Portage Parks Invasive Species Management Plan 2018

Kalamazoo Nature Center

2018

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I. Introduction

The Kalamazoo Nature Center was selected to provide this plan with their twenty-five years' experience with interpretive and ecological services to the park system. KNC has conducted ecological inventory work of the flora and fauna on the high ecological quality areas of the system. KNC specifically provided invasive species identification, mapping, estimates and removal in many of these areas over the years.

The purpose of this plan is to provide guidance, information, and steps the Portage Park system can take to remove, mitigate, and suppress invasive species in their 17 parks. This is a working document and priorities may change based on an annual assessment and monitoring. New species will continue to arrive and could take prescient over existing species. That is why it is of utmost importance that this plan remains flexible in order to treat and eradicate these in a quick, effective way. This will help to reduce the cost of removal by treating these invasives in the early stages of their arrival. Yearly education and monitoring of new areas and species needs to be a priority training of park facilities staff will play a key in the effectiveness of eradication and prevention of new invasive species.

The plan should be reviewed and updated regularly based upon on-going risk assessment and information as populations disappear or new treatment methods are suggested.

The emphasis is on the top parks which have the highest ecological quality within them and the most invasive species removal needed. Each of the parks will have a map identifying the invasive(s), percentage in each unit, recommended steps needed for each area and cost estimates. Terrestrial plant species is the main focus of this report but wetland buffers and areas within or on the boundaries were inventoried as well.

In the preparation of this plan the federal and state level plans were considered but the focus is on the Portage Parks and priorities for the coming years. The primary emphasis should be placed on highly invasive species in the high valued sites. The priority will be based upon identified value, management goals and threats to the

resource. For effectiveness in the control of these invasives, a reactive, proactive control and prioritization will provide a more cost effective less reactive approach. It will allow city residence to see, understand and support the removal to protect these natural areas. It is clear the longer one lets the numbers and quantity grow, these population will increase the cost. If one provides successful mitigation a decrease in cost and vegetation type will happen. There are no boundaries in this process so education of residence adjacent to the parks and visitors to the parks is of utmost importance. It is most important to take a tiered approach with previous work and knowledge of the resource. Each site was examined for their amount of support of wildlife, level of threat posed by invaders, the extent and abundance and effective control methods. If this is not done, the process can become arbitrary and frustrating.

II. Definition

Invasive Species are:

> "species that are non-native to the ecosystem under consideration, and whose introduction causes or is likely to cause economic or environmental harm or harm to human health"
>
> National Invasive Species Council, 1999

A few things one must know as this process moves forward, not all invasive plants are equal—they impact different wildlife habitats, and they have different life histories. Invasive species are not everywhere but understanding where they are is essential to making effective treatment decisions. The discipline of wildlife management is dynamic and what is considered harmful will change with values and as ecosystems evolve.

III. Impacts…. Why are invasive, non-native plants a concern?

Invasive, non-native plants displace native plants and animals These plants will disrupt ecological processes and degrade biological resources which are so important for the quality and visibility of all native species. These invasive plants often lack the natural population controls that keep them in check in their native ecosystems. These new non-natives can out compete the native plants because the existing native species lack the controls (herbivores, parasites, diseases and native plants) in the new ecosystem. The existing native ecosystem lacks the ability to adapt to make use of the non-native invaders. This gap of population controls, in addition to their rapid growth and reproduction, creates a situation in which the invasive plants are better competitors. These invasives can reduce the amount of sunlight, water, nutrients, and space available to native plants, eventually competing with and replacing natives. This creates a loss in quality habitat and diverse food sources for wildlife. Invasive plants have been observed to alter hydrological patterns and soil chemistry. In the long run and in the bigger picture, invasive species reduce biodiversity.

Specifically, these are ways invasive species effect the ecological habitats:

• Valuable resources for wildlife are displaced.
• The critical components of the food chain are not supported, particularly invertebrates.
• The plants can be unpalatable or toxic to wildlife.
• Mutualistic relationships between mycorrhizae and their plant hosts are displaced, which are important for forest regeneration.
• The amount and quality of recreational opportunities can be degraded, including hunting, hiking, bird-watching, etc..

