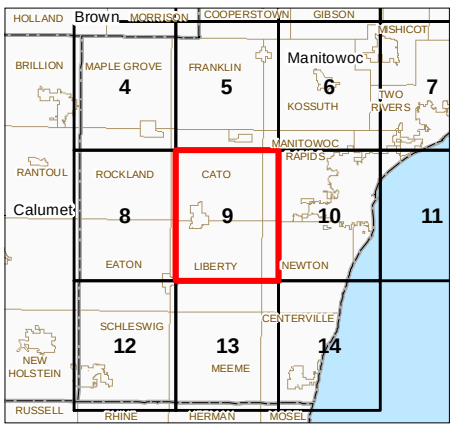

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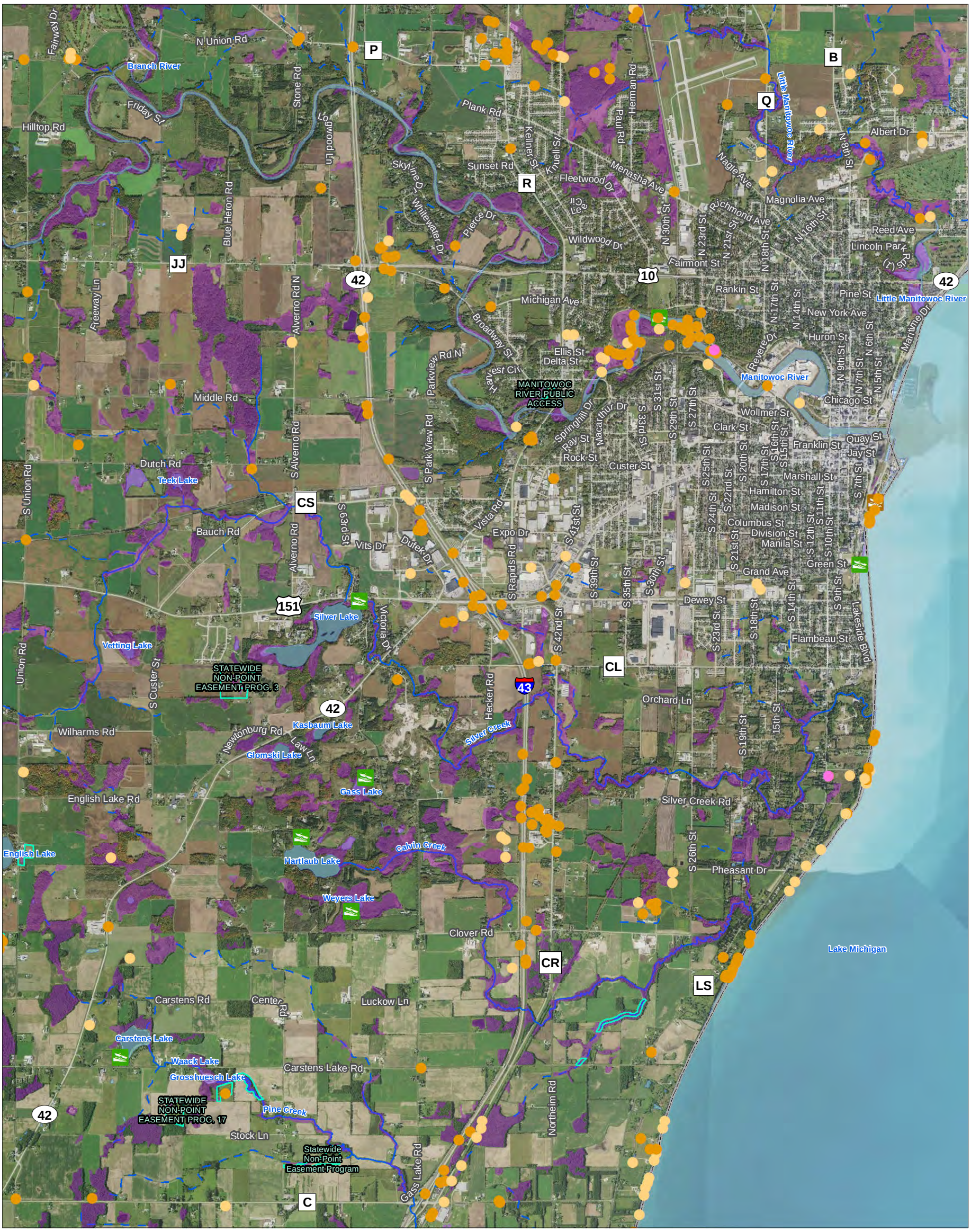

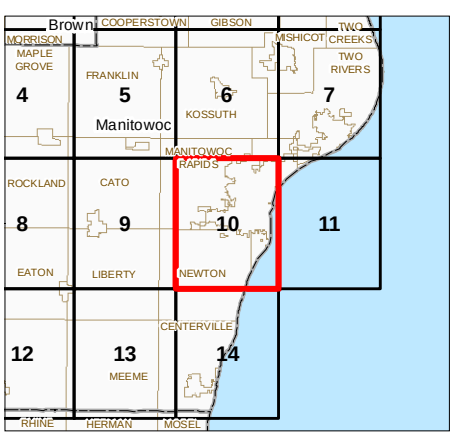

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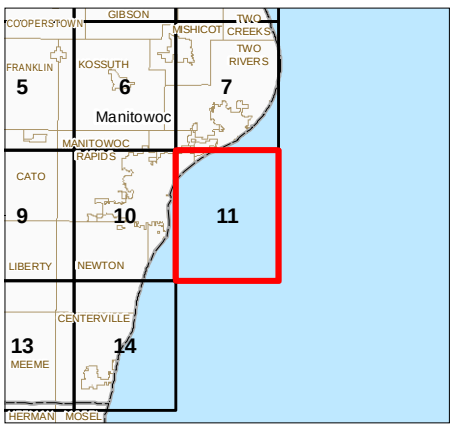

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2. Data Sources Include: Stantec, LNRP, WisDOT, WDNR, PADUS
3. Orthophotography: 2017 NAIP

Legend

- Japanese Knotweed, Treated: 0 acres
- Japanese Knotweed, Untreated: 1.22 acres
- Non-Native Phragmites, Treated: 636.37 acres
- Non-Native Phragmites, Untreated: 180.15 acres
- Native Phragmites: 237.66 acres
- Wisconsin Wetland Inventory
- Protected Areas Database

Public Boat Access Sites

- CARRY-IN
- RAMP
- UNKNOWN

DNR 24k Hydrography

- Perennial Stream
- Intermittent Stream
- Waterbody

Figure No.
1

Title
Invasive Species Areas
Manitowoc County

Client/Project
Lakeshore Natural Resource Partnership (LNRP)
LISMA Invasive Phragmites and Japanese Knotweed Management Plan

Project Location
Manitowoc County
Wisconsin

Prepared by JD on 2020-01-23
Technical Review by MP on 2020-01-23
Independent Review by MC on 2020-01-30

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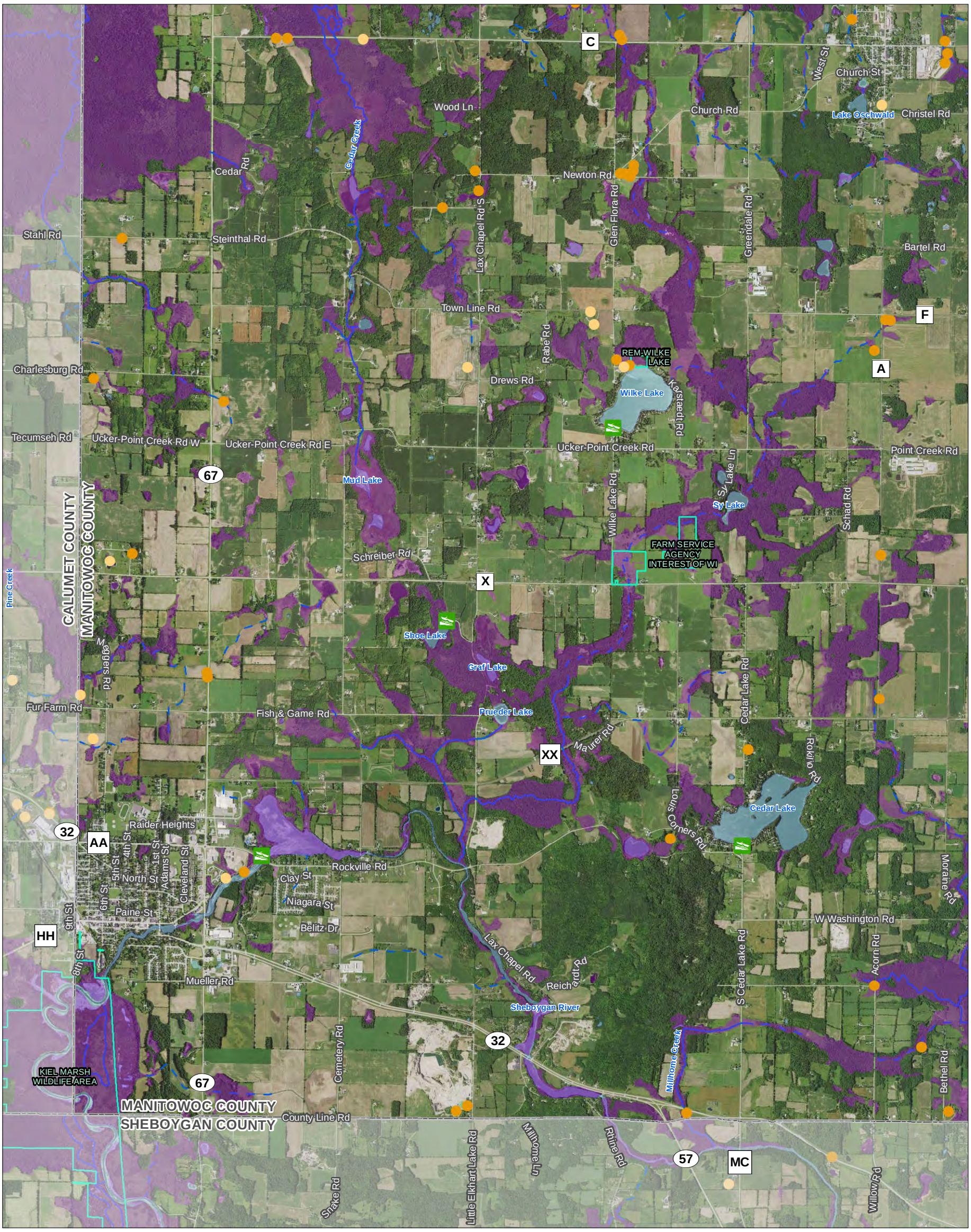

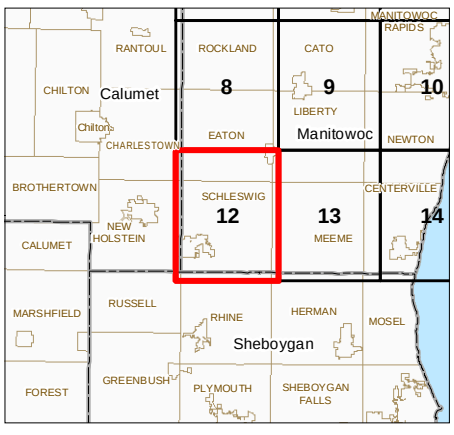

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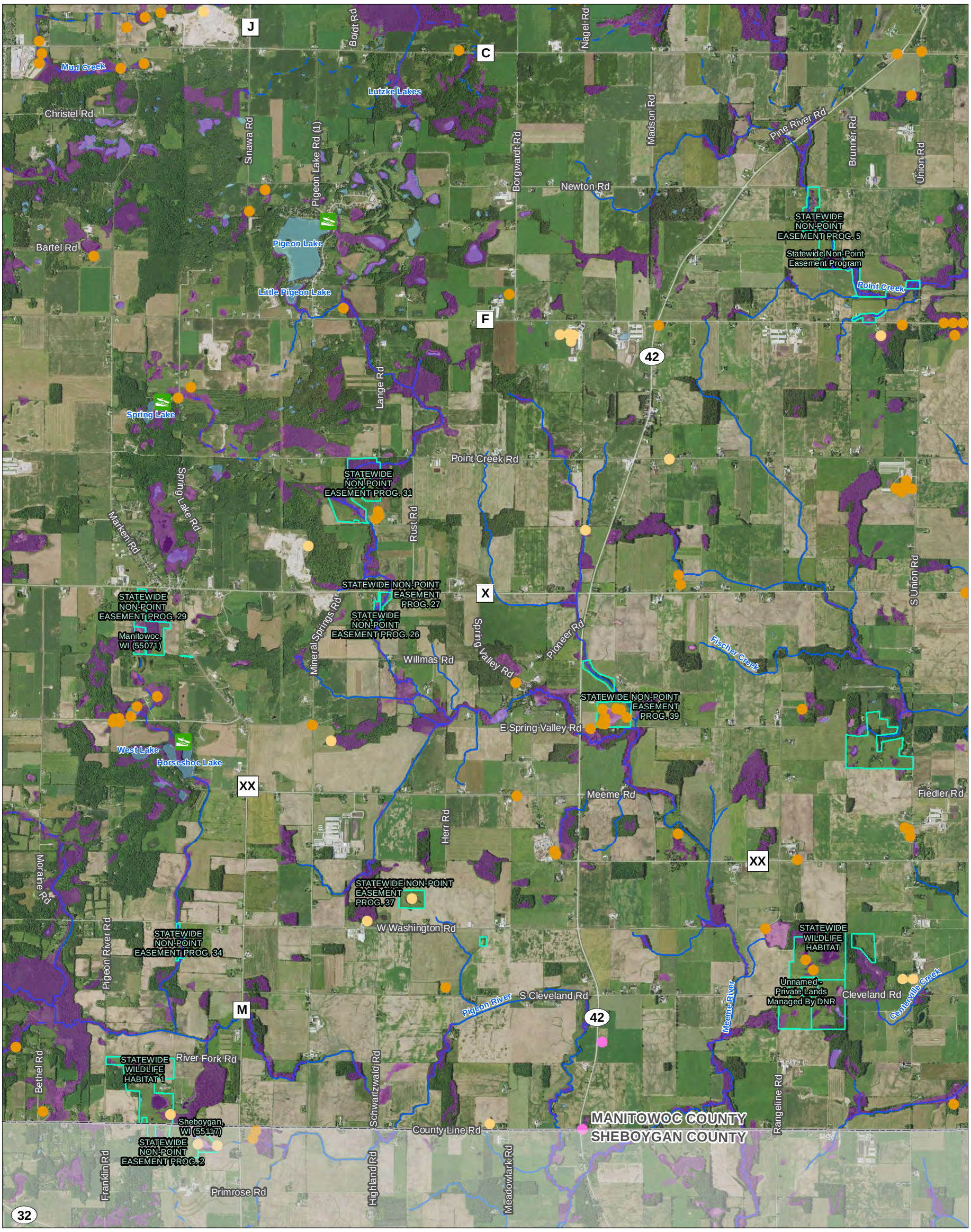

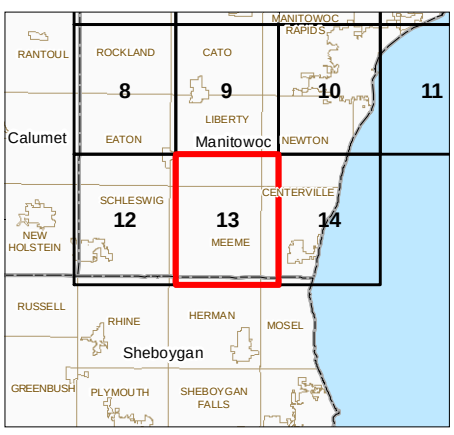

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Manitowoc County

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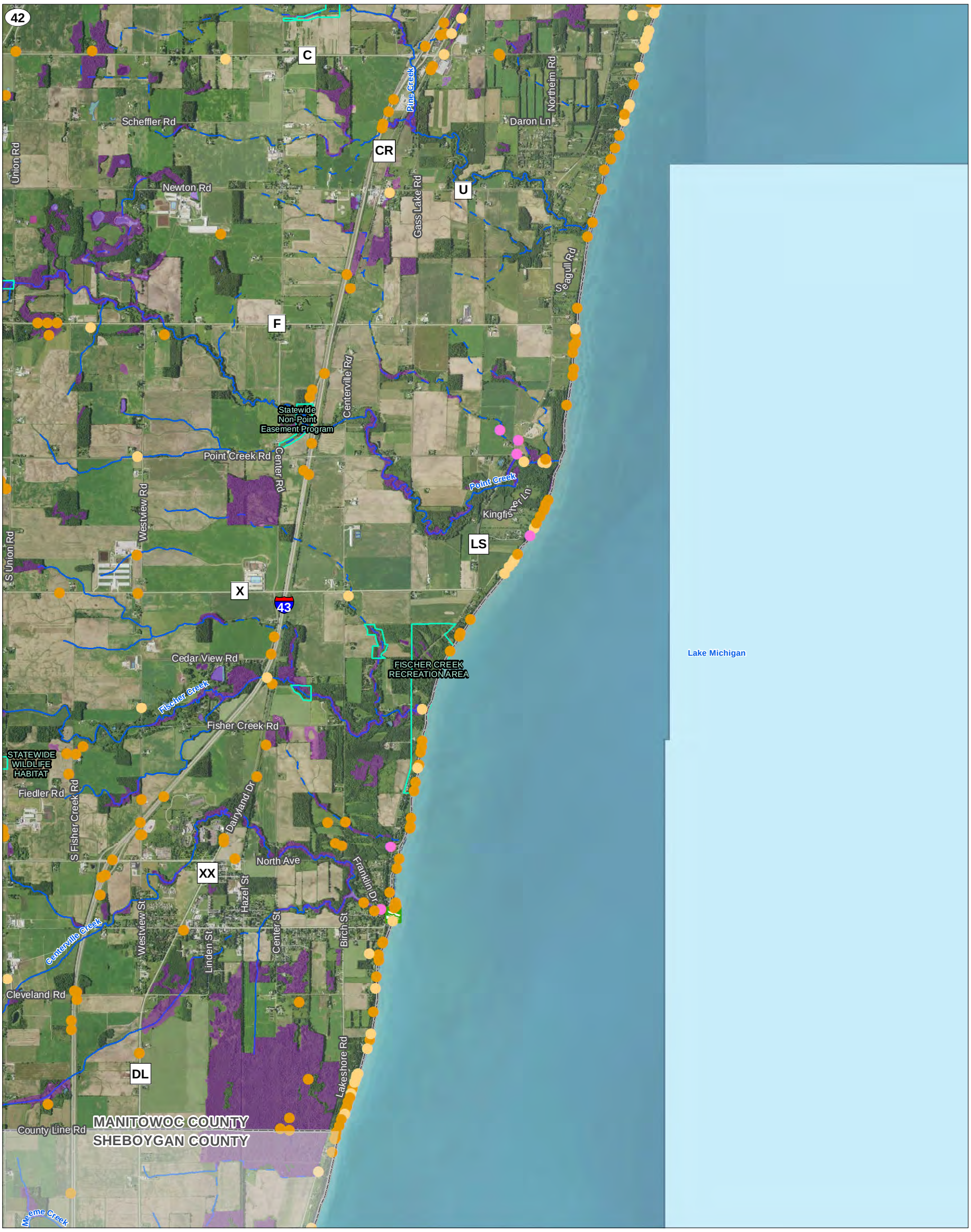

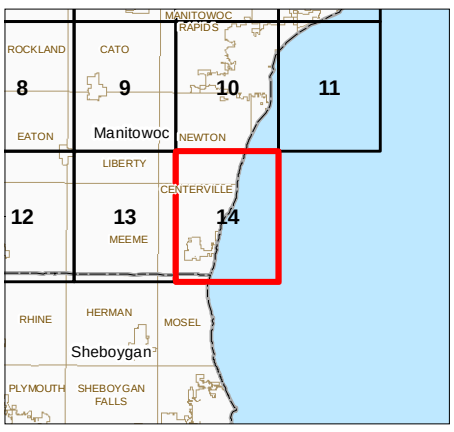

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Manitowoc County

Client/Project
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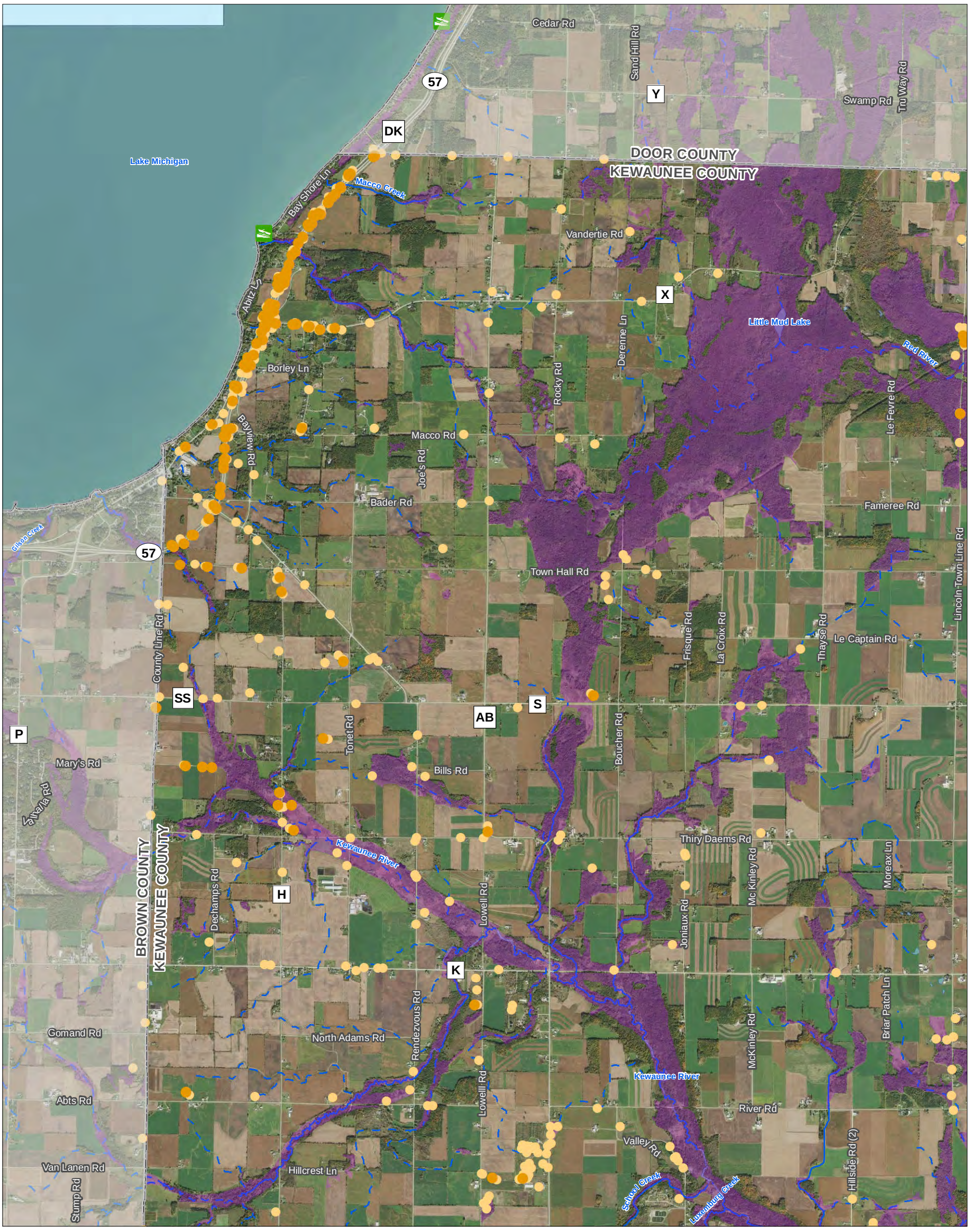