IV. Goals

The goals of this plan are as follows:

- To assess the status of invasive species in each of the 17 parks and address the negative impacts on wildlife and the integrity of the natural areas.
- To prioritize the control and restoration with the most cost-effective process with the most impact to the resource.
- To provide strategies of mitigation and removal using "Best Management Practices"(BMP) to take actions which will be most effective in removal technique and cost.

V. Methods of Assessment-Priorities

KNC in preparation of this plan reviewed existing plant surveys prepared over a 20-year period within some of the priority parks. They conducted field surveys, identification of invasive species and the areas found within the seventeen parks. The areas where mapped and assessed by those which posed threats to the resource where they were found to occur. Assessment of the extent and abundance of each area was also noted. From this information, methods of removal and estimated costs were prepared. The 17 parks were placed in one of the three tiers as to the impact of invasive species and the priority of restoration and attention needed to be completed.

VI. Education and Outreach

Education and outreach are vital to the success of this plan. Awareness, knowledge, and understanding of the "Best Management Practices" will be critical to the effectiveness of this process. This must be a comprehensive program involving all City of Portage staff within all department and the community at large. It is important that all departments have a knowledge of the plan and the part they plan in its success. The community also must know about the plan, because without their support and knowledge there will be a disparity in their involvement and understanding of the importance to the parks. It will be important for the community to understand as they see removal and restoration taking place in the parks, what this means to the resource. To gather support for financial support it will be important for the citizens of Portage to also be knowledgeable of

the need and process. Citizen's will play a critical role in keeping invasives at bay on their own properties for the overall health of the community. They also can become involved in the process with identification of invasives, control and monitoring process. The following recommendations will insure this:

- Place Invasive Species Management Plan on the city website
- Post educational events and products using multiple social media outlets
- Provide links to Barry, Calhoun and Kalamazoo Cooperative Invasive Species Management Area (BCK CISMA), Michigan Invasive Species Network (MISN), individual identification of species and removal information, other resources for residents on website
- Deliver educational opportunities to the public such as demonstration days, workshops, brochures, press releases, on-line tools, individual species information and videos
- Provide avenues for direct engagement with diverse audiences to demonstrate the importance and quality of the parks work, thus bolstering support and fostering new relationships
- Place signs at high risk entry points, information on high threat invasive plant identification, impacts, and preventative practices
- Place signs with information during the removal/treatment process at the sites
- Provide volunteer opportunities to assist in the detection, treatment, and monitoring of high threat invasive plants

Park personnel's knowledge of invasives species and "Best Management Practices" (BMP), continued monitoring and removal will need to be a constant in order to make the impact needed to be successful. The plan must be institutionalized into the of the overall park staff planning and yearly duties. The staff must know the plan and begin to make it part of their daily work to document this process. It will be vital to provide the staff with the time and training to identify and conduct rapid response using BMP. They will need to establish an internal database system to record all of this work for future needs to be assessed.

The plan will need to be reviewed annually in order to develop a work plan as to what needs to be accomplished in order to keep the removal and restoration effective. The establishment of protocols for continued documentation, treatment and measure of success is critical.

VII. Partnerships

Coordination and partnerships will be critical to helping to spread the work and gain continuing knowledge of information regarding invasive species. There are many strong and knowledge organization which can assist with the dissemination of information, help to accomplish your goals and continue the knowledge of the community and staff with the city of Portage. A list of those organizations which can provided assistance are found in the Appendices. (See Appendix A)

The goal is to remove, reduce, or contain infestations by stopping their reproduction and dispersal. Few invasive plants will be eradicated in Michigan. There impacts and spreading can be minimized by implementing effective control techniques. It is very important that those areas or species which pose the greatest threat to the most important areas be the focus first. These areas of focus will also be the most likely to have success in their restoration. The species with the highest threat are provided. These lists should be reviewed and added to as improved information is available through the review of the latest species information from the state of Michigan and other organizations. The list will be specific to Portage Parks at this time and another list will include species on the "watch list" for the state. (See Appendix B)

This plan identifies the important sites as places that are valued for wildlife, sites where established infestations that can be contained or restored over time, and sites that serve as rapid vectors for spread, such as roads. The extent and abundance of the infestation, known effective control techniques, specific site conditions and available resources will determine the likelihood of success.