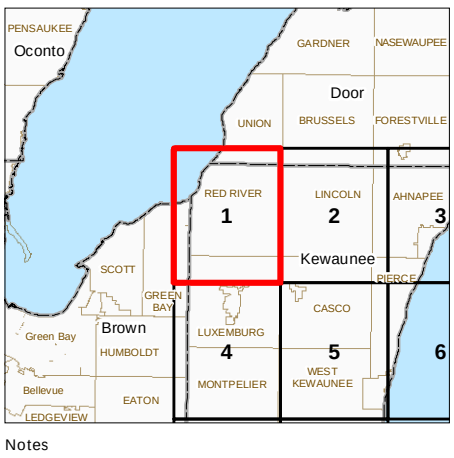

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Legend

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Public Boat Access Sites

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DNR 24k Hydrography

- Perennial Stream
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- Waterbody

Figure No.
2

Title
Invasive Species Areas
Kewaunee County

Client/Project
Lakeshore Natural Resource Partnership (LNRP)
LISMA Invasive Phragmites and Japanese Knotweed Management Plan

Project Location
Kewaunee County
Wisconsin

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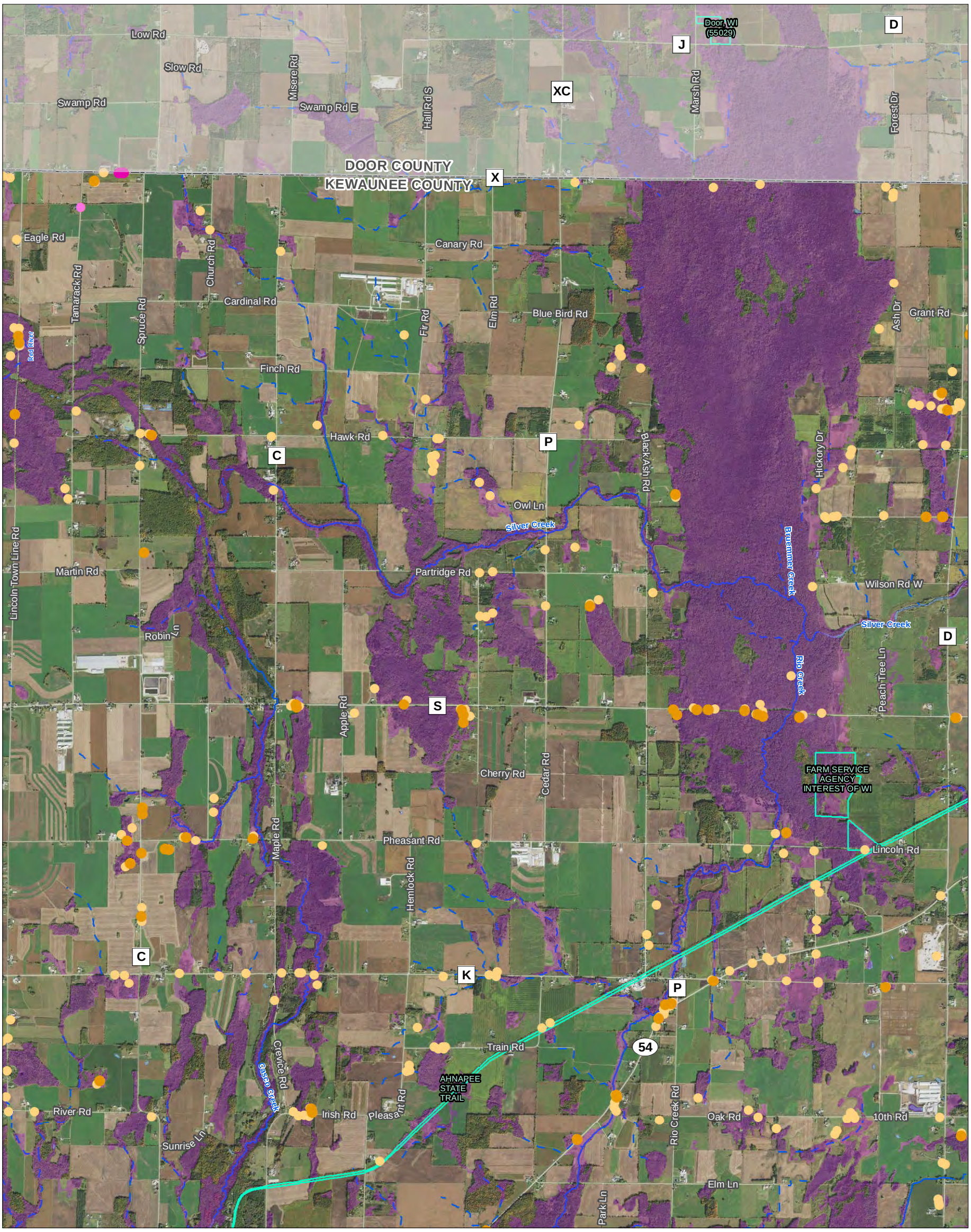

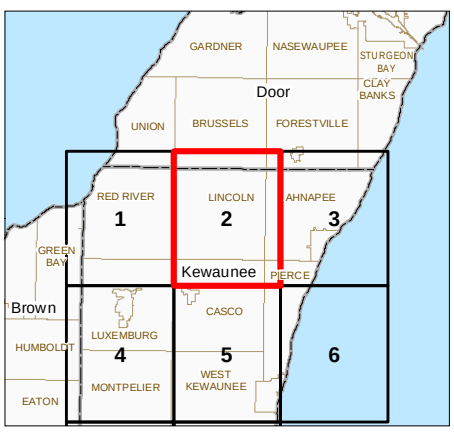

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DNR 24k Hydrography

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Figure No.
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Invasive Species Areas
Kewaunee County

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Project Location
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Wisconsin

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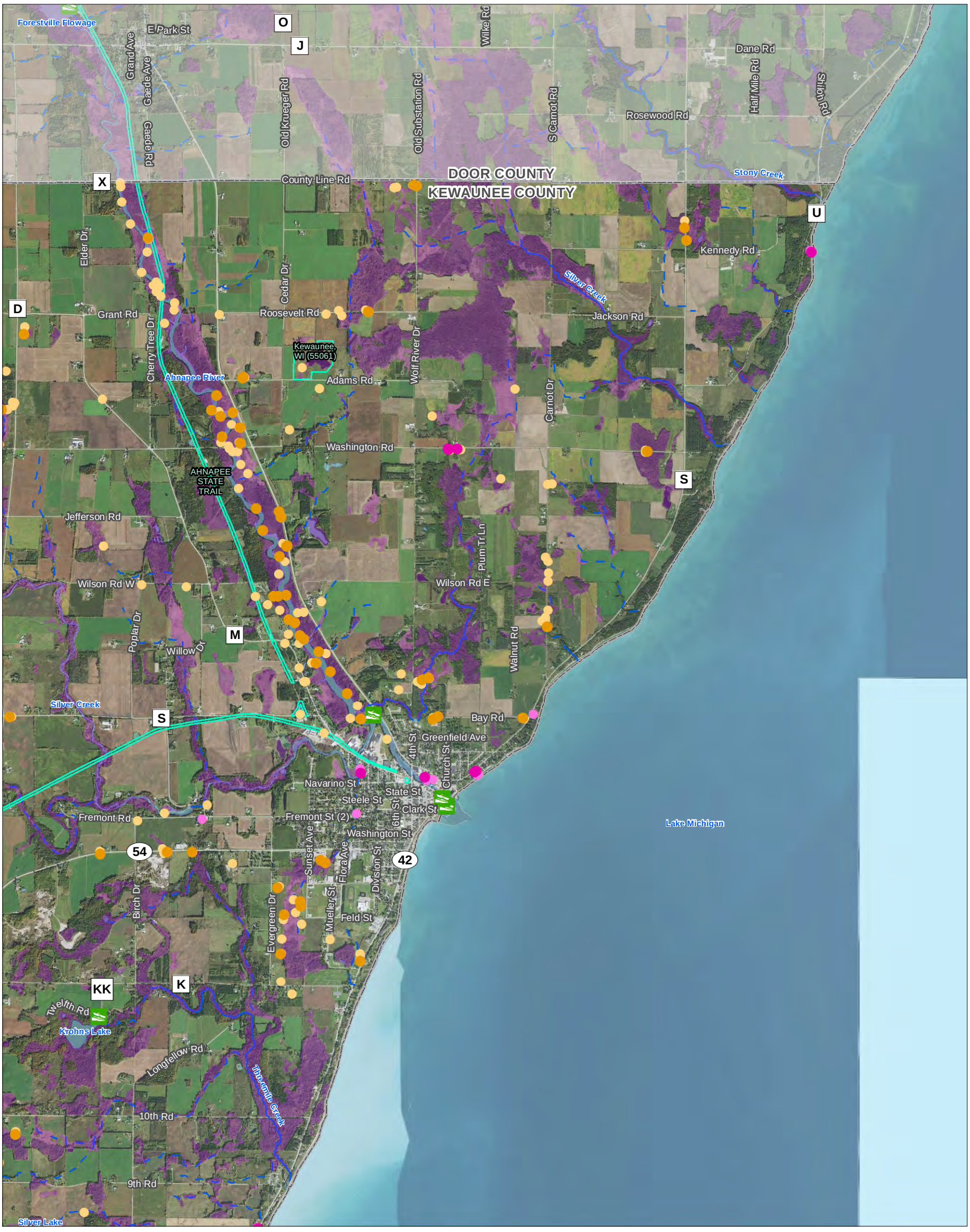

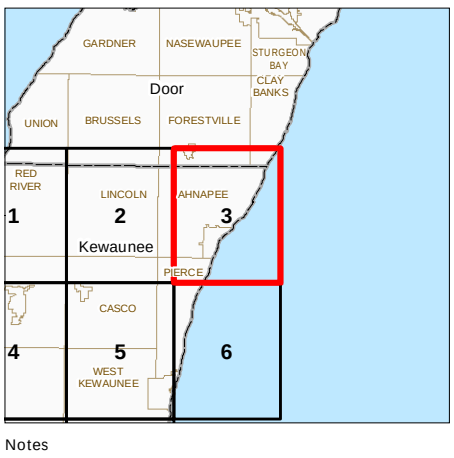

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Public Boat Access Sites

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DNR 24k Hydrography

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Figure No.
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Title
Invasive Species Areas
Kewaunee County

Client/Project
Lakeshore Natural Resource Partnership (LNRP)
LISMA Invasive Phragmites and Japanese Knotweed Management Plan

Project Location
Kewaunee County
Wisconsin

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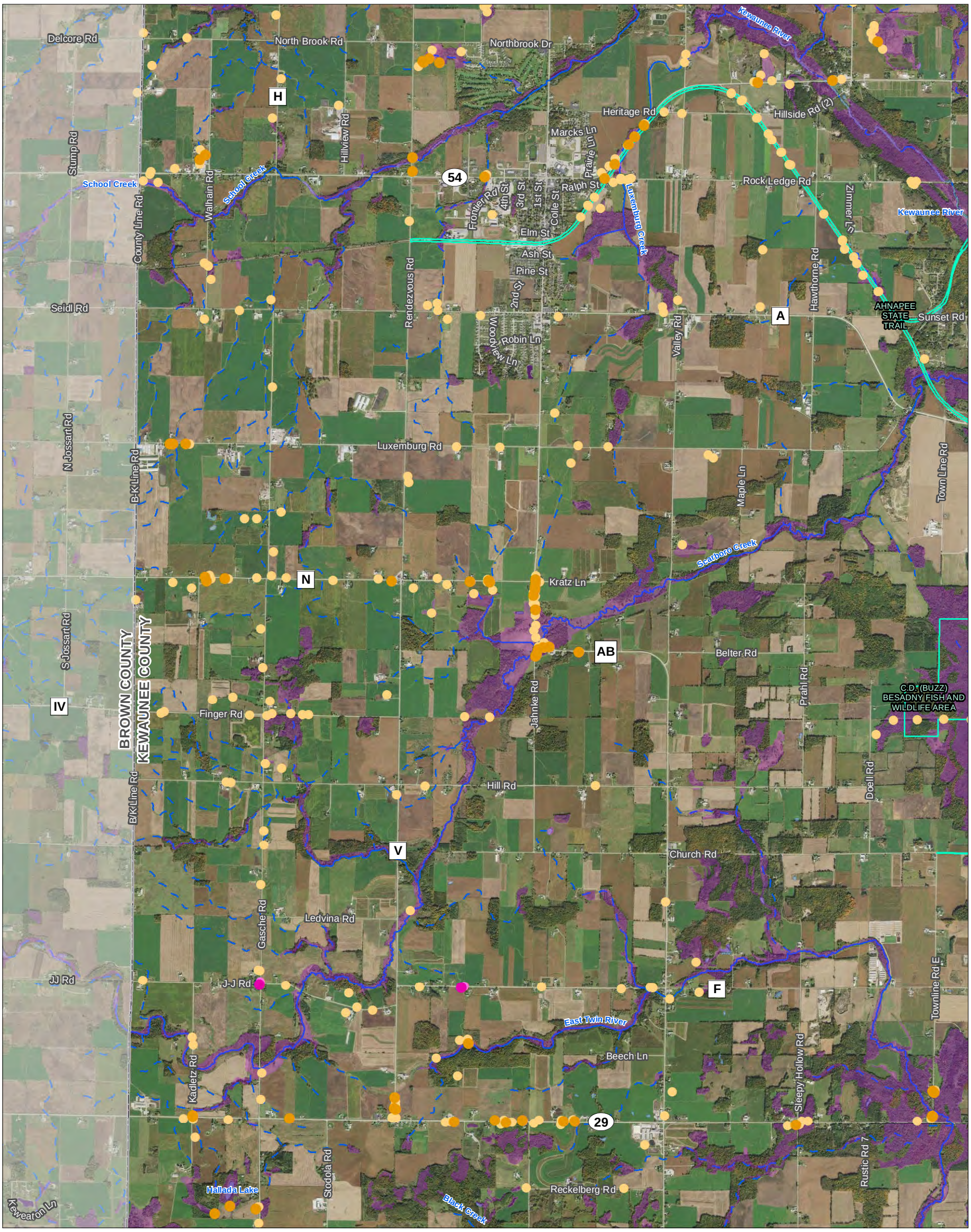

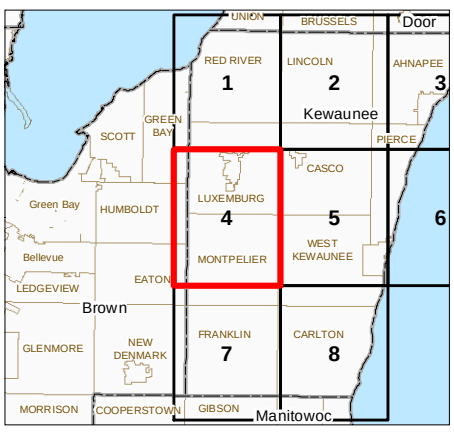

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Invasive Species Areas
Kewaunee County

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Project Location
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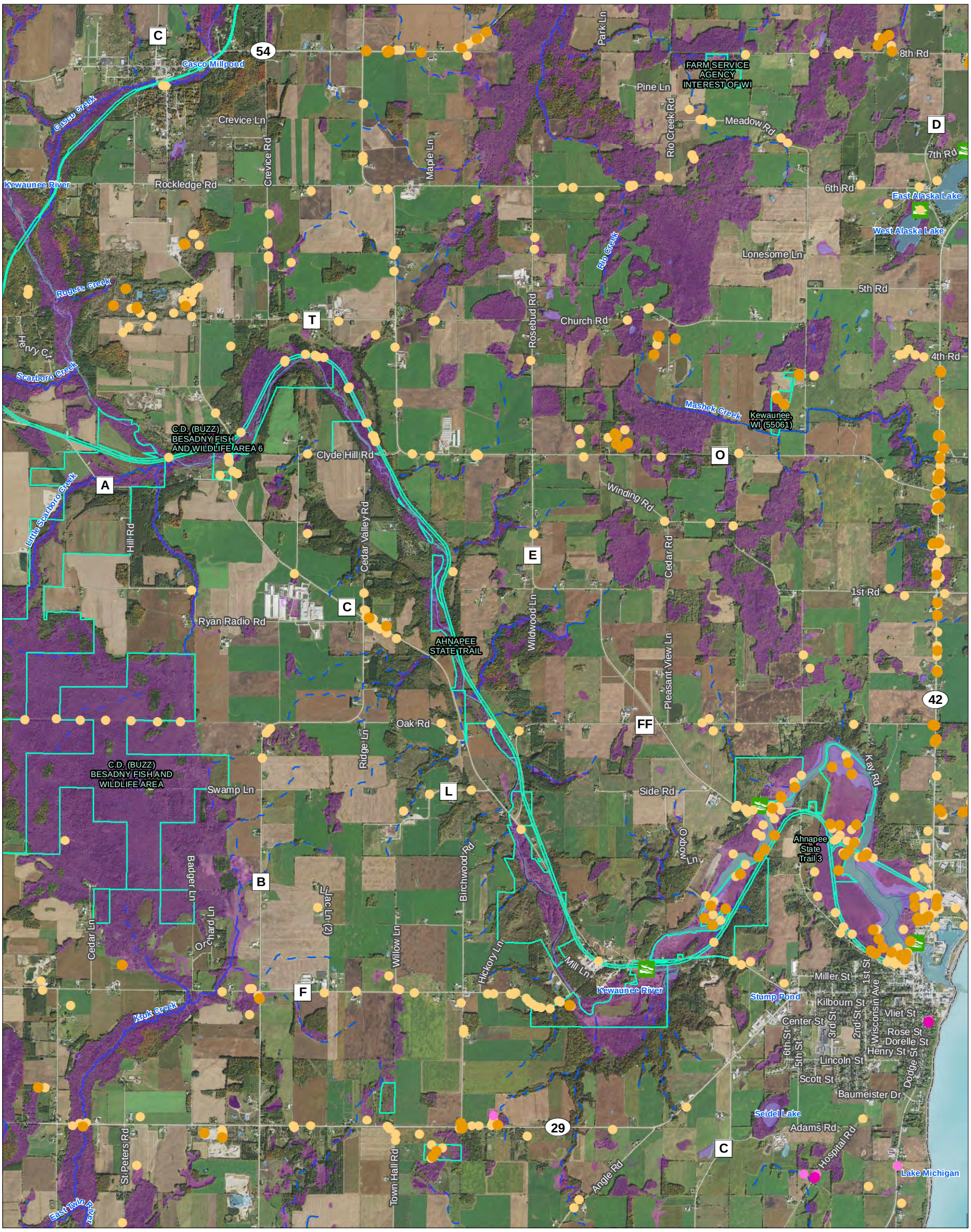

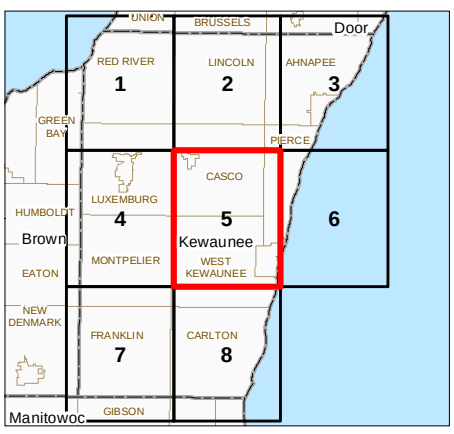

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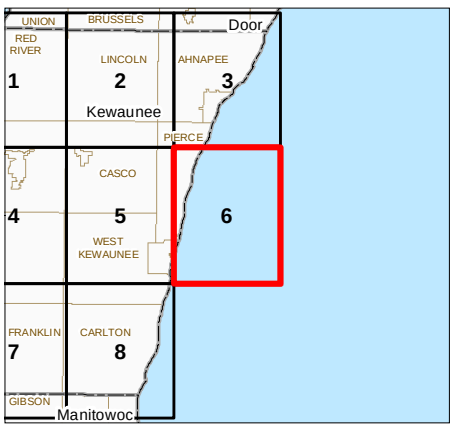