Prioritizing is important and both an art and a science, that will change as identified values, scientific information, available funds, social climate and opportunity are determined. However, there is no single right answer. Once priorities are set it is important that control techniques and timing are fully

understood and followed for the most cost-effective process. In order to insure success and continuation of the prioritized work the following should be implemented:

- Plan is shared with all who will be involved in the work within the parks but also the community stakeholders as well
- Utilize the methods laid out in this plan as well as keep up to date on the status of control practices for treating invasive plants and new invasive to be aware of
- Implement processes for continued prioritizing of the plan with a review of the state, regional, and local scale plans and work
- Establish and implement protocols for documenting treatments, expected outcomes, monitoring, and measures of success
- Train staff to assess, implement and monitor treatments
- Assess, implement and monitor prioritized treatments and monitoring

VIII. Treatment Effects and Information

There are varied and specific treatments for the removal of invasive species. This plan outlines each species found in the park with a photo and characteristics and methods of treatments. This plan will for each park, identify the unit, species within, percentage of each species and cost estimates. Also, it will denote which and where early rapid response (ERR) could be done to mitigate the spread of a particular species. Existing staff could respond to these areas and those areas which will take much more extensive work will need to be accomplished by a professional crew with expertise to accomplish the eradication on a larger scale.

It is important that this plan is followed and remains in the forefront of your natural areas management of the parks. Invasive species take continued focus on a seasonal and yearly basis. Treatment failures will occur if one does not follow these guidelines:

i. Not establishing unrealistic goals
ii. Having inadequate capacity or knowledgeable staff (internal or contractor)
iii. Inadequate assessment of treatments

iv. Use of ineffective techniques
v. Lack of follow through on documentation or follow up treatments.

IX. Methods of Treatment

The goal of treatment is to stop the reproduction and dispersal of species using the best techniques at the same time making the least amount of impact,
To stop reproduction and dispersal using the best combination of techniques with the least negative impact. The following are the techniques which can be used in combination.

- Hand-pulling, digging
- Cutting, mowing, disking
- Chemical control
- Prescribed fire

*** (See Appendix C) for treatment methods

A. Manual Control

Manual control techniques work best on small populations or in areas where chemicals or motorized equipment cannot be used. Manual control efforts must be persistent and several treatments may be needed to reduce or eliminate the target population. If infestations are too pervasive, manual control may become labor intensive and thus not economically feasible.

1) Digging/Hand-pulling

Usually works best with small or young plants, in sandy or loose soils, or when soils are damp. Remove entire root to prevent re-sprouting.

2) Controlled or Prescribed Fire

Controlled fires or burns, are used to reduce invasive and woody plant density and competition, stimulate the growth of native plants, return nutrients to the soil, promote germination of dormant seeds and enhance wildlife habitat. These fires are called "controlled" or "prescribed" because they are done only under specific weather-and fuel-related conditions that ensure an effective burn and the safety of the burn crew and the surrounding area. Purposely set in plant communities that

have evolved with fire, such as oak woodlands, prairies, savannas, and sedge meadows, controlled burns can kill or set back certain invasive species that do not tolerate fire. Burns are usually conducted in spring or fall. If early blooming wildflowers are present, it is often best to burn in very early spring or late fall to avoid damaging them.

Fire is a control technique which can be very cost effective. It is important that knowledgeable trained professionals be used to conduct such control. Local burning regulations, checking local ordinances, permits and contact with the local fire department is critical. Burning is a dangerous activity that requires planning, coordination, equipment, and trained personnel**.** It also requires an understanding of how fuel conditions and weather conditions, such as humidity, temperature, wind direction, and wind speed, affect a burn

Badly infested natural areas with invasive plants, controlled burns may initially need to be done for several years in a row to reduce the invasive species seed bank and stimulate native species. Chemical controls are used frequently after a burn in the preceding years. Burning one-third to one-half of a natural area each year on a rotating basis is usually the preferred management strategy and will lead to increased plant and insect diversity.

B. Mechanical Control

Mechanical control techniques include cutting, girdling, tilling, mowing and chopping using tools or machines. These techniques are most useful in areas with large infestations where terrain does not create safety or equipment issues. Repeated mowing or cutting of invasive plants can weaken the population by depleting root reserves and preventing flowering; however, mechanical control is typically most effective when used in conjunction with herbicide treatments. When infestations are small, the cost of mechanical control is usually low, in combination with other treatments it can be very effective. However, cutting large populations of woody invasive plants can become labor and resource intensive.

1) Cutting/Mowing

Cutting or mowing several times during the growing season is most effective if done just before plants flower. It is important to monitor the site for re-flowering. Herbicide can be applied to the cut stems or re-sprouts. Avoid mowing if seeds have already developed as this will spread them. (See Appendix D)

For large areas with trees or shrubs, no larger than 8 inches, a Forest cutter/mower can be used. This would be used where a large percentage of the area is invasive species and minimal impact would be made to the native species. It is well suited to take care of invasive species such as buckthorn, honeysuckle, multiflora rose, or autumn olive in the forest understory or field. In many cases, when invasives shrubs or trees are 80-90% coverage of an area and only invasives are present. A forestry mowing is a powerful and efficient tool to set them back and allow for effective management in the future. Herbicides would need to be used in the following seasons to address re-sprouts.

2) Girdling

This involves removal of the bark and cambium layer in a ring,1-2" on trees with a diameter of 6-8". The ring needs to extend entirely around a trunk or stem and cutting in only enough to interrupt the flow of sap. Girdling could be done any time, unless it is done in the spring, herbicide should be used. A chainsaw should be used for thick barked trees cutting two rings 2-6" apart, making sure to cut beyond the cambium, and apply herbicide to the cuts.

C. Chemical Control

Chemical control refers to the use of pesticides. Some invasive organisms cannot be controlled without the use of pesticides. The choice of pesticide depends on the target population, stage of growth, the presence of desirable species that may be affected, the proximity of water resources and environmental conditions. There can be some areas where chemical control is inappropriate, for example if rare species are present. Pesticides must always be applied in accordance with the label and by a trained individual. Proper equipment and the knowledge to safely apply chemicals is a must or hire a licensed applicator. Visit the Michigan Department of Agriculture and is reference to finding out more about pesticide applicator trainings, requirements and certification process. (See Reference section)

1) **Cut-stump treatment** is a common, effective method for woody shrubs**.** Cut all stems of a plant near its base and apply herbicide to the exposed cambium (outer) layer and down the sides of the root crown. Water-based herbicides should be applied immediately after the stem is cut. Oil-based herbicides can be applied later. Best timing is in fall and early winter. Applications can be made using a sponge wand, spray bottle, or a backpack sprayer. Adding a dye to the solution helps keep track of what cut stumps have been treated.

Foliar spray is the application of herbicide directly to the leaf surfaces of plant. Use care to avoid applying to any non-target plants. Use special formulations near open water. A variety of sprayers can be used, including handheld, backpack, and mounted sprayer units for off-road vehicles and trucks. A surfactant may be needed when applying herbicides to fuzzy or waxy leaves.

2) **Basal bark**

Apply herbicide (generally in an oil carrier) in a ring, at least 6" wide, to the base of a woody stem, typically the bottom 12-24 inches. For trees that root sucker, treat the exposed root collar as well. Spray to the point of run-off, but not beyond. Herbicide will penetrate the stem and move to the roots. Best timing is in fall and early winter. Do not treat wet bark. Herbicide solutions may vary based on the diameter of the plant. Always apply in accordance with the herbicide label.

3) **Injection gun** is another way to apply chemicals. This is used to inject the chemical into the stem of specific invasive.