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Invasive Species Areas
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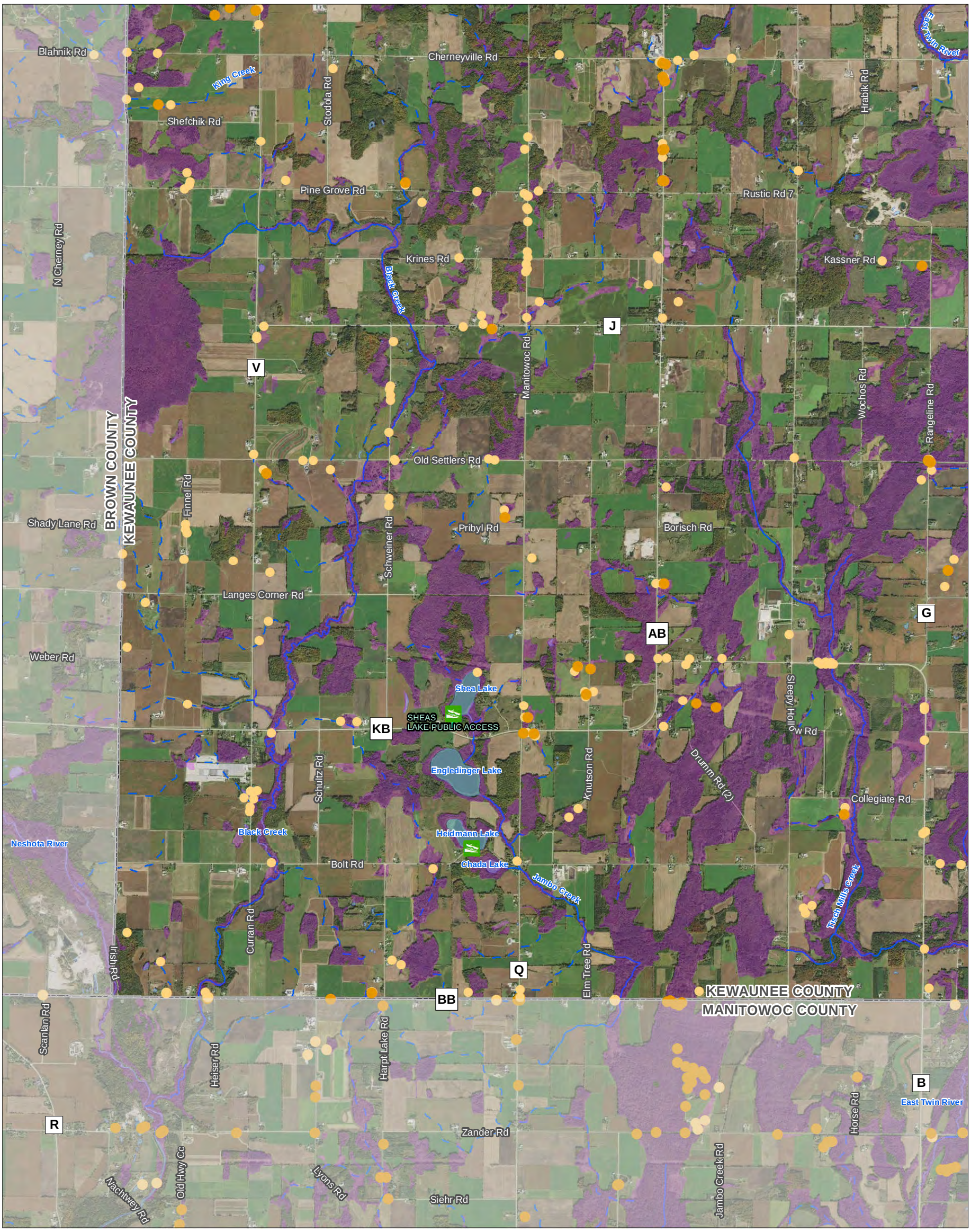

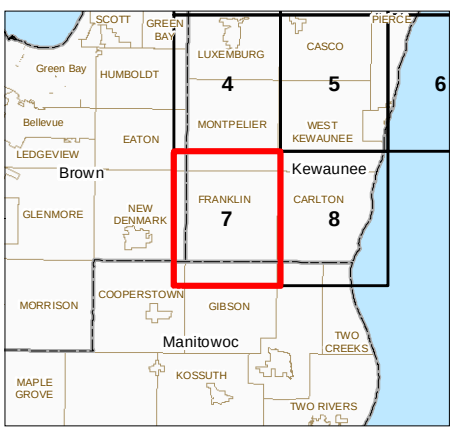

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Invasive Species Areas
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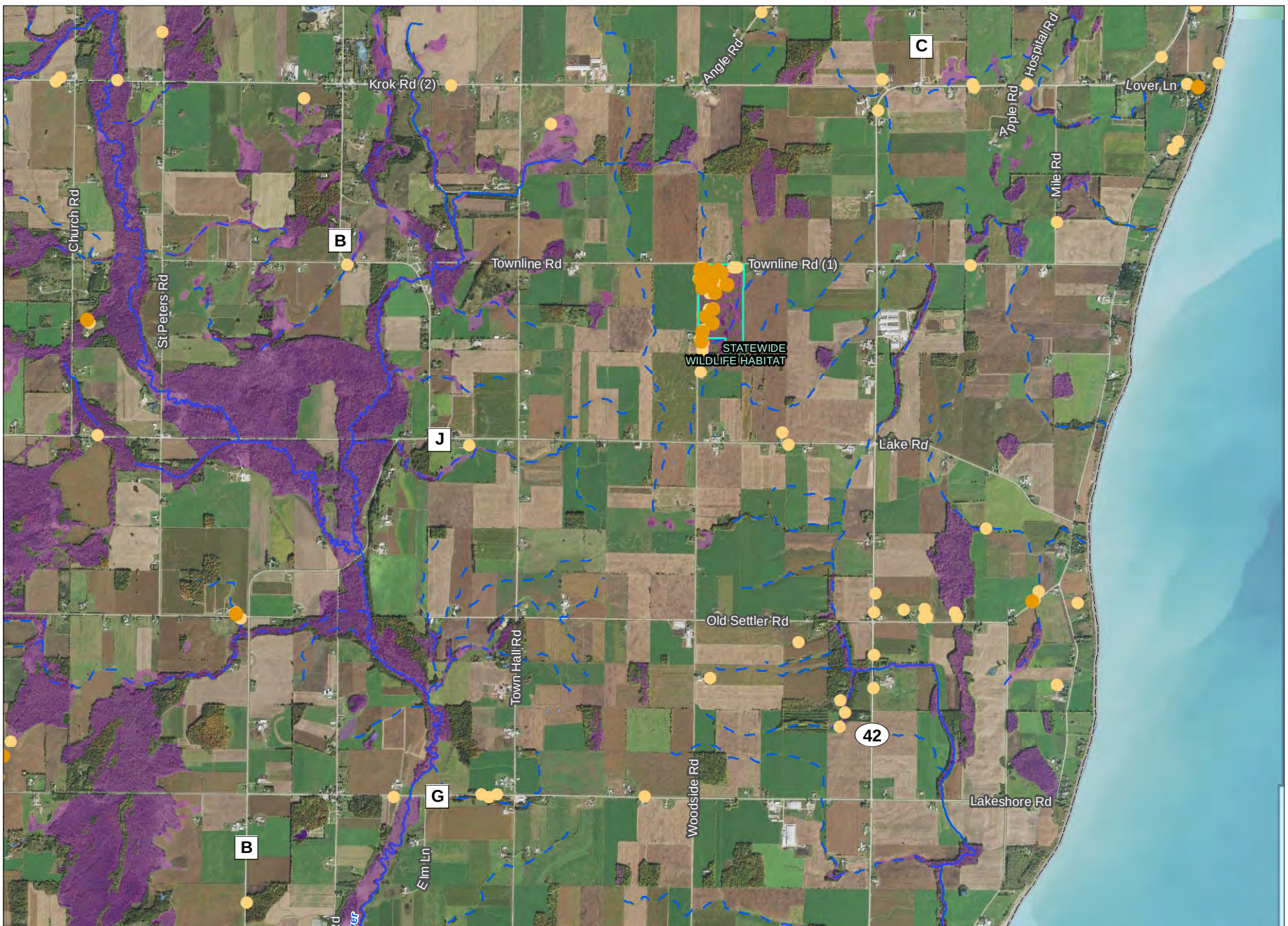

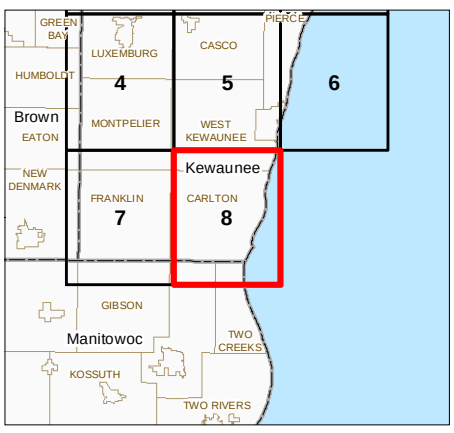

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Public Boat Access Sites

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- UNKNOWN

DNR 24k Hydrography

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Figure No.
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Title
Invasive Species Areas
Kewaunee County

Client/Project
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LISMA Invasive Phragmites and Japanese Knotweed Management Plan

Project Location
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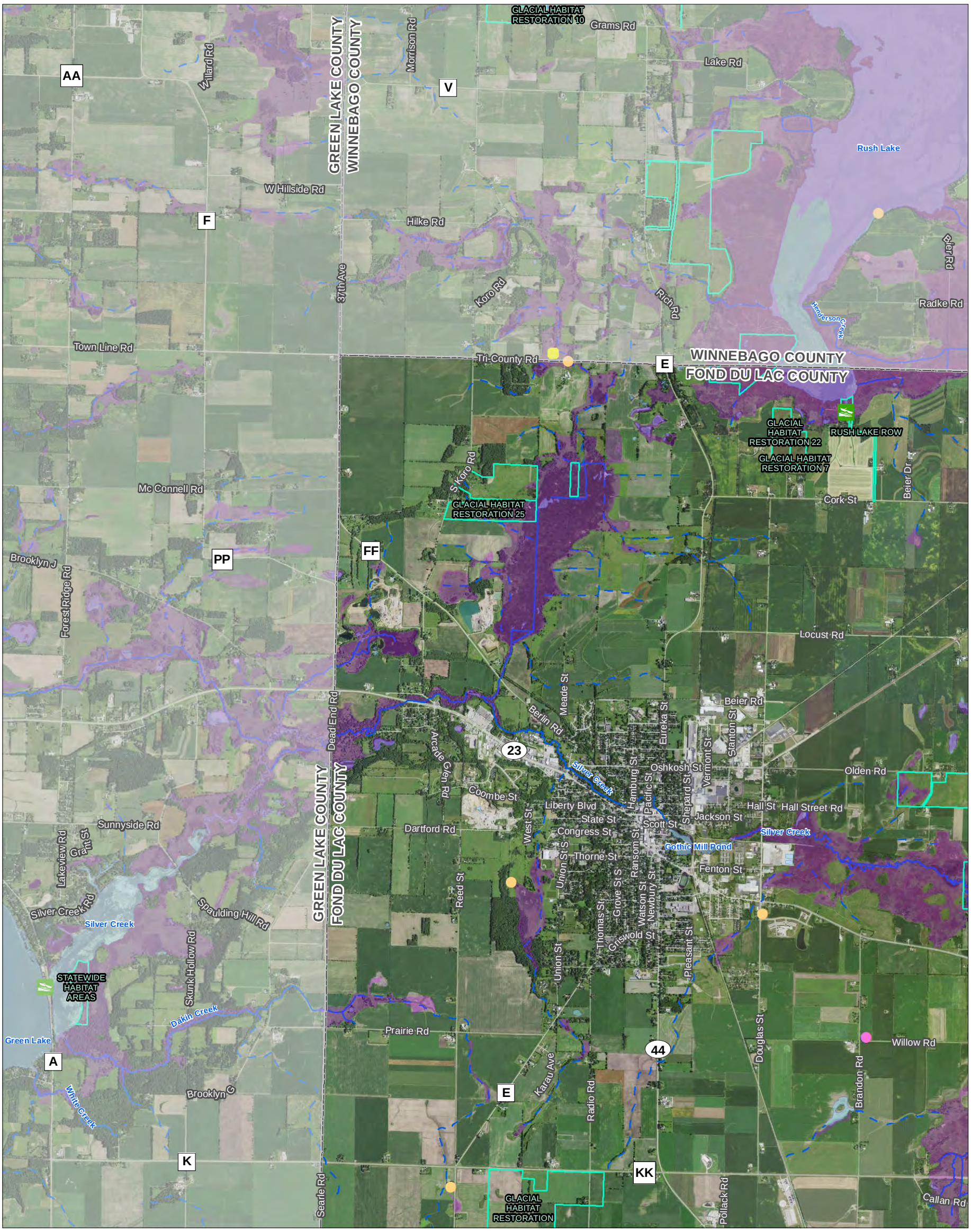

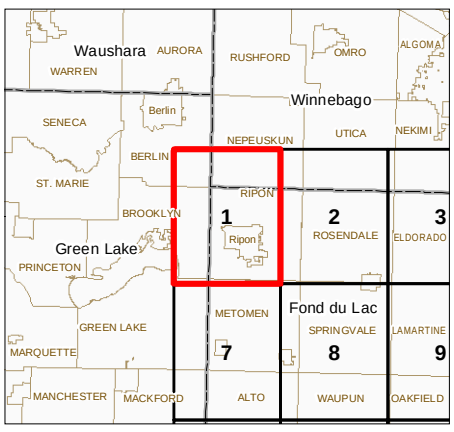

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Legend

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- Japanese Knotweed, Untreated: 0.31 acres
- Non-Native Phragmites, Treated: 52.65 acres
- Non-Native Phragmites, Untreated: 306.95 acres
- Native Phragmites: 25.35 acres
- Wisconsin Wetland Inventory
- Protected Areas Database

Public Boat Access Sites

- CARRY-IN
- RAMP
- UNKNOWN

DNR 24k Hydrography

- Perennial Stream
- Intermittent Stream
- Waterbody

Figure No.
3

Title
Invasive Species Areas
Fond du Lac County

Client/Project
Lakeshore Natural Resource Partnership (LNRP)
LISMA Invasive Phragmites and Japanese Knotweed Management Plan

Project Location
Fond du Lac County
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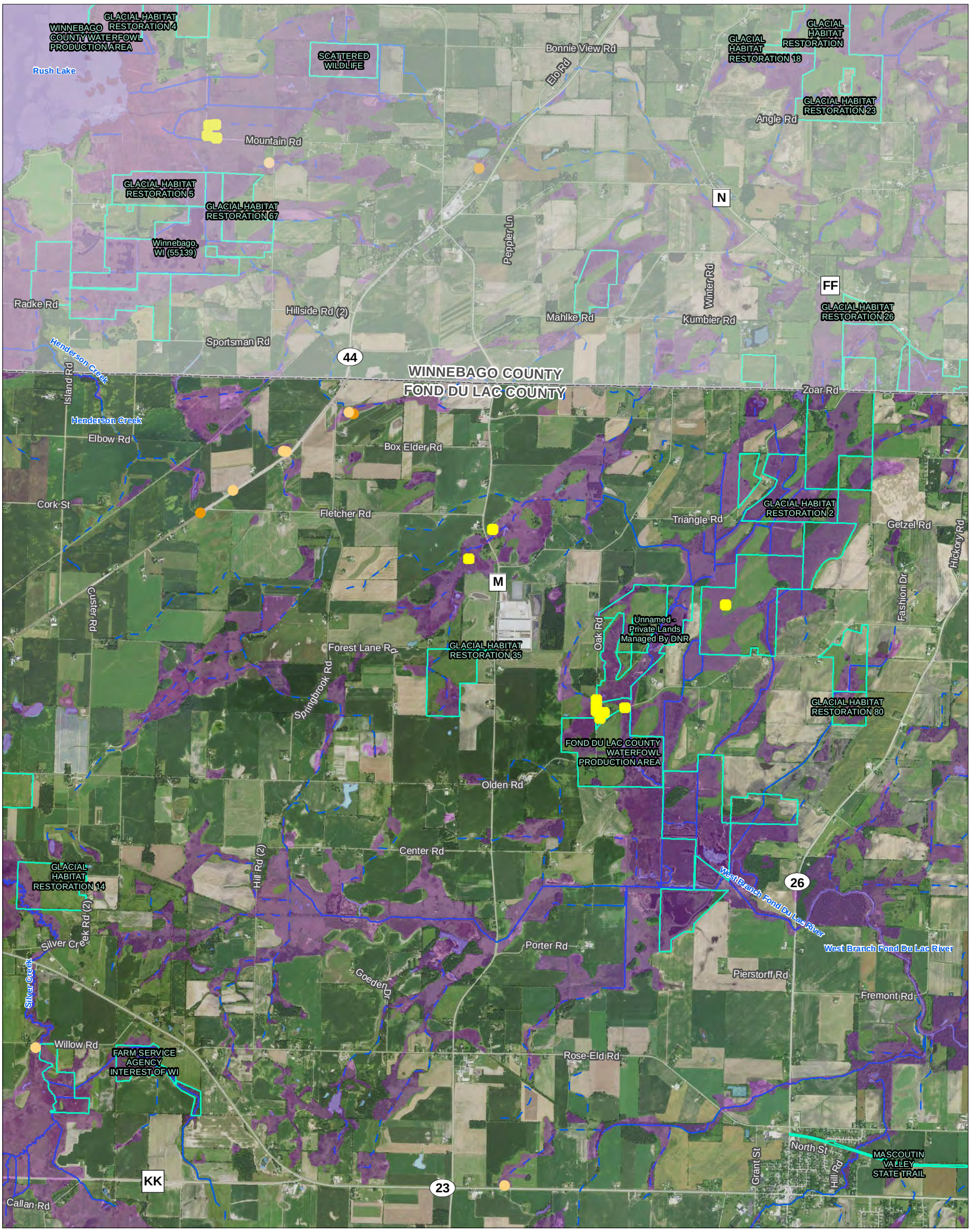

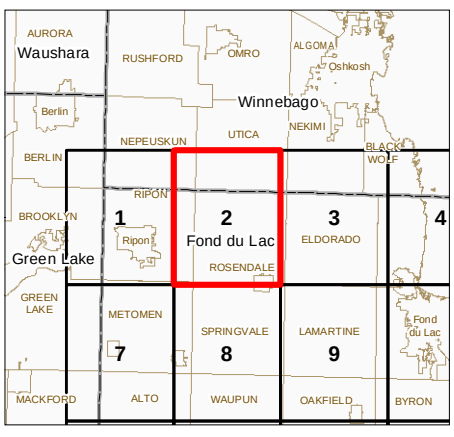

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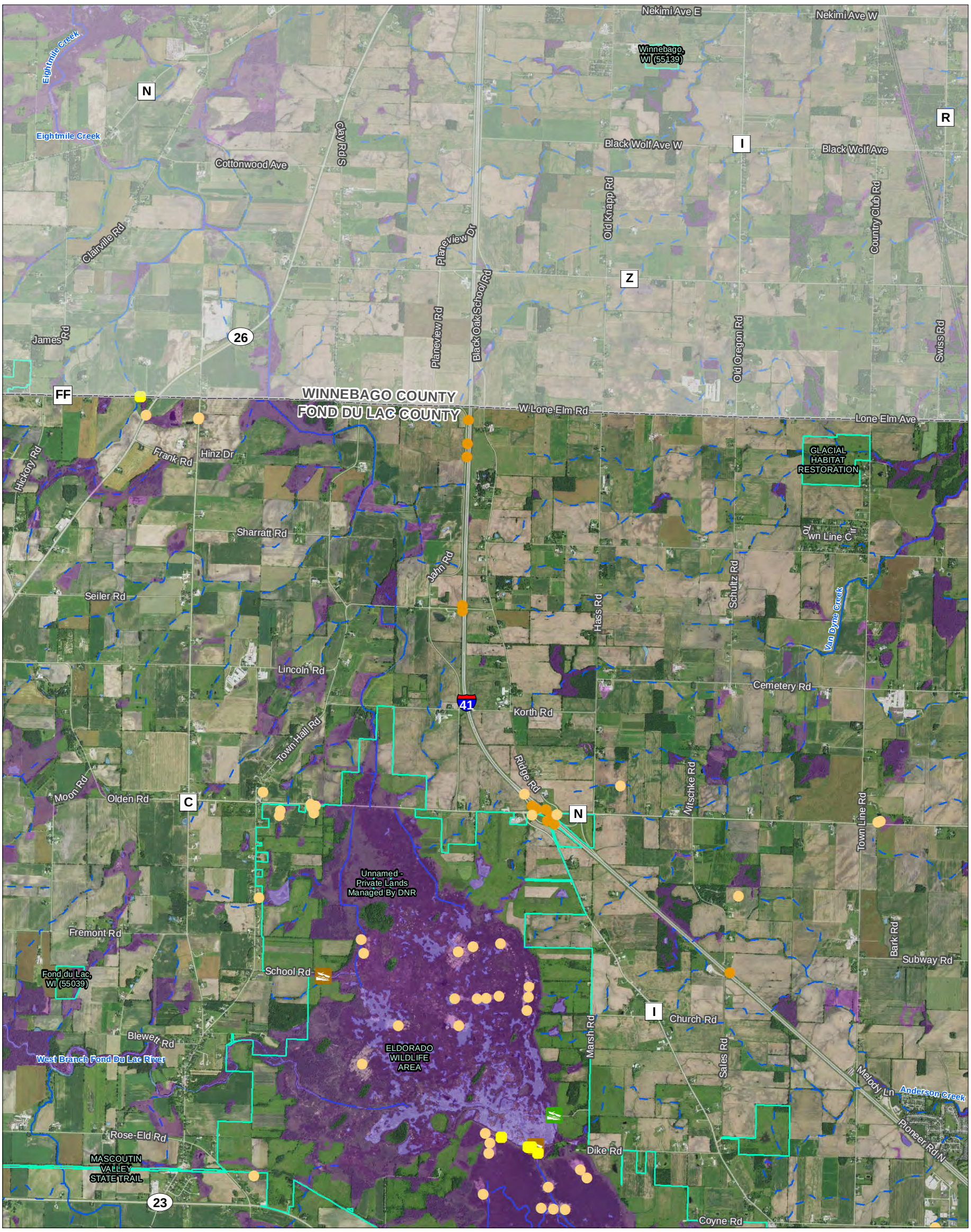