All herbicide label formulations are listed as percent active ingredient in this is the chemical that kills the plant. When an herbicide is purchased it will contain a certain amount of active ingredient. You will need to know the percent needed in your herbicide of choice to determine the amount of carrier (i.e. water or oil depending on the herbicide's formulation) you need to add. (See Appendix E)

D. Biological Control

Biological control refers to the use of animals, fungi or diseases to control invasive populations. Biological control typically does not eliminate the invasive species, and usually takes several years to show results. Biological control has been effective for some species. Examples include the *Galerucella* beetle which has been used with some success to control the European perennial purple loosestrife (*Lythrum salicaria*), which has been used throughout the city of Portage over many years.

Grazing animals can also be utilized as biological control agents. For effective control, grazing may need to be used multiple, consecutive years, generally during the rosette (early growth) to early flowering stages, sometimes with multiple treatments per year. This practice is best used as part of an integrated pest management plan including manual, mechanical, or chemical controls. Care needs to be taken when using grazers since they can eat desirable plants as well as invasive plants and some plants are toxic depending on the grazer breed. The following is a list of invasive plant species and the grazers that will eat them:

- **Sheep and goats** - garlic mustard, spotted knapweed, white and yellow sweet clover, reed canary grass
- **Goats -** Japanese knotweed
- **Goats** - black locust, common buckthorn, honeysuckle (all species), Japanese barberry, multiflora rose, autumn and Russian olive, Oriental bittersweet, crown vetch
  **See Reference section for further information on grazers

X. Disposal

Many weeds, like garlic mustard, continue to develop seeds once they have been pulled from the ground. For plants like this, effective control means that you must remove the flowering plants from the site to keep the seed from spreading. Allowing the plants to dry out and burning them is an option. Burying the plants works but is not feasible for most situations. Although backyard composting is normally the preferred method for dealing with most yard waste, backyard compost piles and bins do not reliably generate enough heat for a long enough period of time to destroy some weed seeds. The same problem may occur at many municipal or rural compost facilities, thereby spreading the weeds when the

finished compost is utilized. Groups removing invasive weeds from public properties like parks should make arrangements with their local public works office for collection and disposal.

XI. Monitoring

Monitoring plays a vital role in invasive plant management and prevention-it provides the justification and knowledge needed for evaluating management actions and adjusting them if necessary. Monitoring is needed to reach invasive plant management objectives and sustainable land management goals more effectively and efficiently.

Monitoring will insure that the treatments and removal are remaining effective year after year. Record keeping of the treatments and when is necessary every year. A good database system for each park will be needed. Repeated surveys through time will determine changes in the status of the invasive in each park. This system needs to:

- Develop and maintain lists of high threat species for targeted prevention, eradication and control.
- Establish a centralized GIS-based database to collect, house, and analyze distribution data for high threat invasive plant species.
- Update distribution maps for high threat invasive plant species.

Monitoring can also be used to:

- Detect new populations
- Determine the status in population sizes and distributions over time (e.g., evaluate invasiveness)
- Measure success of restoration and revegetation projects
- Measure success of best management practices (e.g., during road and building construction, fire-fighting, etc.) that are meant to prevent the introduction and spread of invasive plants into and throughout a management area

XI. Types of Monitoring

1) Early Detection

Early detection monitoring is implemented before unwanted species have arrived in an area. It is the most cost-effective monitoring because when rapid eradication takes place, control efforts are minimal.

Finding species when they first appear is important to continued control. Designing a systematic schedule will be important. This could be done every two years, depending on resources. Recording investigation and non-infested sites during monitoring events is important. Volunteers could be used to survey these areas for detection of well know easily identified plants. Use of field botanist to detect new or difficult species to identify may be needed. Monitoring the effects of treatment on the target invasive populations helps to determine the most effective control method and apply further treatment if needed.

2) Assessment of Treatments and Restoration

It is important for monitoring to take place and depending on type and technique of treatment used. This may be two weeks after, a month or a year depending on the species. This should be determined at time of treatment and placed on the schedule of needs for monitoring per units and treatments used.

3) Park Personnel Observations

As staff preform other duties having been trained that can continue to monitor progress of treatment and find new areas of concern.