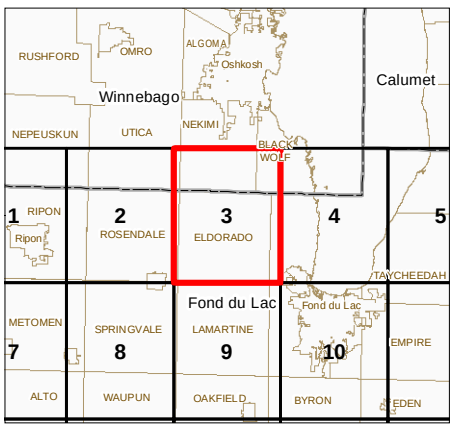

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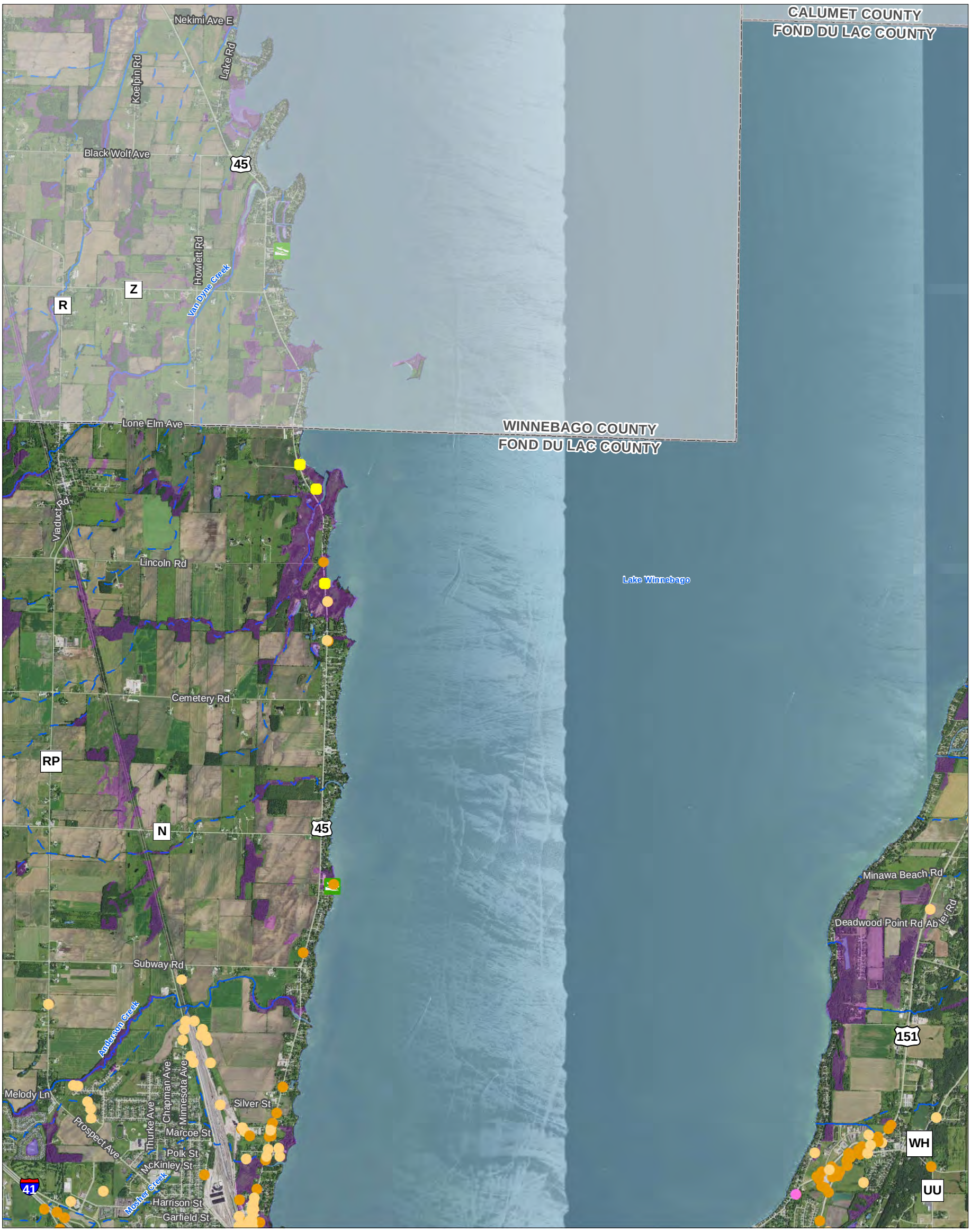

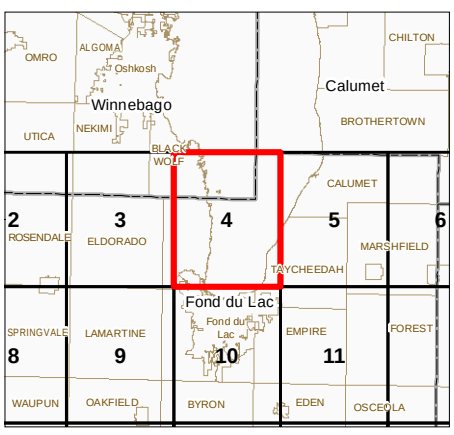

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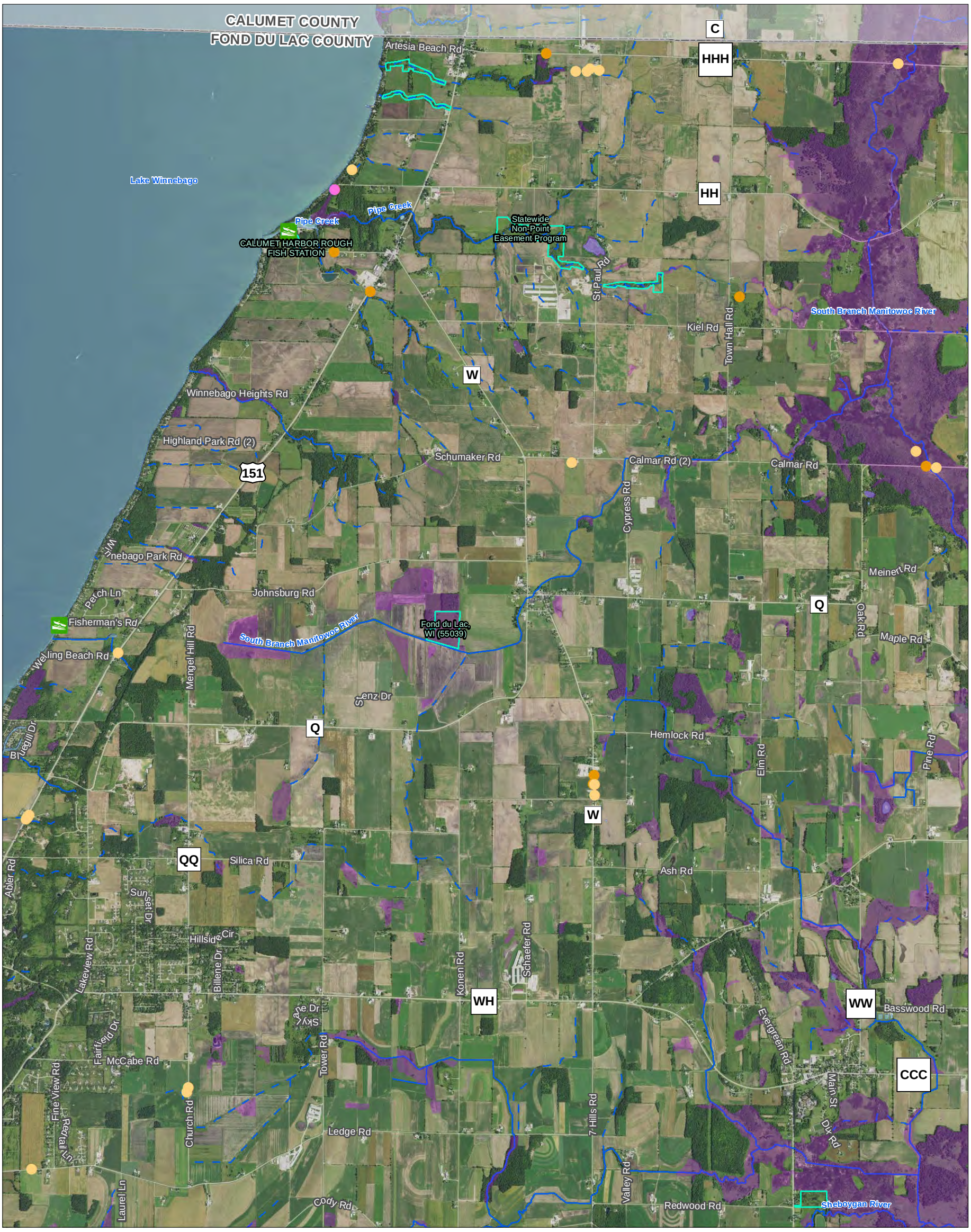

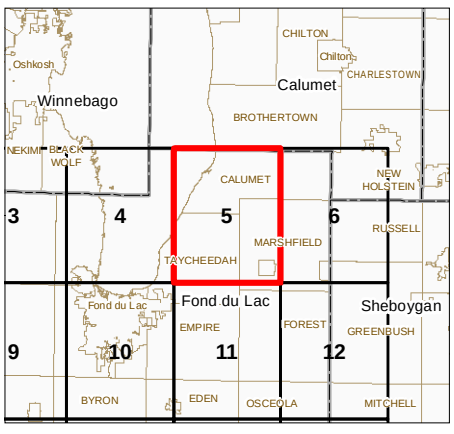

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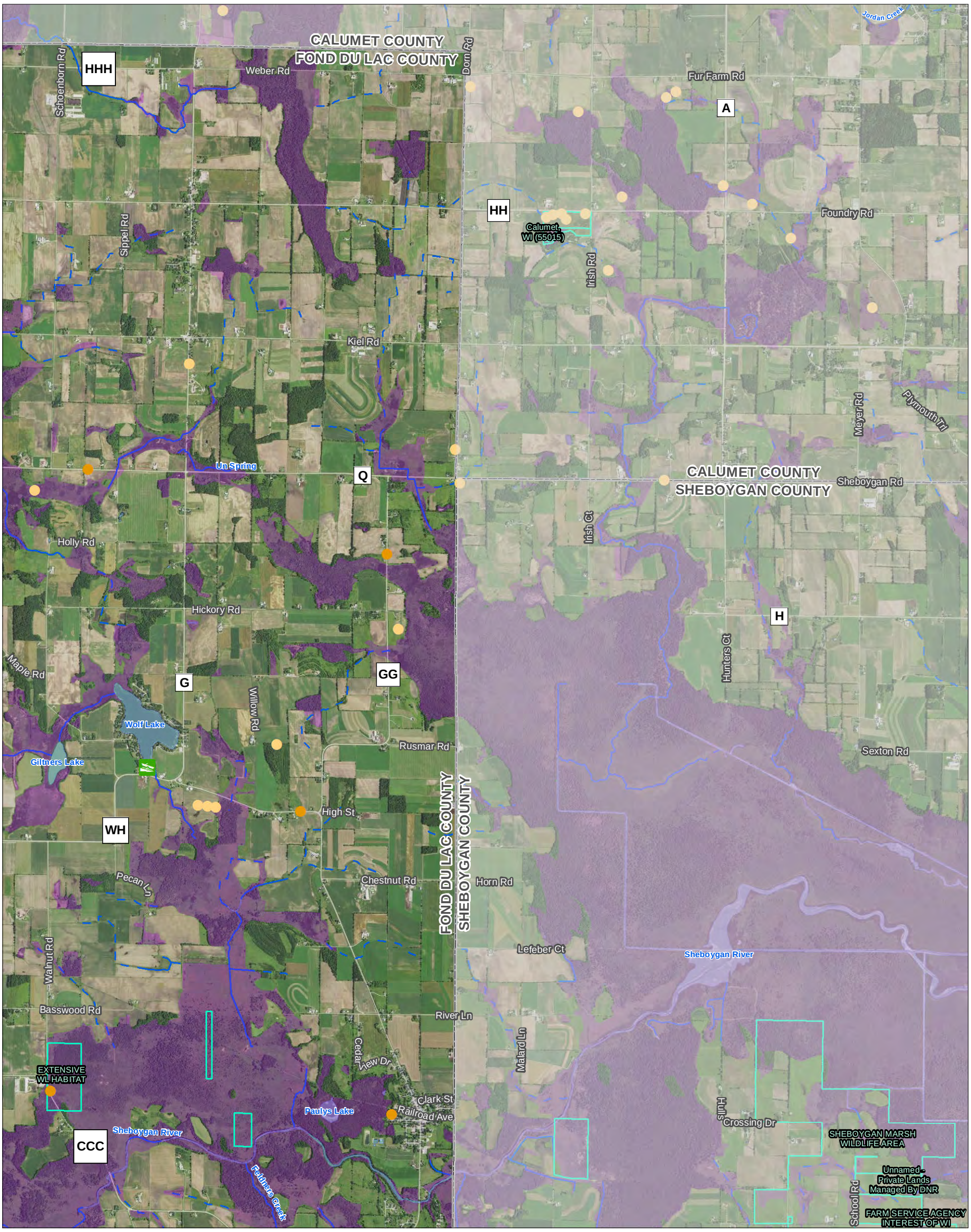

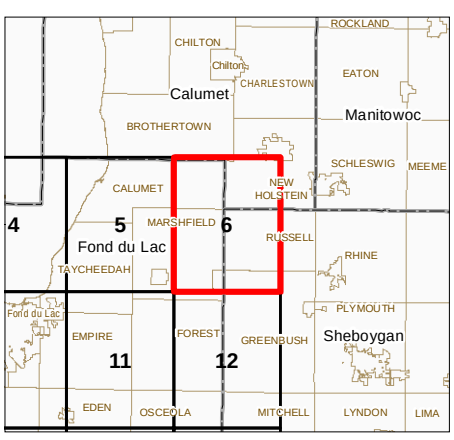

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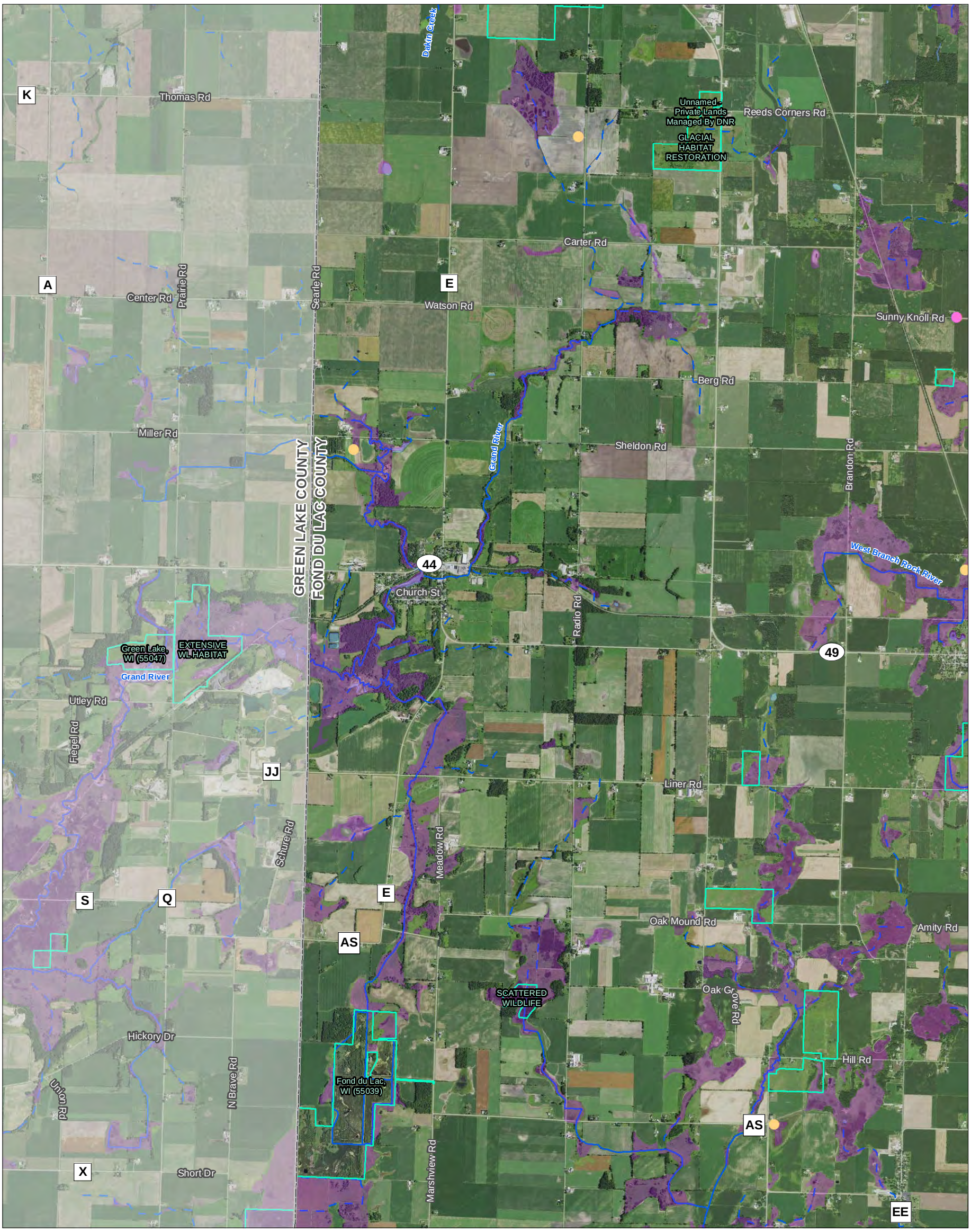

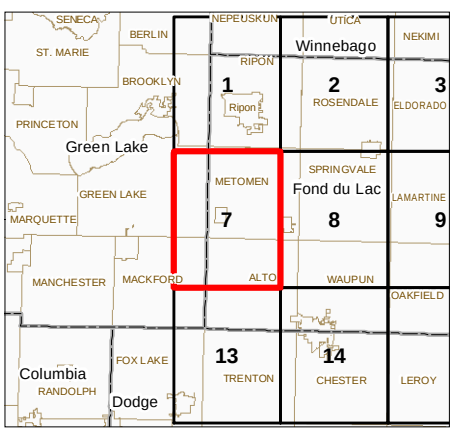

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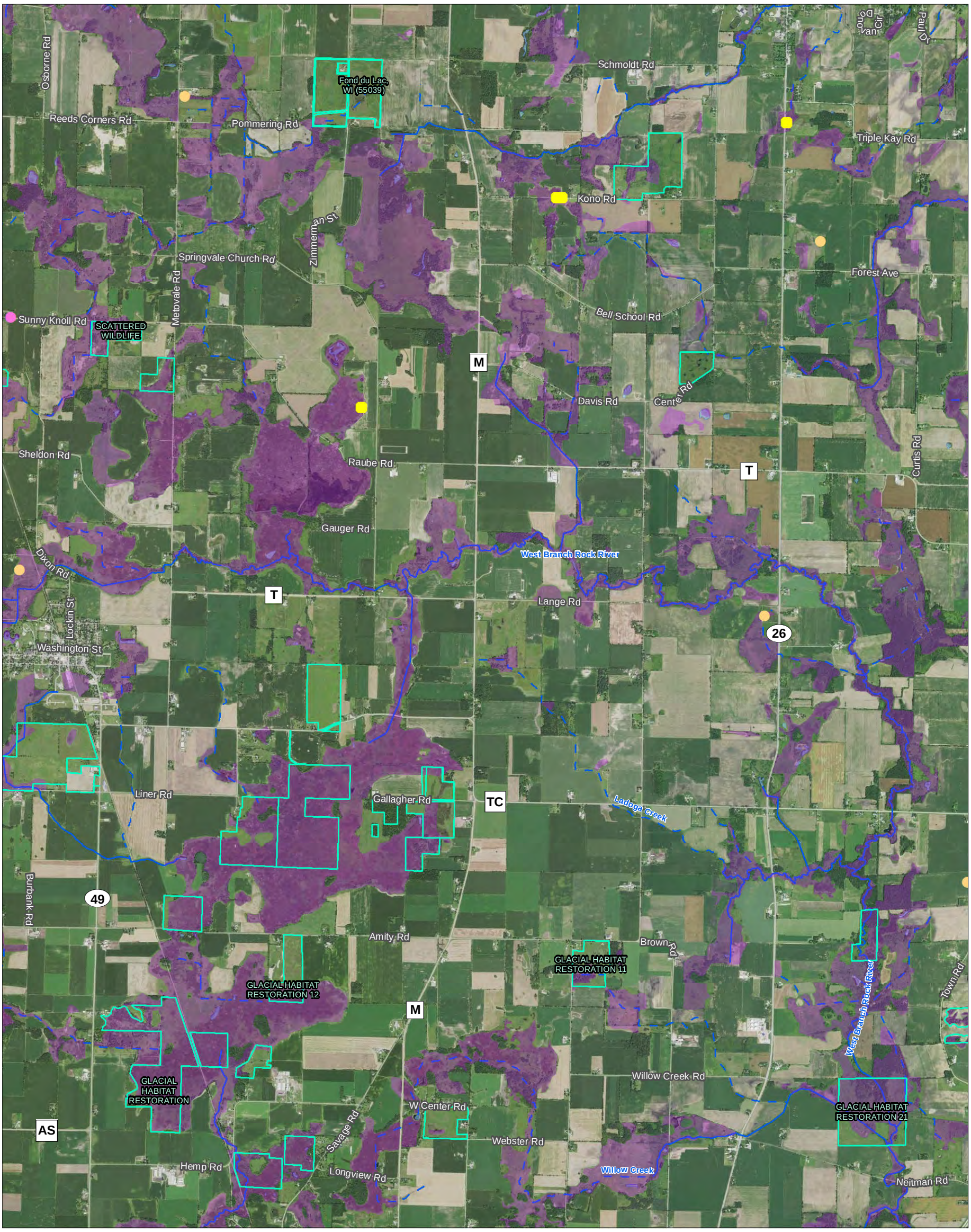

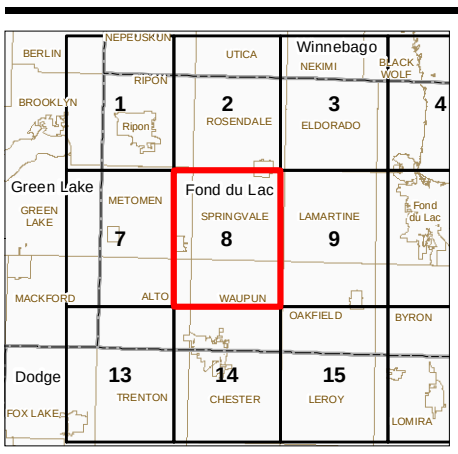

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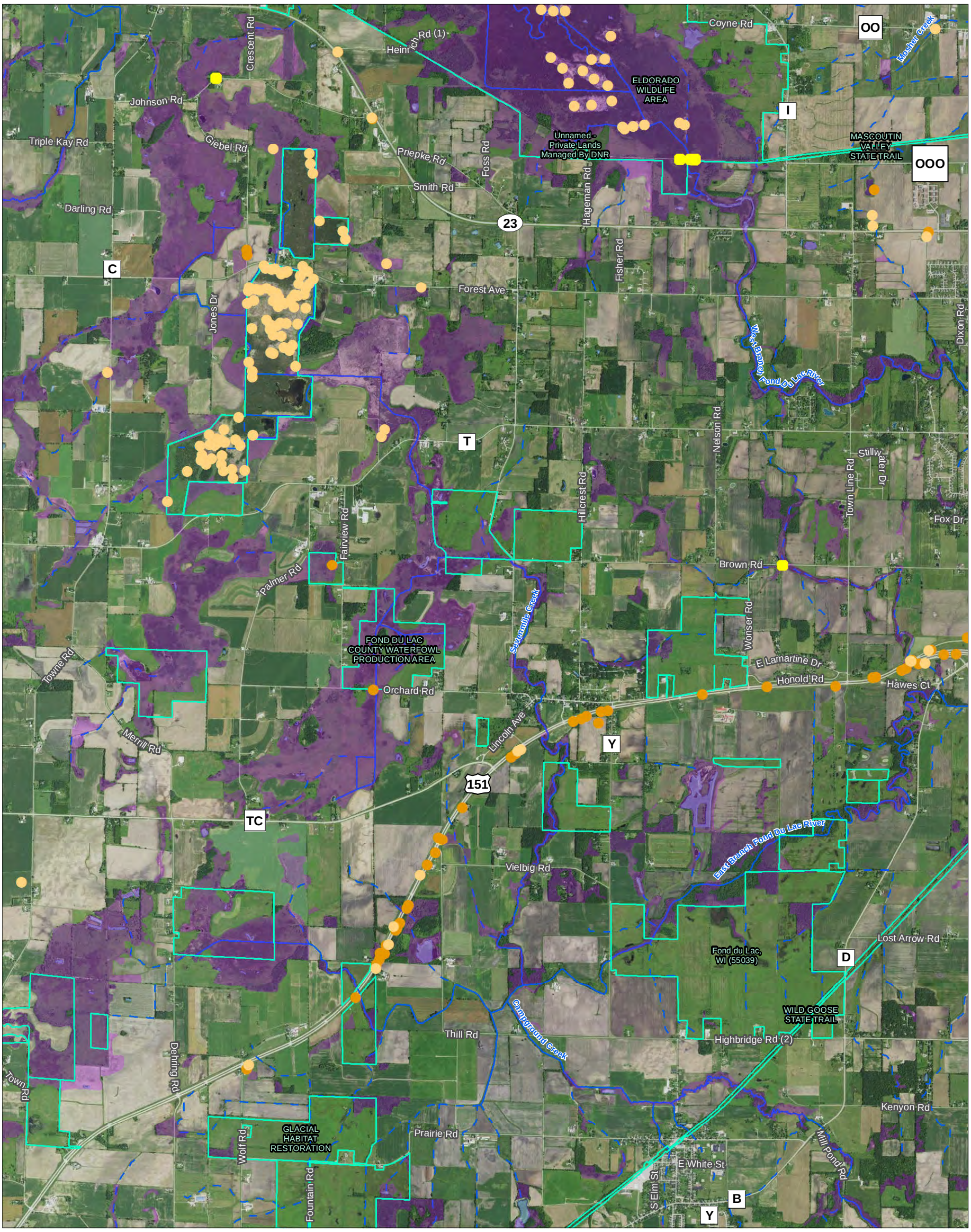

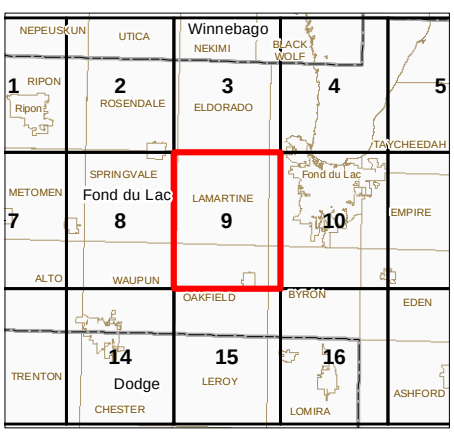

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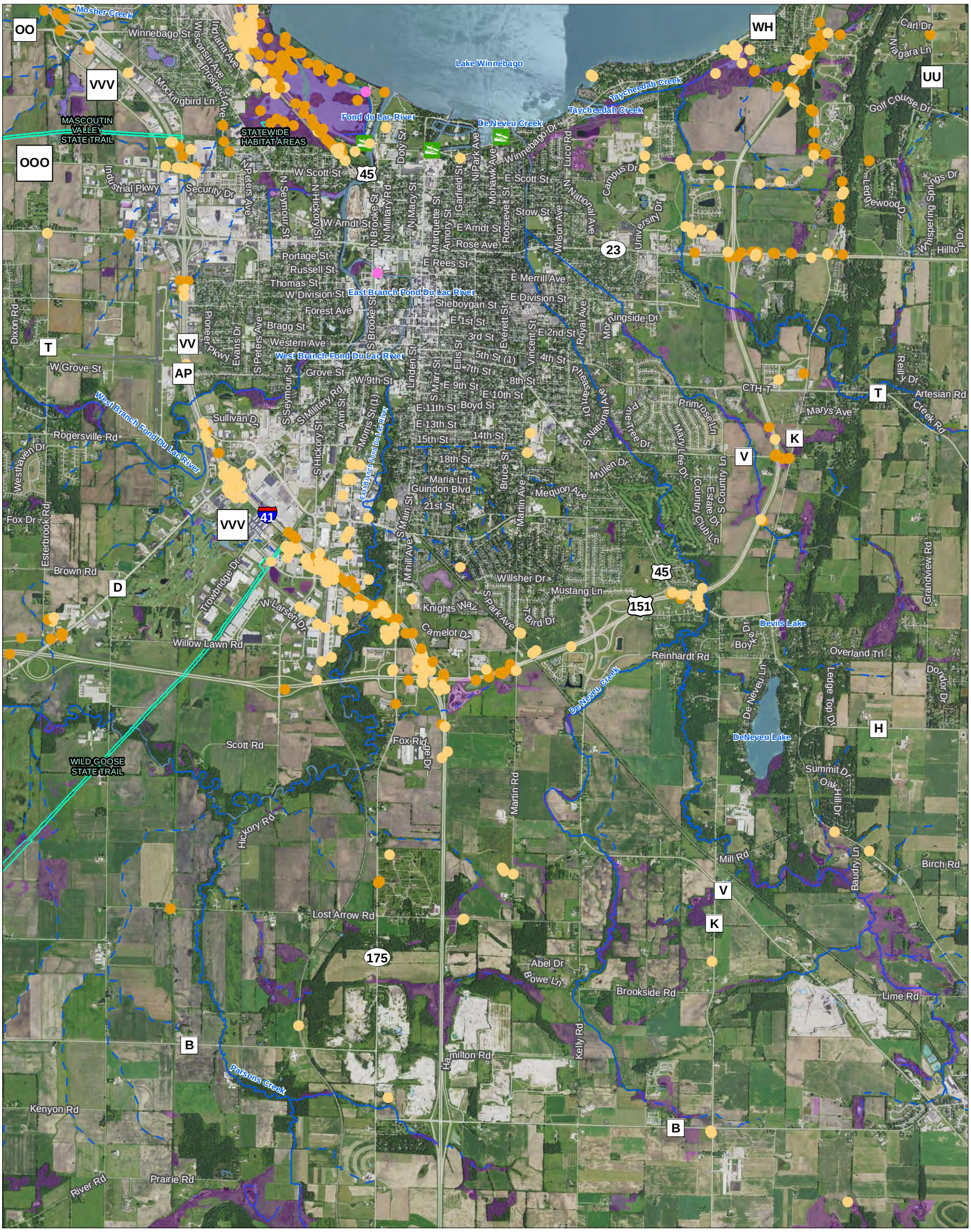

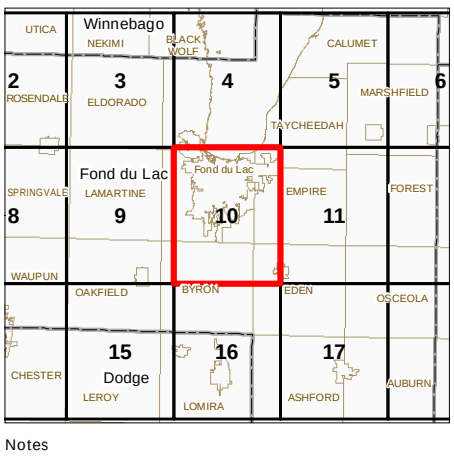

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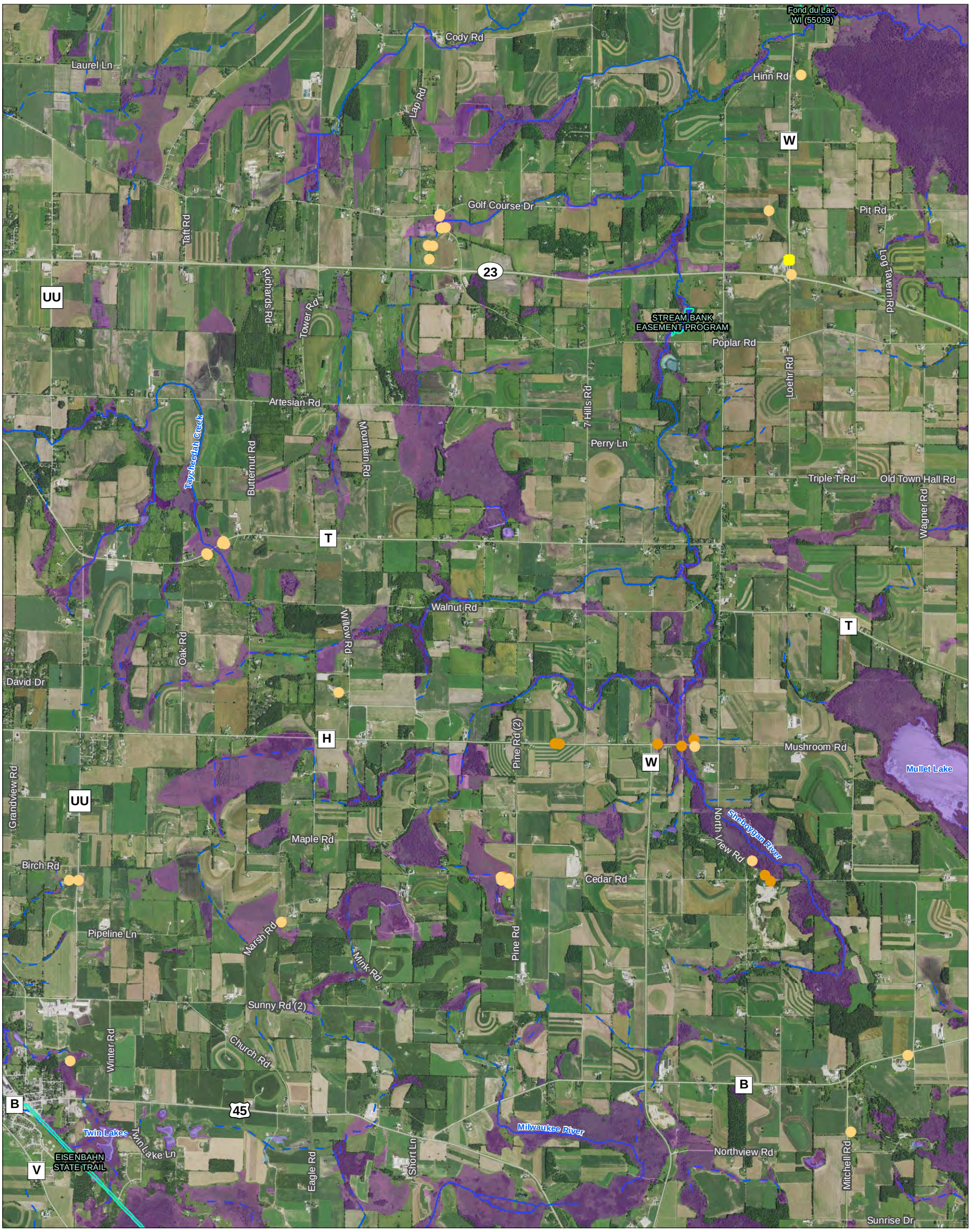

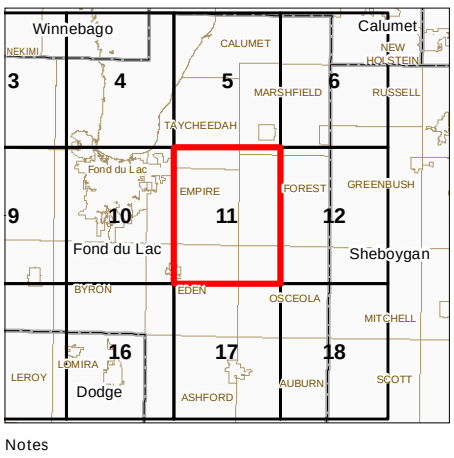

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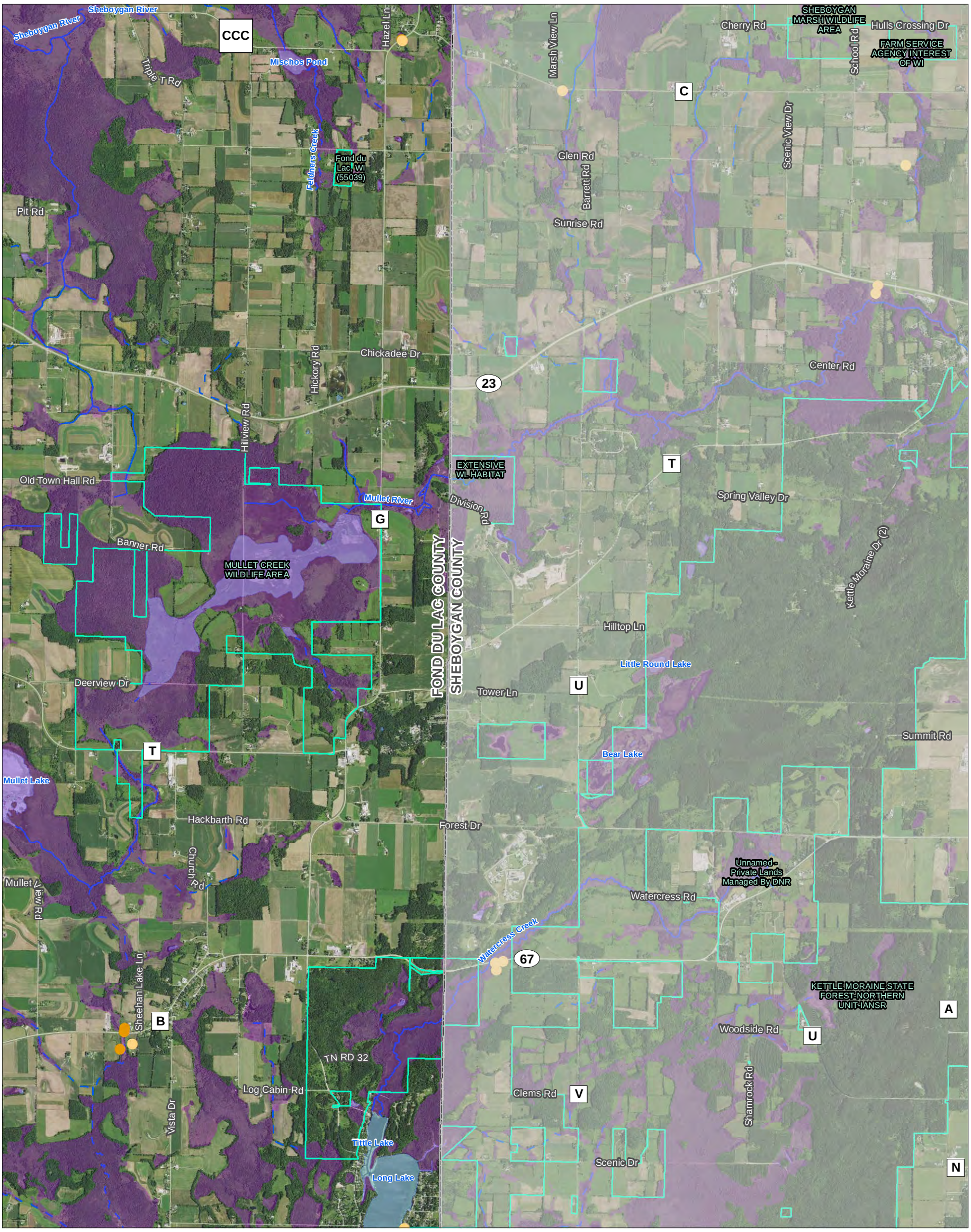

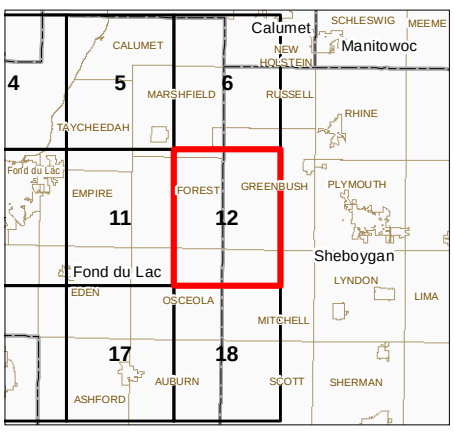

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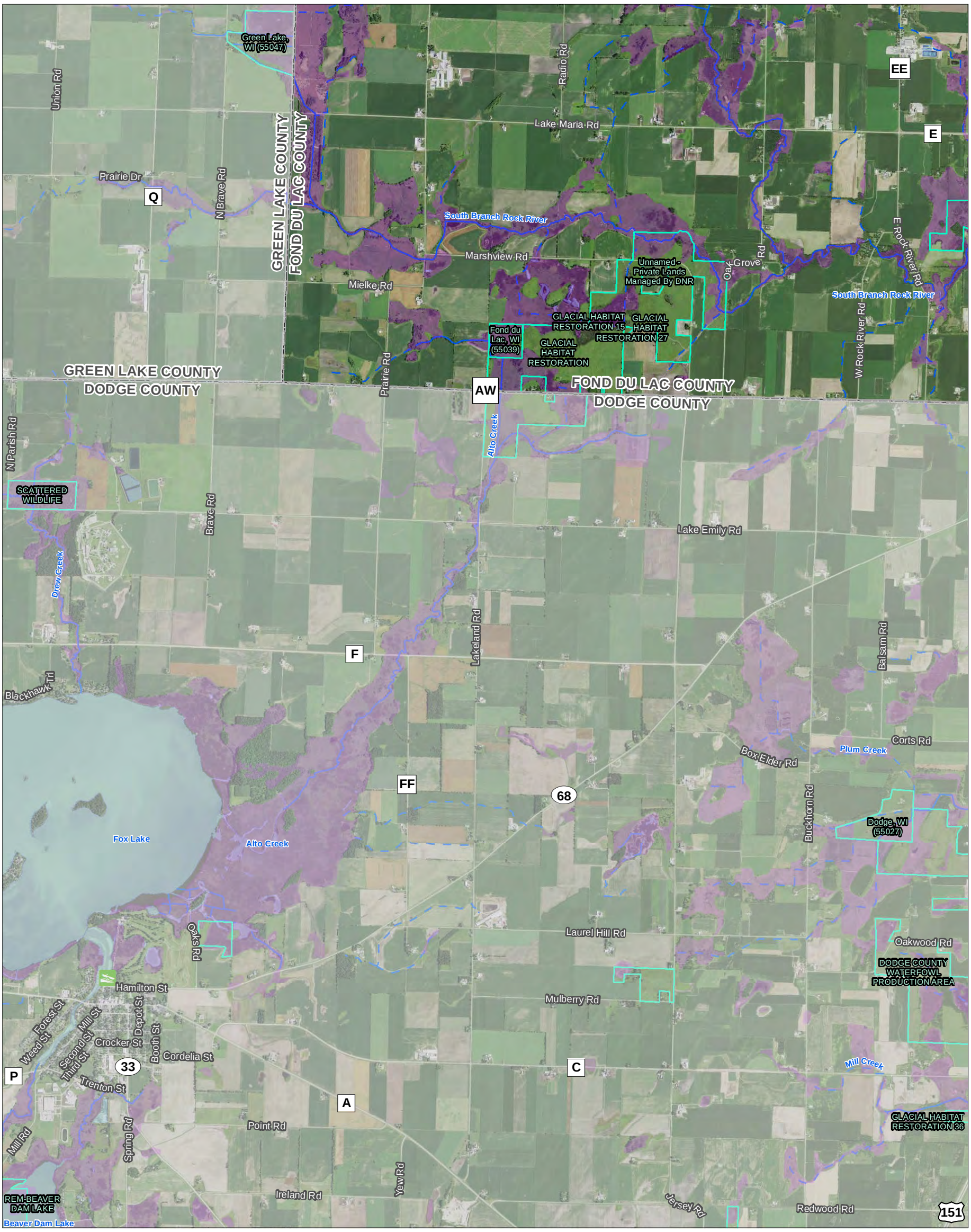

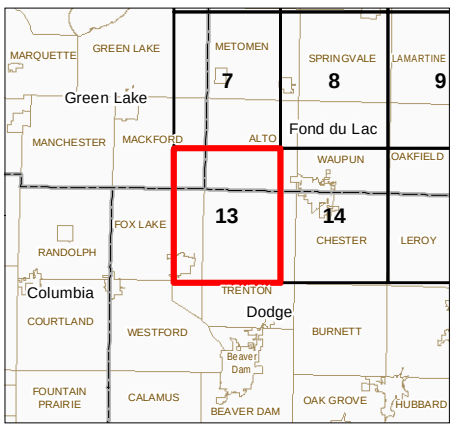

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- Waterbody

Figure No.
3

Title
Invasive Species Areas
Fond du Lac County

Client/Project
Lakeshore Natural Resource Partnership (LNRP)
LISMA Invasive Phragmites and Japanese Knotweed Management Plan

Project Location
Fond du Lac County
Wisconsin

Prepared by JD on 2020-01-23
Technical Review by MP on 2020-01-23
Independent Review by MC on 2020-01-30

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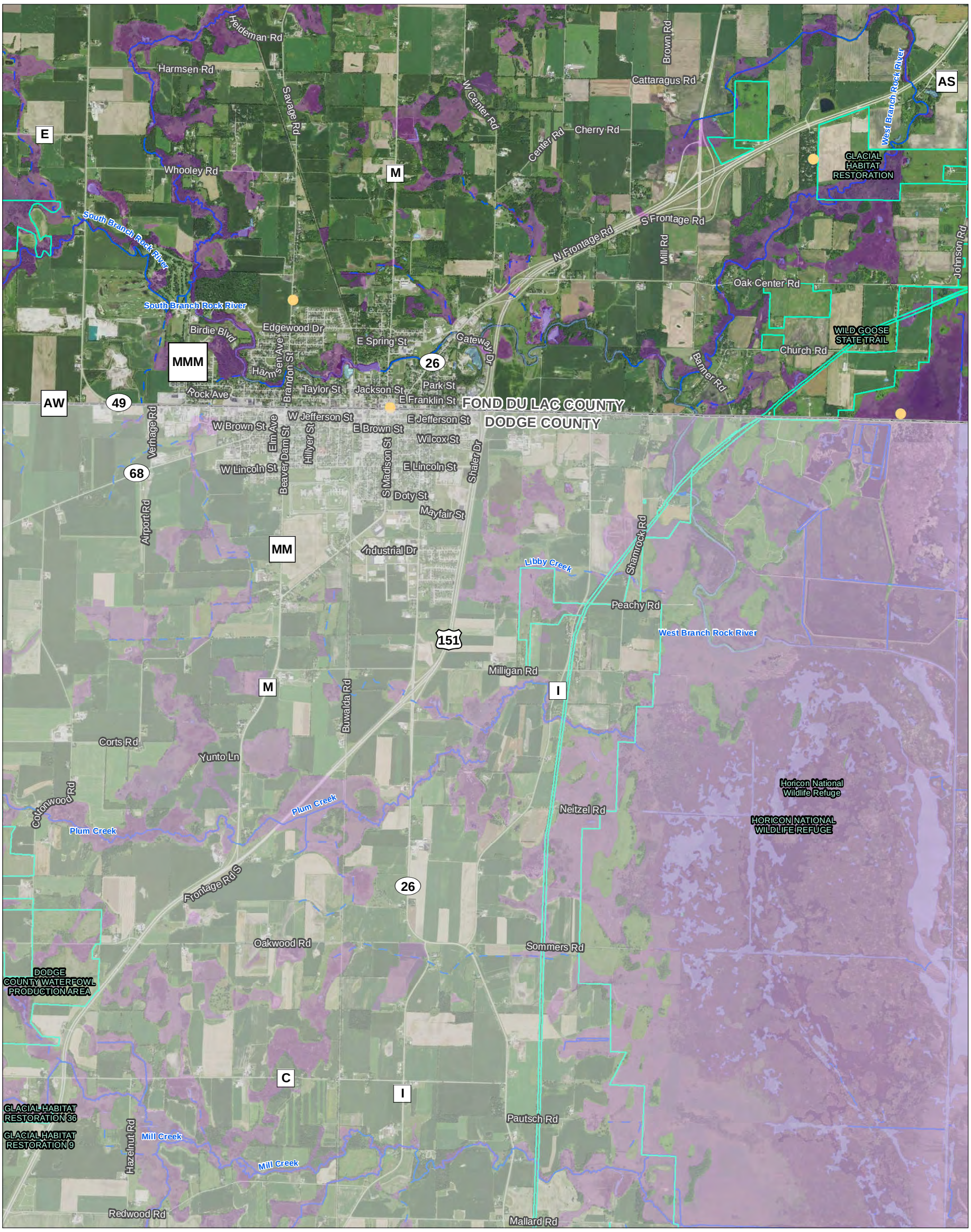

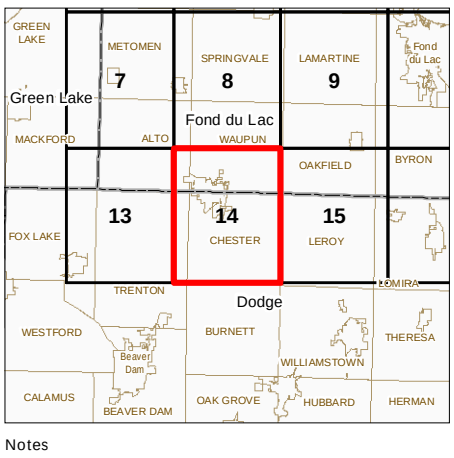

Notes

1. Coordinate System: NAD 1983 UTM Zone 16N
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3. Orthophotography: 2017 NAIP

Legend

- Japanese Knotweed, Treated: 0 acres
- Japanese Knotweed, Untreated: 0.31 acres
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- Non-Native Phragmites, Untreated: 306.95 acres
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- Wisconsin Wetland Inventory
- Protected Areas Database

Public Boat Access Sites

- CARRY-IN
- RAMP
- UNKNOWN

DNR 24k Hydrography

- Perennial Stream
- Intermittent Stream
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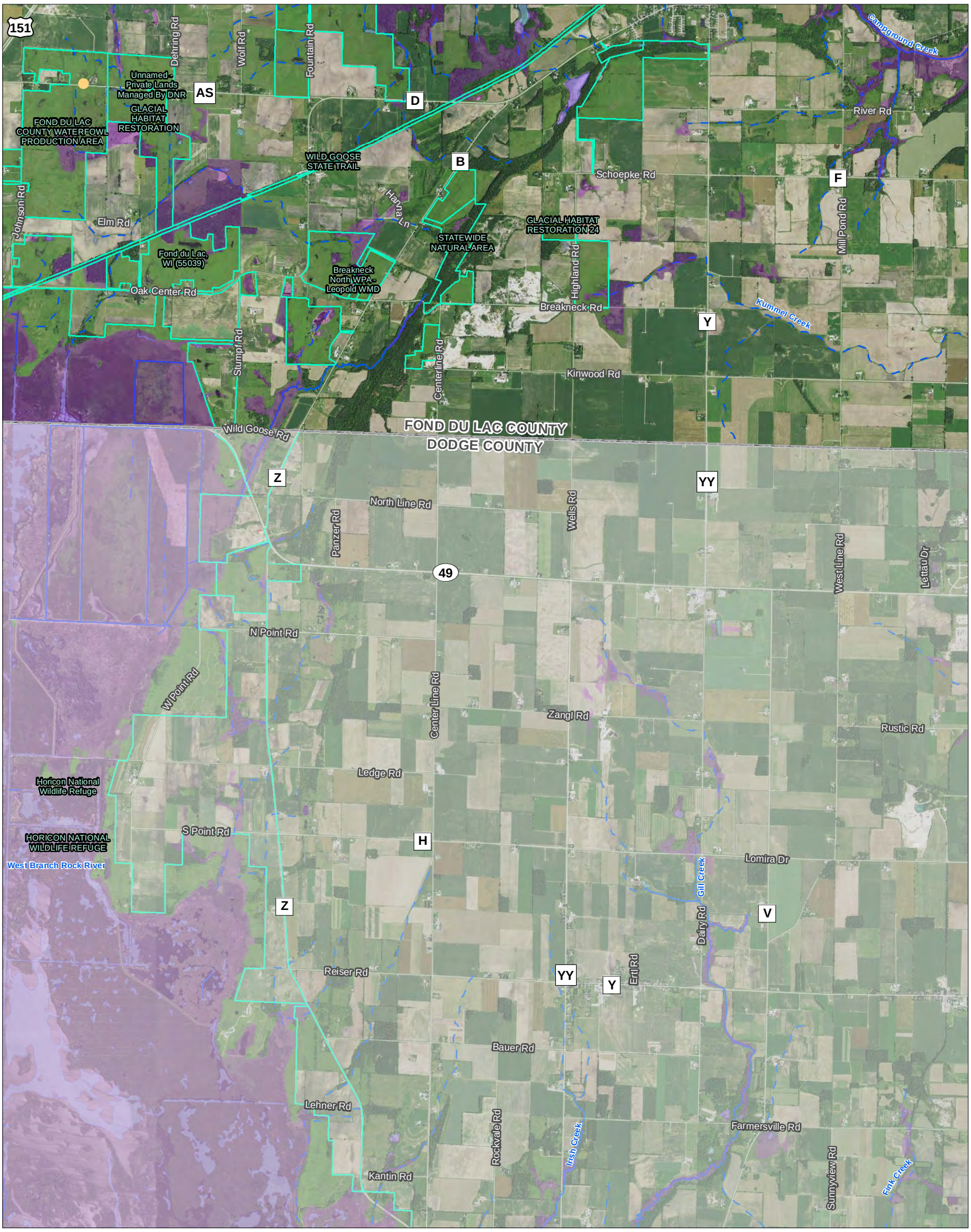

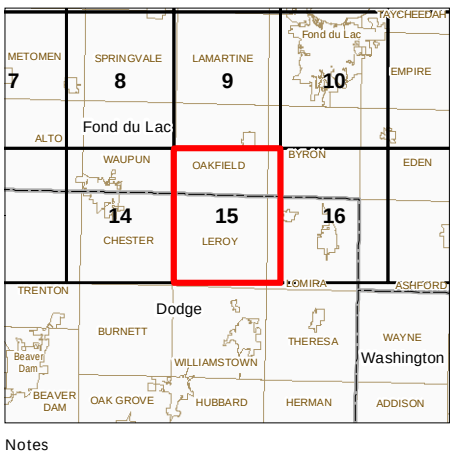

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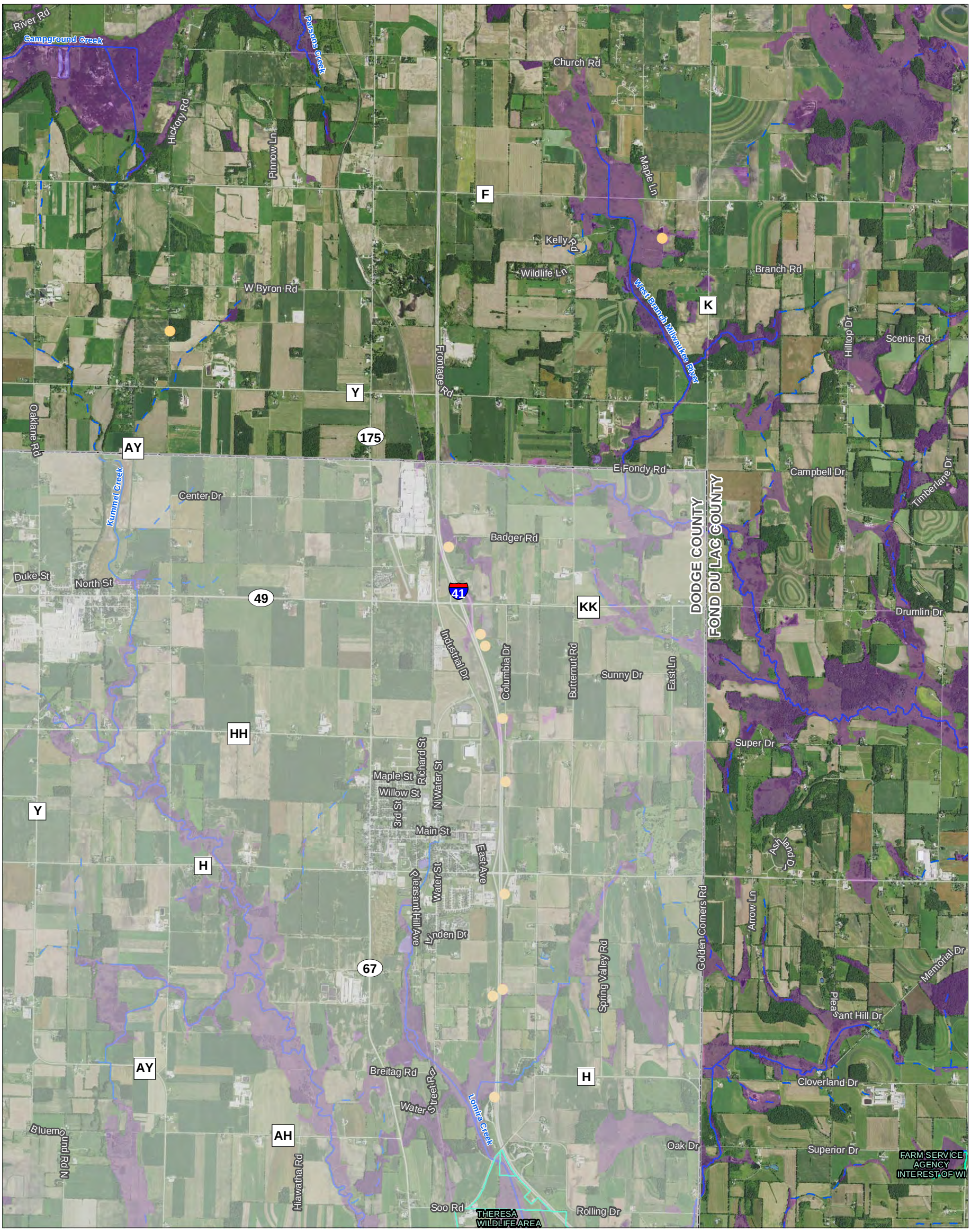

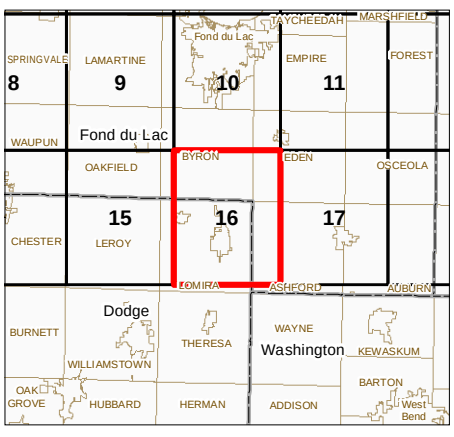

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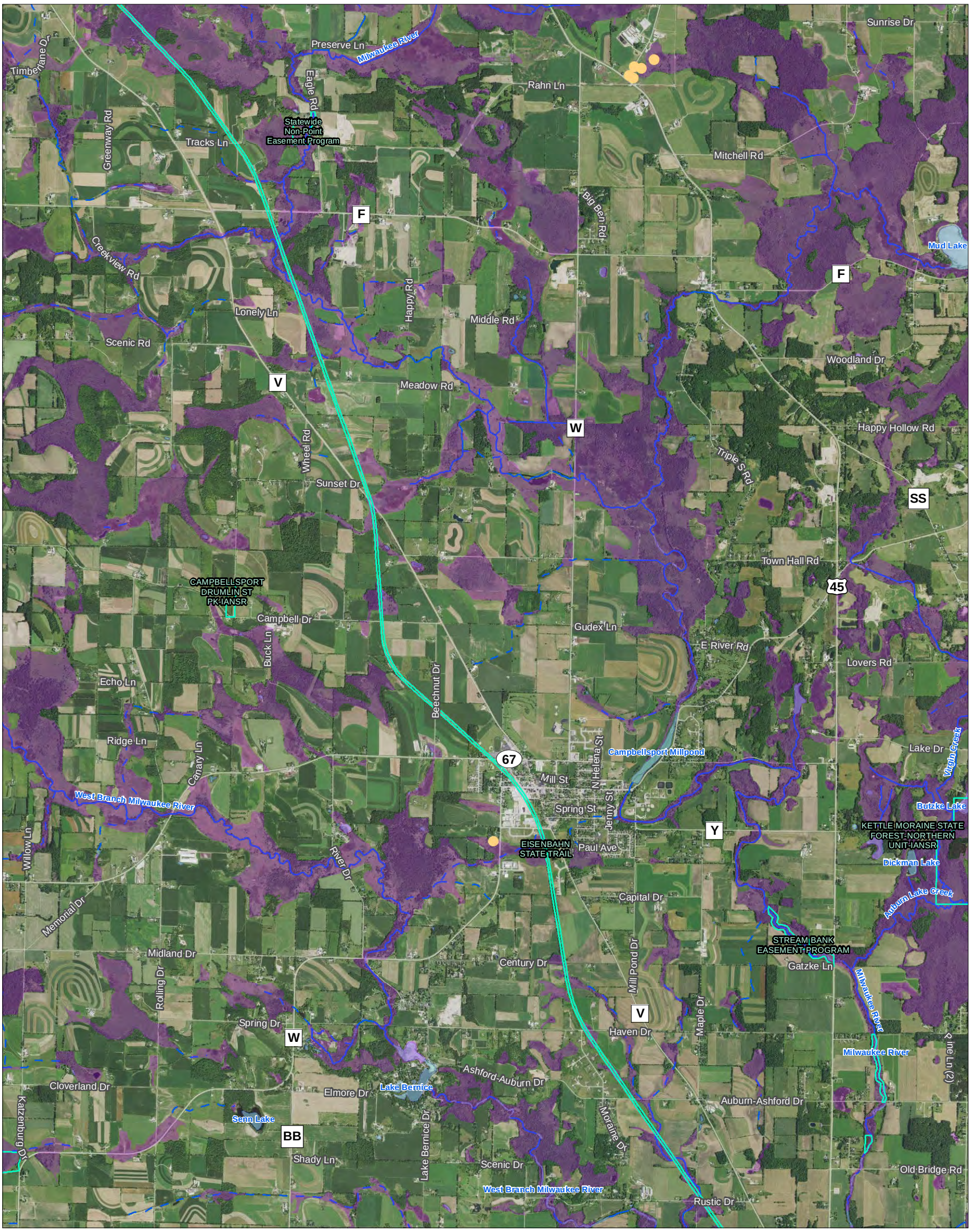

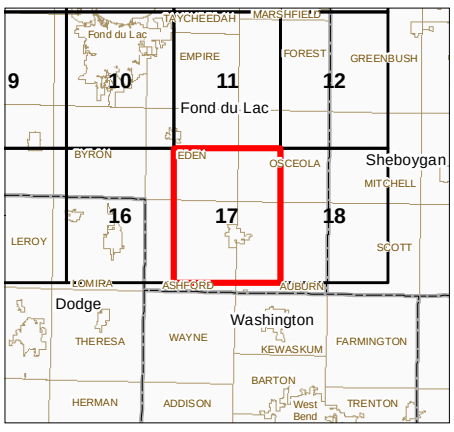

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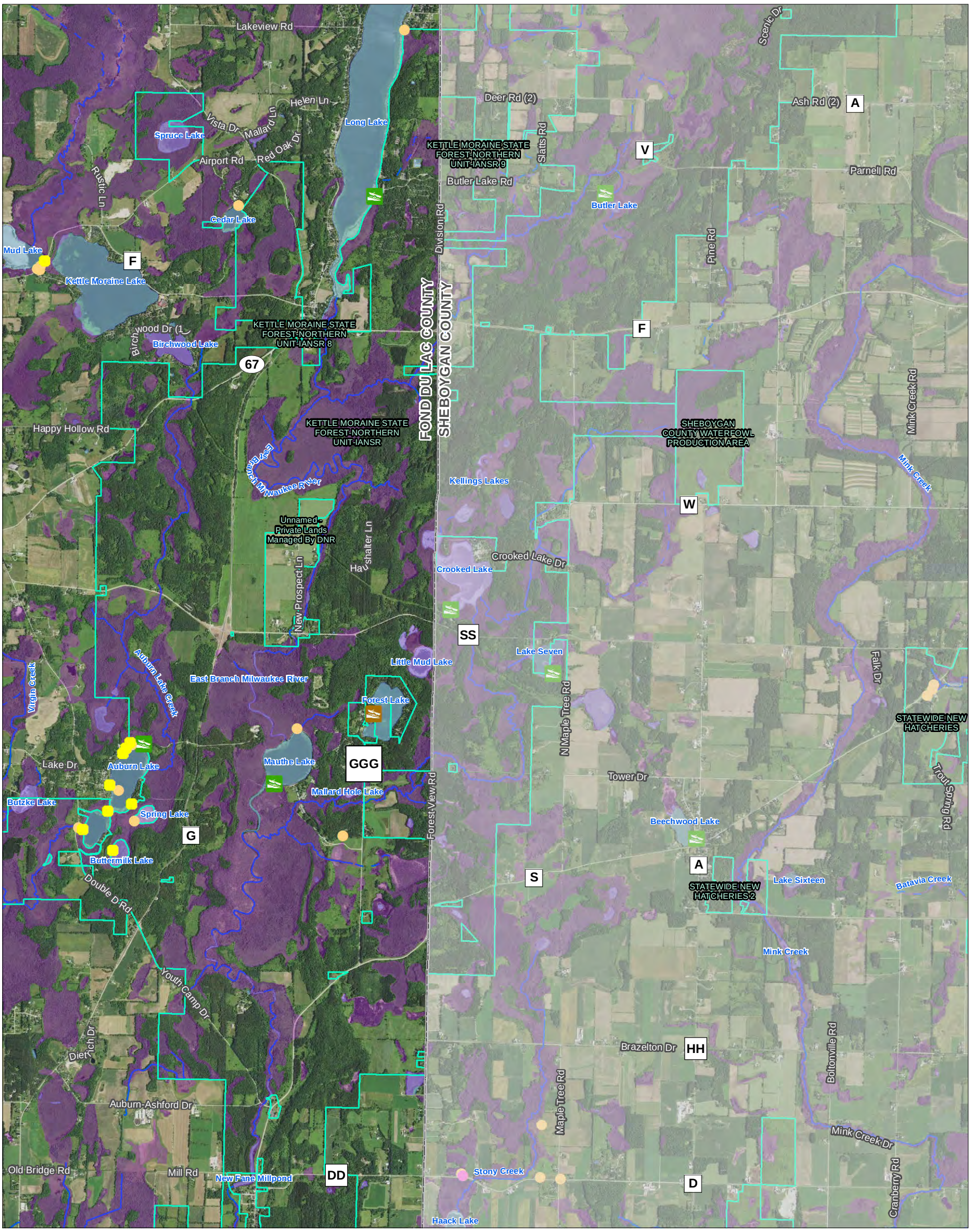

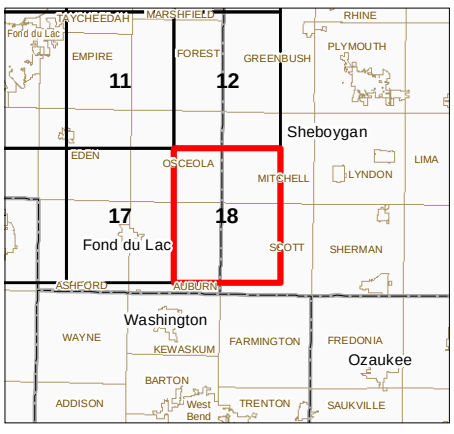

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Title
Invasive Species Areas
Fond du Lac County

Client/Project
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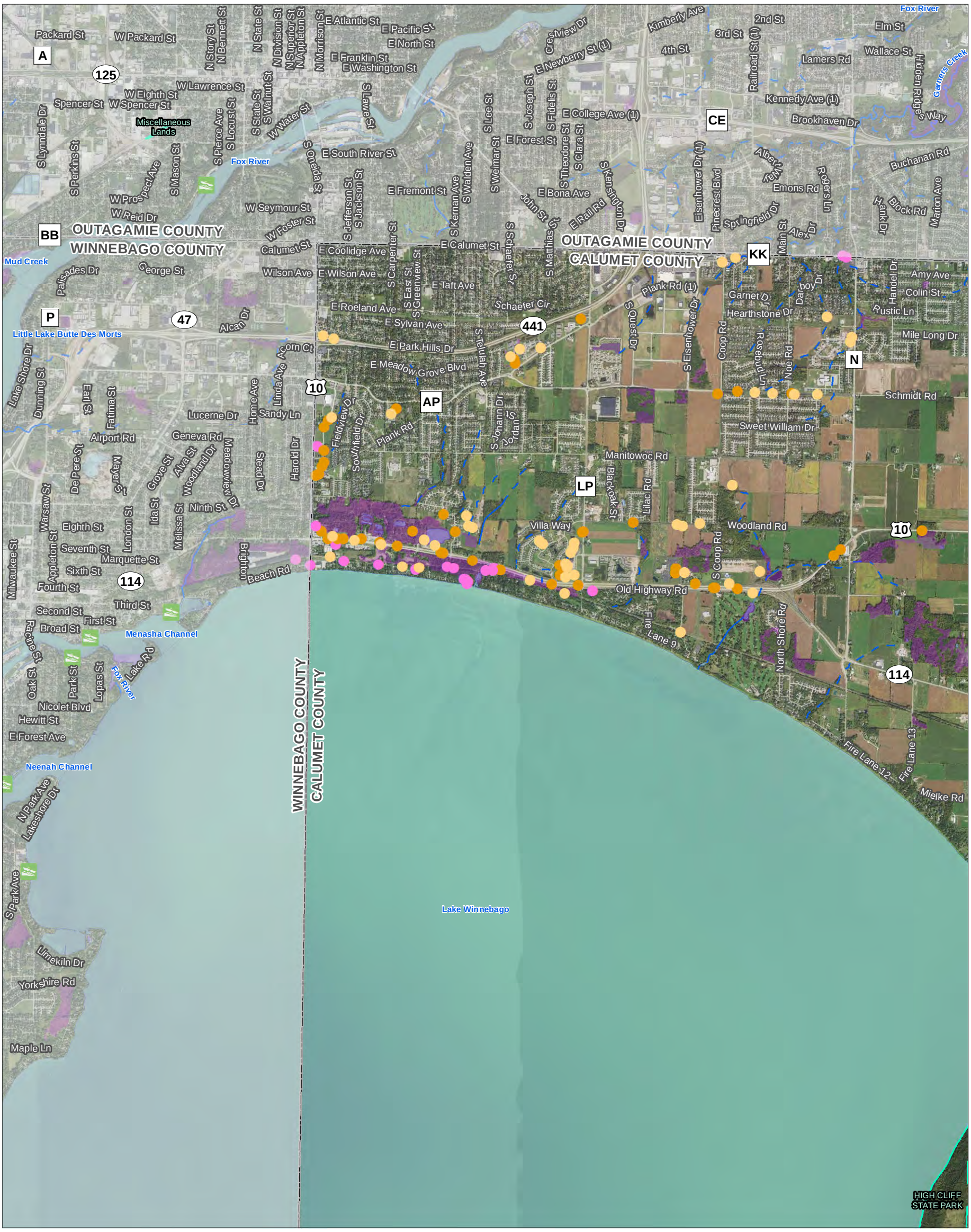

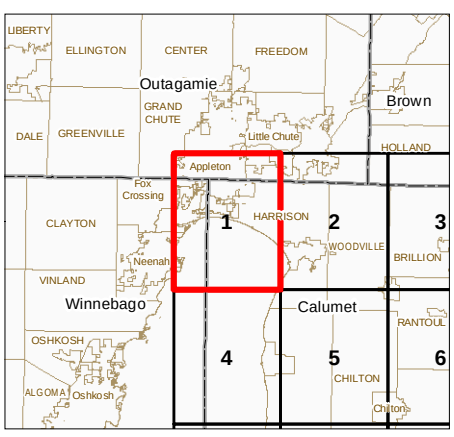

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Public Boat Access Sites

- CARRY-IN
- RAMP
- UNKNOWN

DNR 24k Hydrography

- Perennial Stream
- Intermittent Stream
- Waterbody

Figure No.
4

Title
Invasive Species Areas
Calumet County

Client/Project
Lakeshore Natural Resource Partnership (LNRP)
LISMA Invasive Phragmites and Japanese Knotweed Management Plan

Project Location
Calumet County
Wisconsin

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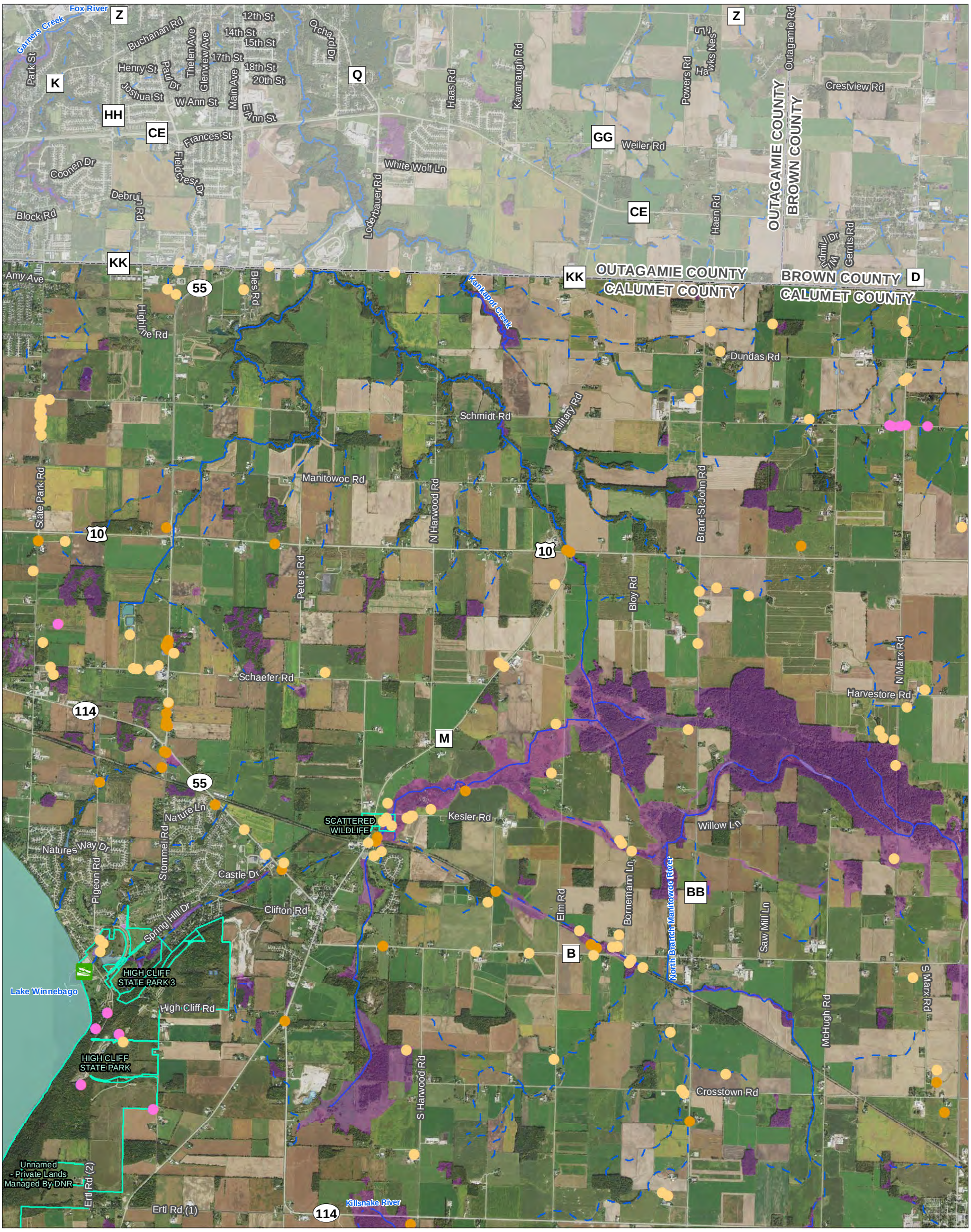

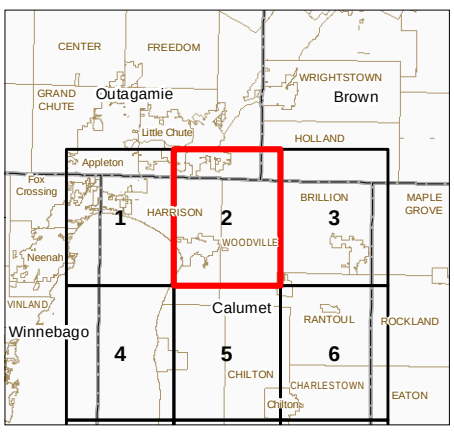

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DNR 24k Hydrography

- Perennial Stream
- Intermittent Stream
- Waterbody

Figure No.
4

Title
Invasive Species Areas
Calumet County

Client/Project
Lakeshore Natural Resource Partnership (LNRP)
LISMA Invasive Phragmites and Japanese Knotweed Management Plan

Project Location
Calumet County
Wisconsin

Prepared by JD on 2020-01-23
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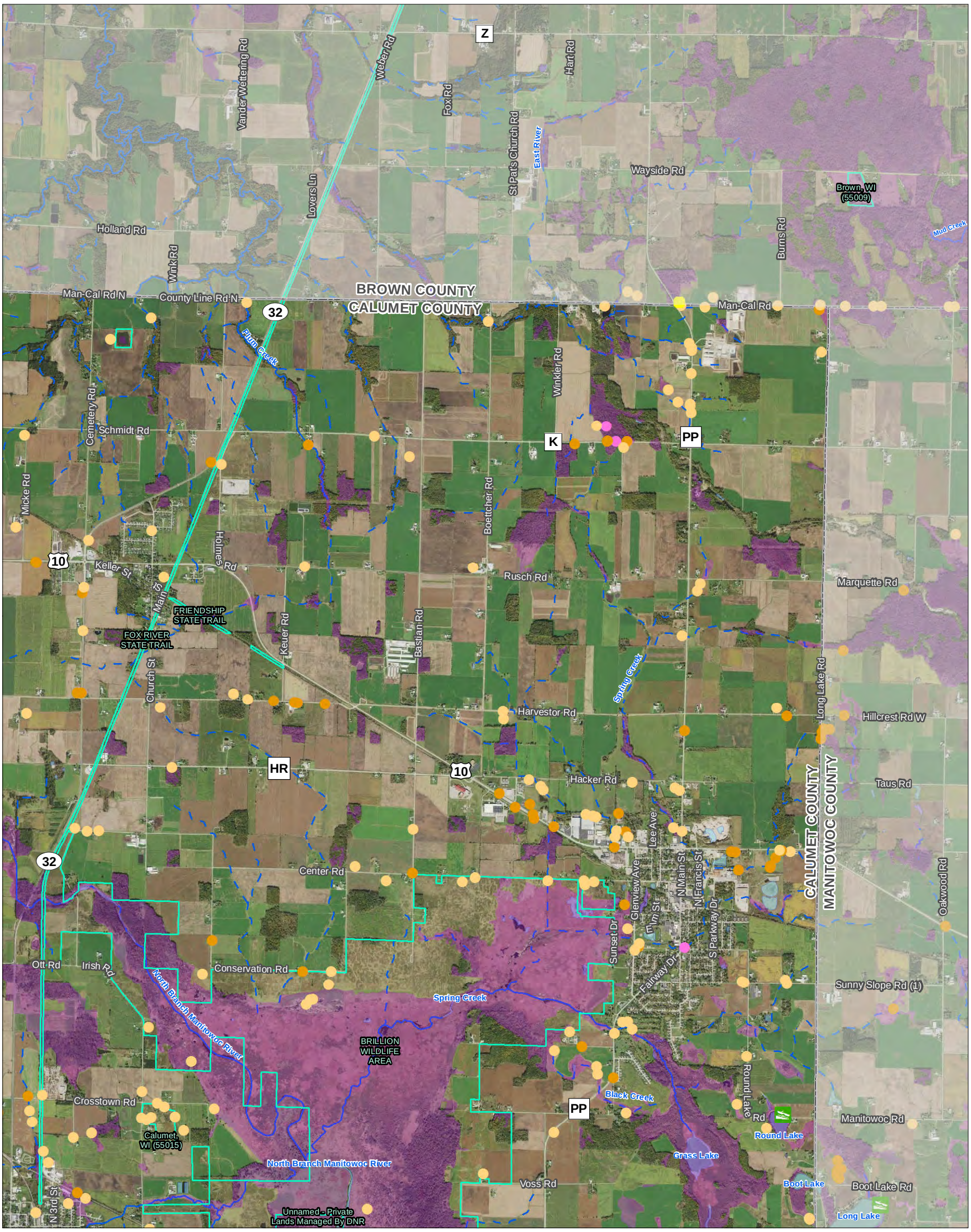

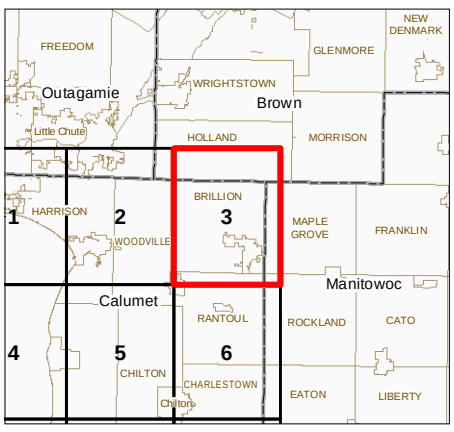

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DNR 24k Hydrography

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Figure No.
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Invasive Species Areas
Calumet County

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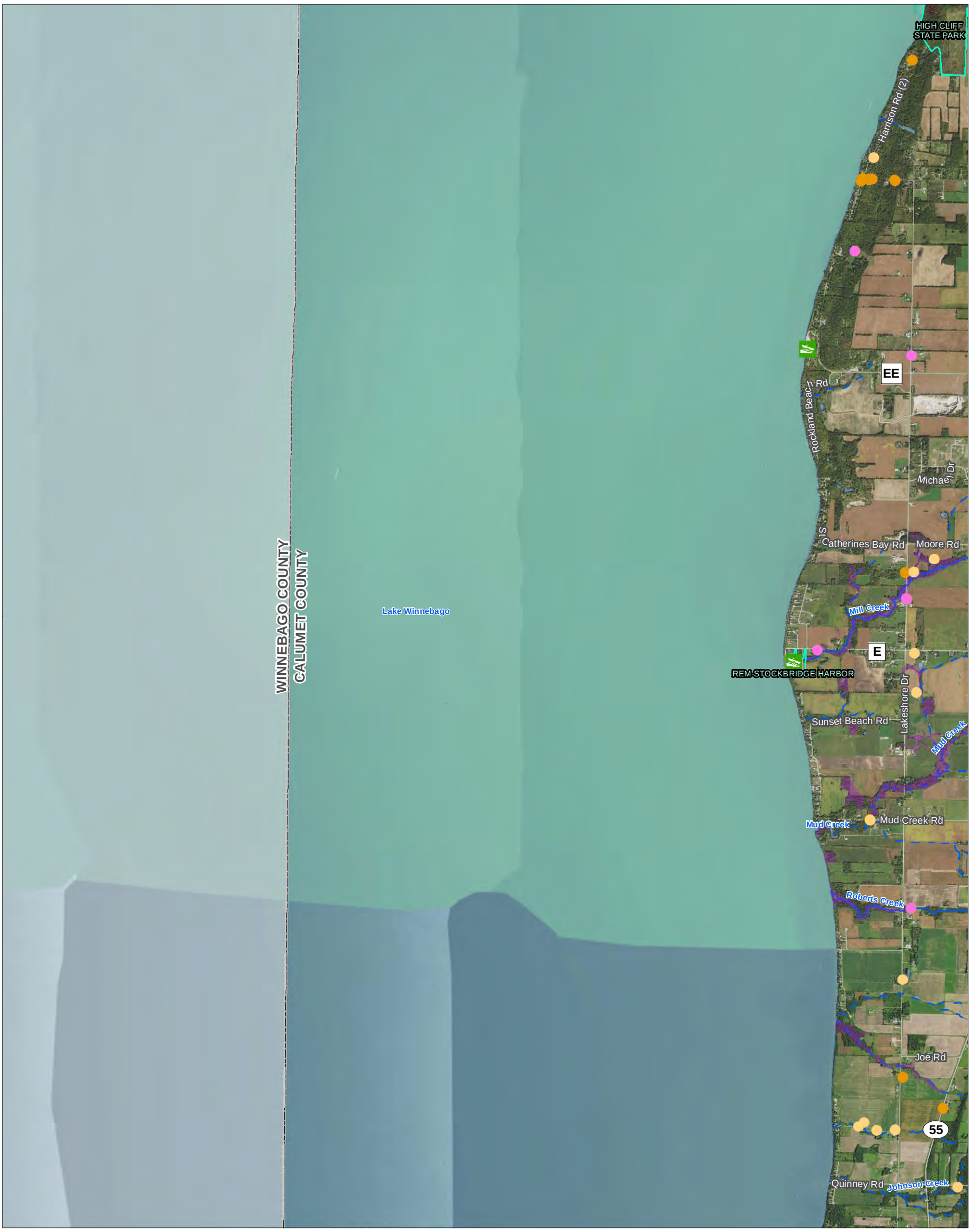

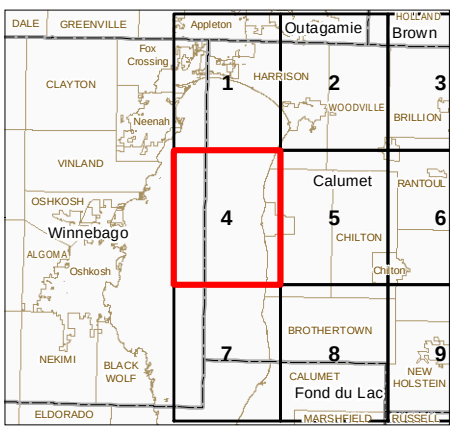

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DNR 24k Hydrography

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Invasive Species Areas
Calumet County

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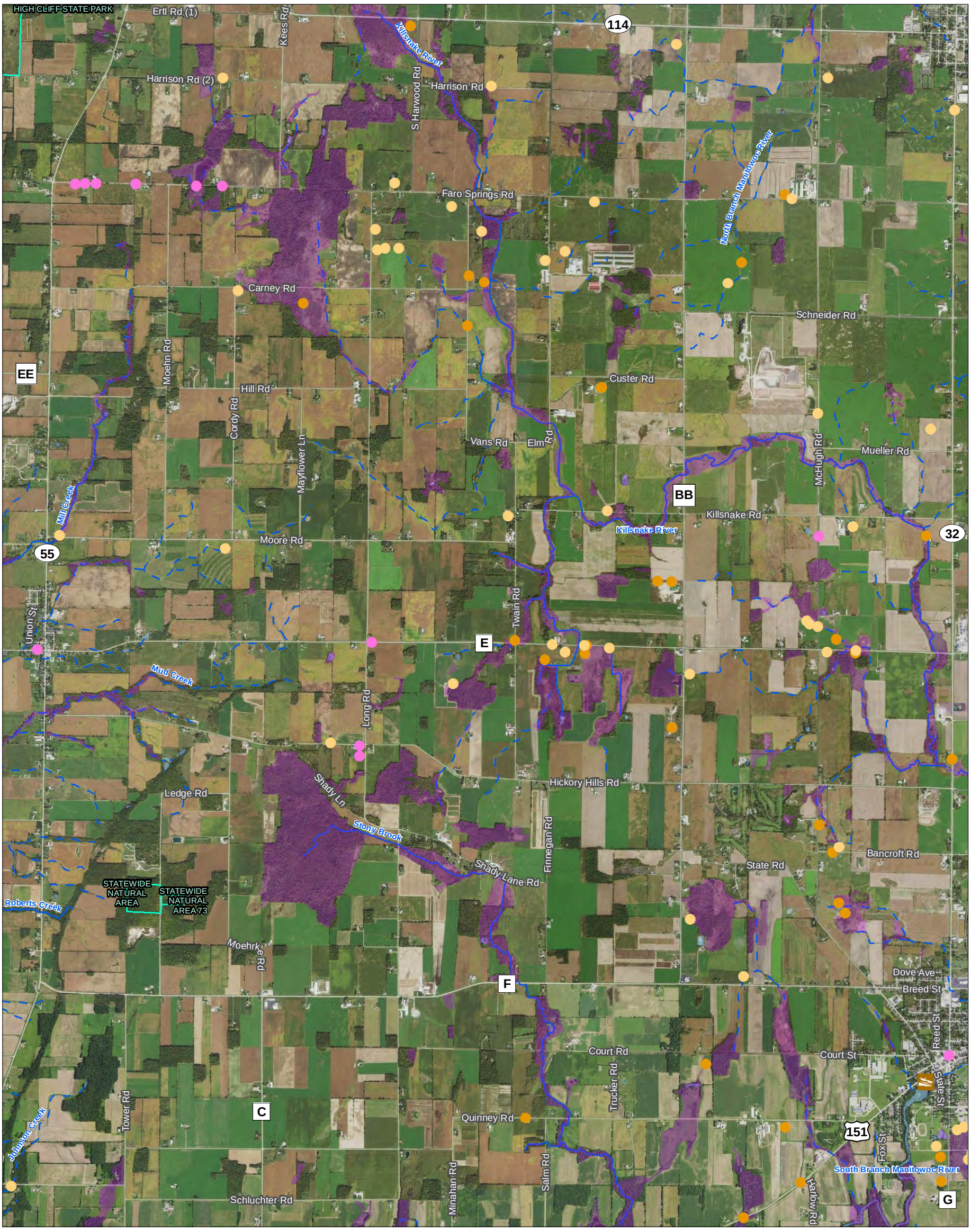

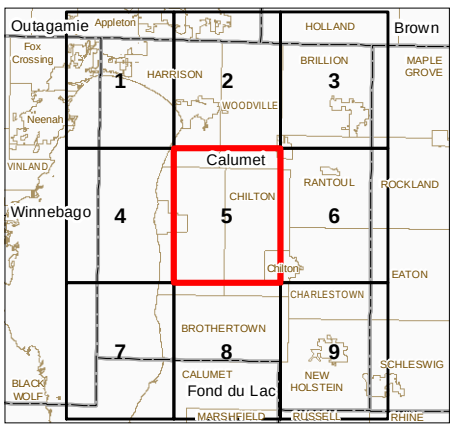

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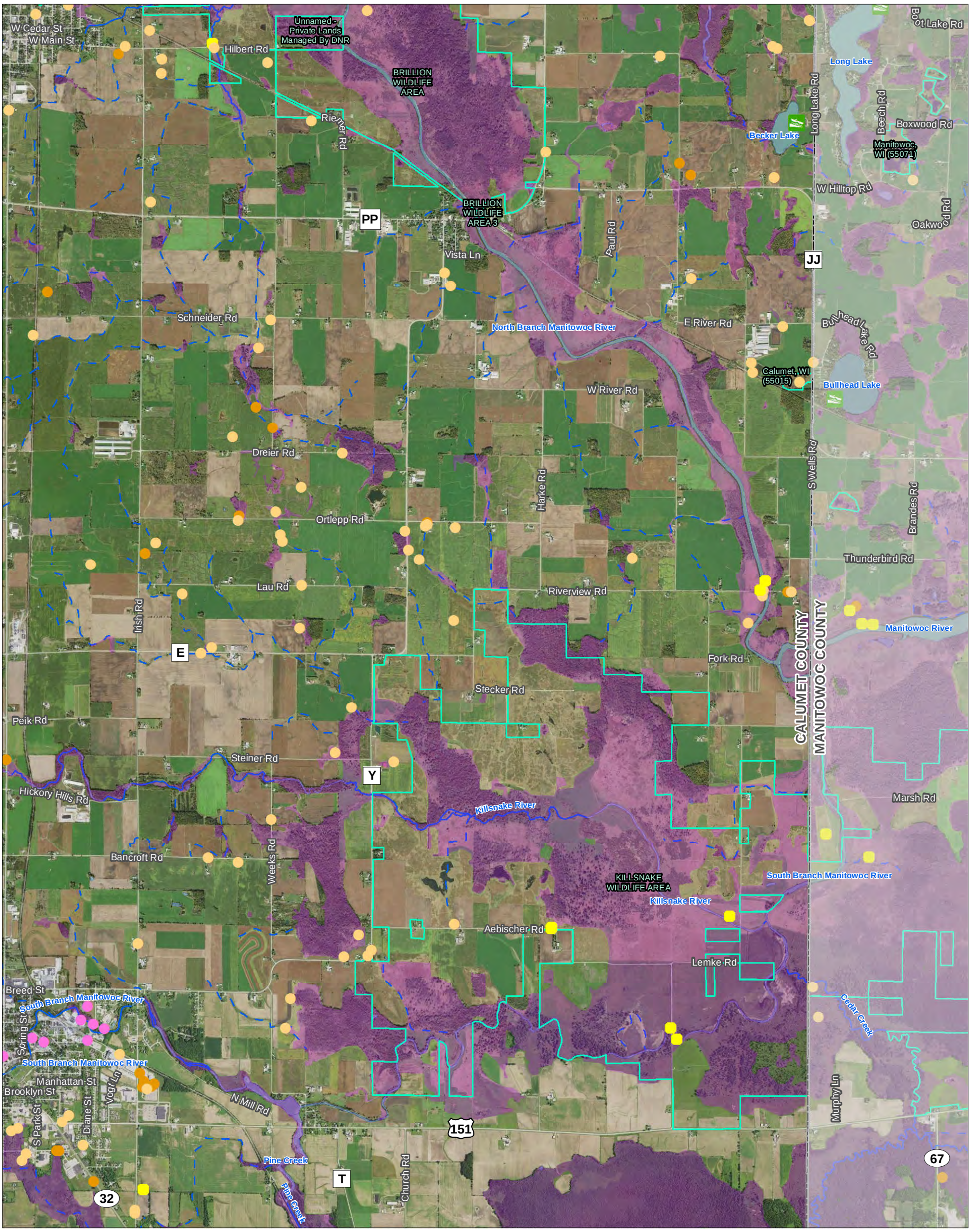

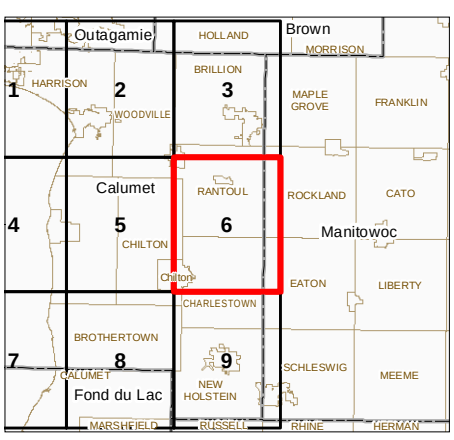

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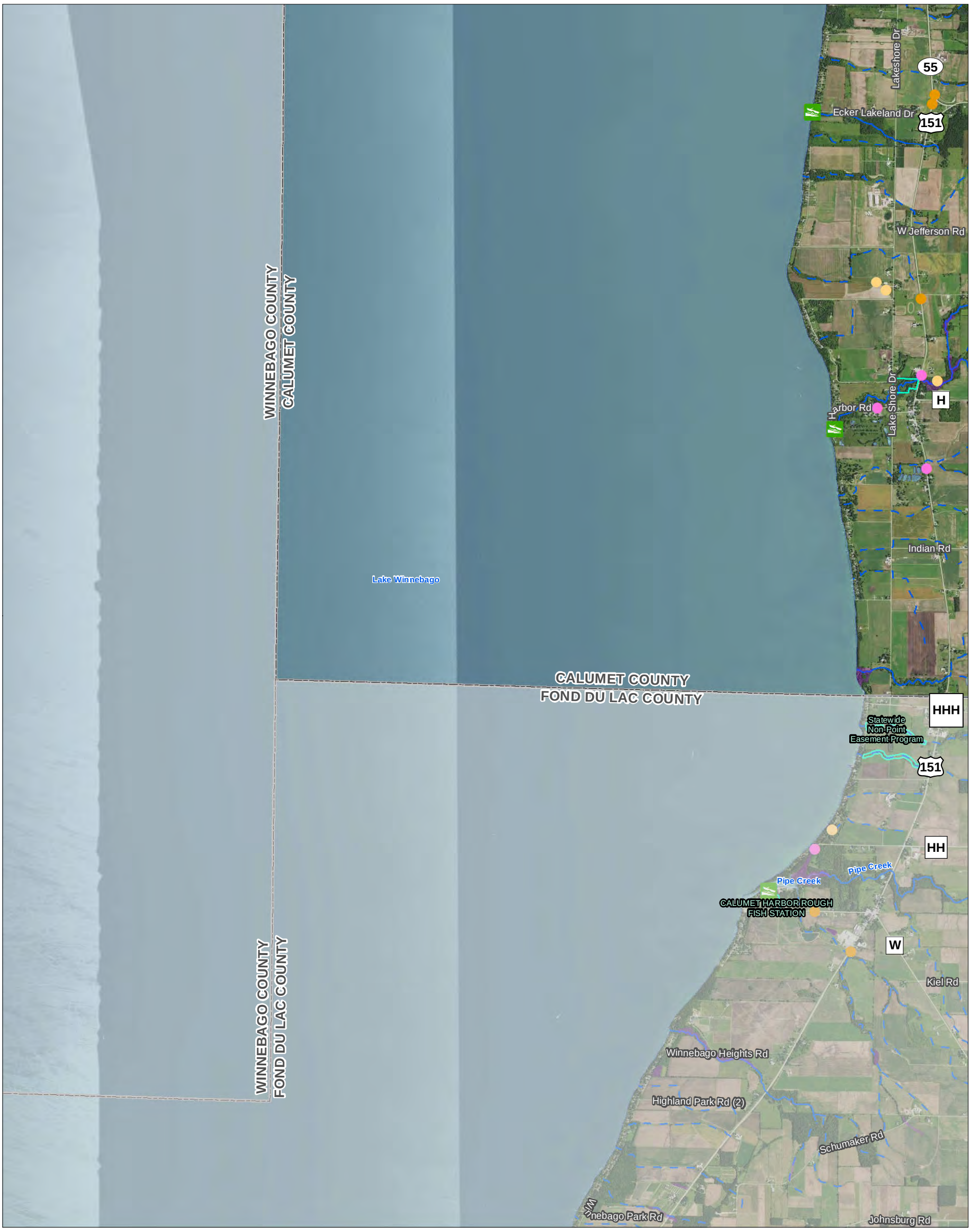

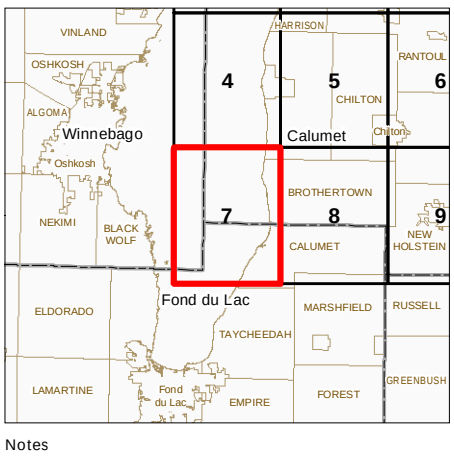

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- Protected Areas Database

Public Boat Access Sites

- CARRY-IN
- RAMP
- UNKNOWN

DNR 24k Hydrography

- Perennial Stream
- Intermittent Stream
- Waterbody

Figure No.
4

Title
Invasive Species Areas
Calumet County

Client/Project
Lakeshore Natural Resource Partnership (LNRP)
LISMA Invasive Phragmites and Japanese Knotweed Management Plan

Project Location
Calumet County
Wisconsin

Prepared by JD on 2020-01-23
Technical Review by MP on 2020-01-23
Independent Review by MC on 2020-01-30

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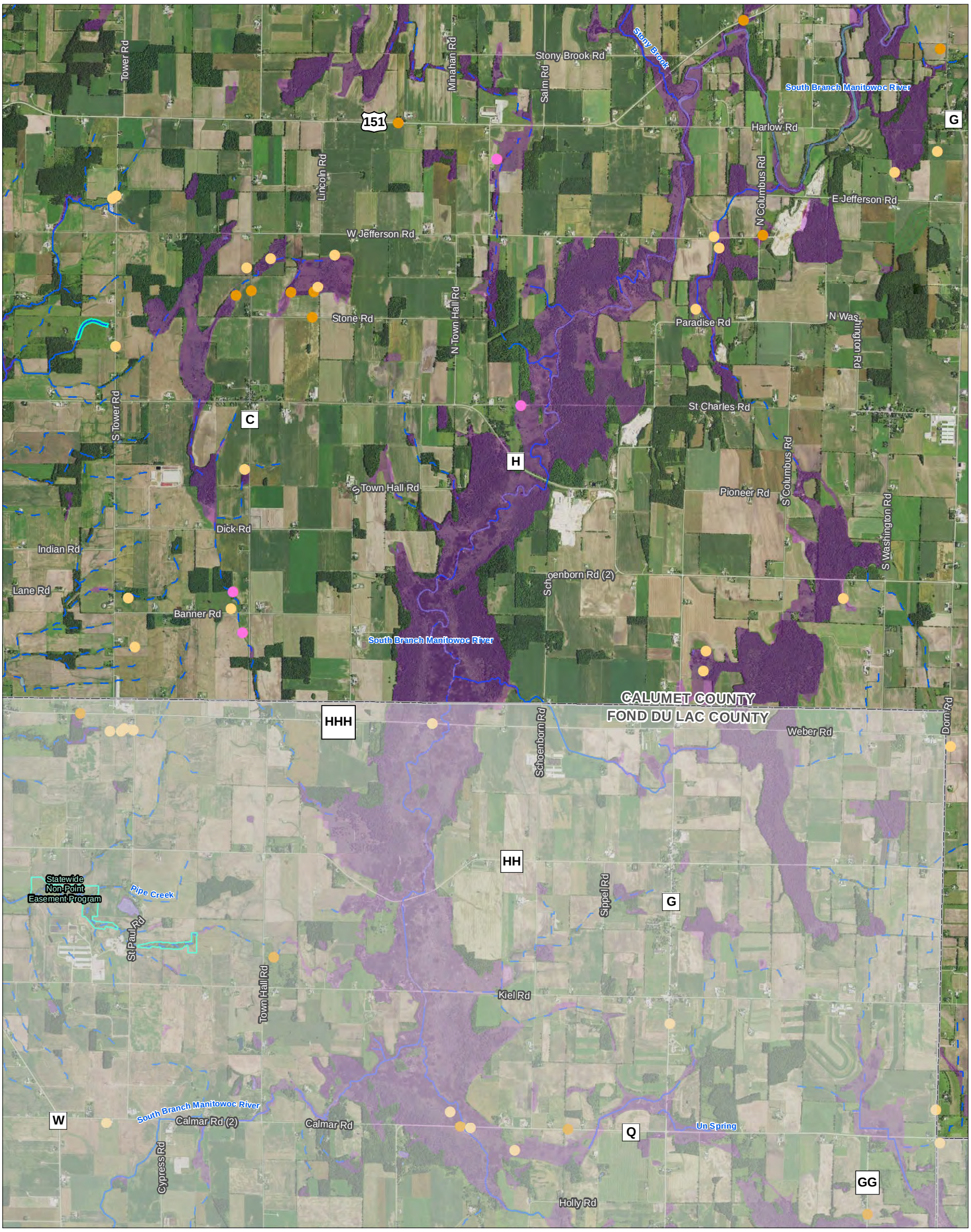

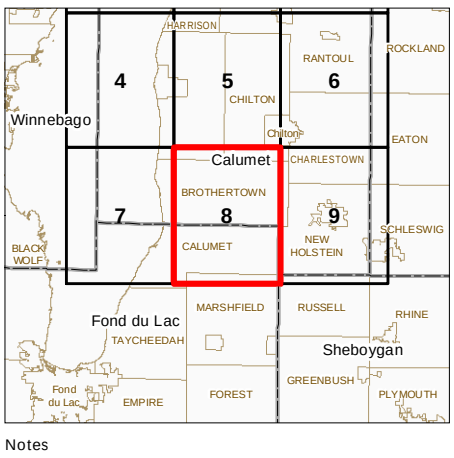

Notes

1. Coordinate System: NAD 1983 UTM Zone 16N
2. Data Sources Include: Stantec, LNRP, WisDOT, WDNR, PADUS
3. Orthophotography: 2017 NAIP

Legend

- Japanese Knotweed, Treated: 0 acres
- Japanese Knotweed, Untreated: 3.04 acres
- Non-Native Phragmites, Treated: 19.23 acres
- Non-Native Phragmites, Untreated: 63.62 acres
- Native Phragmites: 5.69 acres
- Wisconsin Wetland Inventory
- Protected Areas Database

Public Boat Access Sites

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- Perennial Stream
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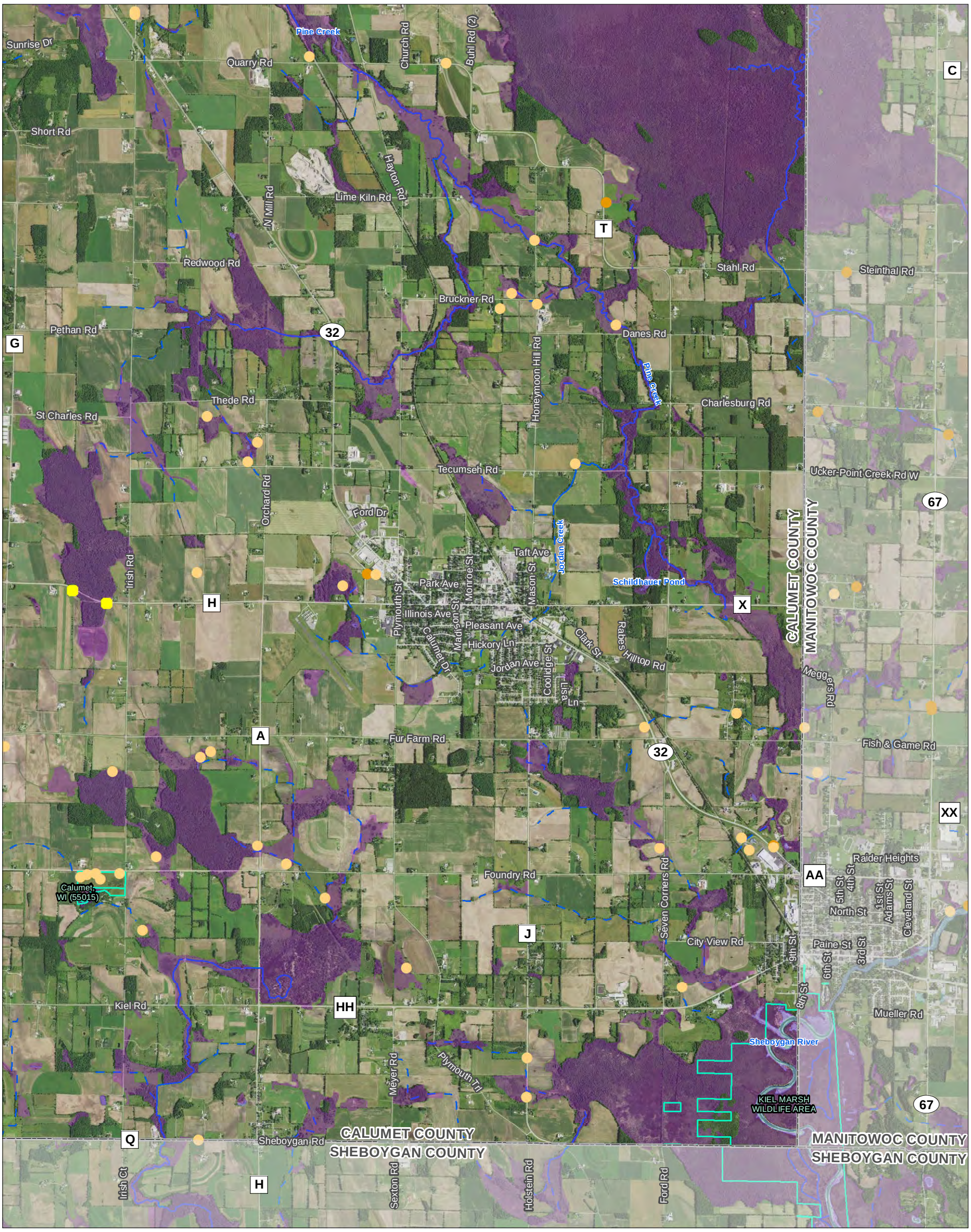

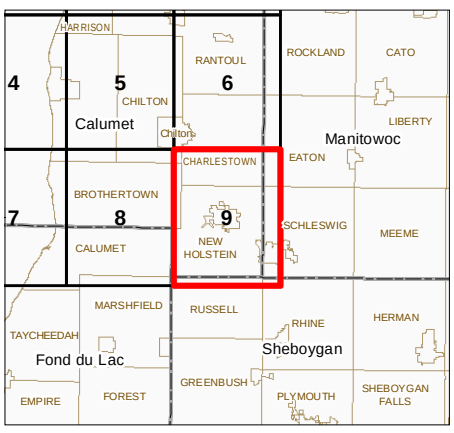

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Figure No.
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Invasive Species Areas
Calumet County

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