XII. Recommended Method of Monitoring

Photo point monitoring is an easy and inexpensive, yet effective, method of monitoring vegetation and ecosystem change. It consists of repeat photography of an area of interest over a period of time. These photographs are taken from the same location and the same field of view as the original photos. Site markers are placed in the area (a post with labeled location number) and data of the site is recorded. The photos can be precisely replicated by different people many years apart. The data must then be organized and filed. Photo points should be established for evaluating management activities, assessing the impact of a weed infestation, or determining whether management objectives are being met. Caution

should be taken not to not to trample the vegetation when locating or taking pictures at the photo points.

A. Steps to Establishing Photomonitoring

Once a photo point is established, it cannot be changed, use care in choosing locations and subjects for monitoring. You photo point will be used as the site in which you will take photos from in a North South east and west direction. Select points from which multiple photo points can be photographed.

The following steps outline items for consideration and procedures for establishing photo points:

1) **Identify photo points**. Within selected monitoring areas, identify elements in the landscapes that are most critical to document in order to achieve the project objectives. Ensure that enough photo points are established to adequately document changes.
2) **Mark photo points**. Photo points should be permanently marked so they can be relocated in the future. Metal or wooden fenceposts work well for this purpose. (Having a post visible in some areas is a good educational tool for letting the public know what is happening on the site. Interpretive signage that explains their purpose is a good idea) Another option if the metal/wooden post do not fit the area are using steel rebar driven close to the ground can be used instead. A global positioning system (GPS) unit should be used to record location for relocating them in the future.
   a) **Identify a unique feature at the site**. An immovable object in the monitoring area that can be easily identified when returning to the area can also be helpful. It serves as a reference to quickly locate the monitoring area. It should be noted in your documentation notes.

   b) Assign identification numbers. Assign identification numbers to all photo and camera points.

   c)) Record site information. Record information about the monitoring site on a map, aerial photograph, and/or site description form. Information such as date, observer, location, site description, objectives, identification numbers, and unique features, photo points, should be recorded.

   d) Determine when to photograph and make record of this.

e) **Determine how frequently the photo points should be photographed, duration of monitoring, and time of year photographs should be taken.** Determine based on the species if it should take place two weeks, two months or yearly after treatment. Photos might be collected once per year at the time when the weeds are most visible during peak flowering.
f) **Create an Invasive Species Photomonitoring field notebook.** A pocket-size site locator field book should be created to aid in locating the monitoring locations and photo points during subsequent visits to the area. The field book should contain copies of the original photo point photographs and directions.

A. Establishing Photo Points Records

Once the photo points have been established and placed in the field phot documentation begins. Site Identification cards (11" x 8.5") a laminated card can be used by writing information with dry erase markers and reused for each photo. The card should be used for each picture depicting each location. This is taken as a photo at the site to be filed with those specific sites. The card should contain the site name, photo point number, camera point identification (north, south, east or west), and date. The photograph number, time of day, and the photographer's initials can also be included. Using site location information and a site locator field book and/or a GPS unit, locate the photo and camera points. It is recommended that original and repeat photographs be taken at a designated height. For each visit and to repeat the photo, point the camera toward the photo point and compare the view through the camera to a copy of the original photograph.

B. Organizing and Filing the Data

A well-organized, easily accessible filing system is needed for photo point monitoring. This should consist of computer files as well as a hard copy folder which contains photos, site documentation, maps, directions with each park, monitoring areas, a site locator field book, site descriptions and other descriptive data. A digital camera or phone camera should be used for photo point monitoring. Provided is a list of equipment:

C. Equipment Needs

- Camera
- Memory cards
- Extra batteries
- GPS
- Forms
- Site description and location
- Photo points
- Photo ID cards
- Clipboard
- Copies of original photos (field notebook)
- Fenceposts or Steel stakes
- Hammer

XIII. Specific Park Management Needs

This section will prioritize the parks in the order of need for the removal of invasive species. The parks were prioritized based on the assessment completed and the value given to each park in regards to ecological quality and significance. Each park section will contain a brief description of the habitats as far as Invasive species are concerned. Recommendations are included on a 5- year cycle as a guide to the needs of each park and its' management and monitoring. Percentages of each invasives within each park unit are included. (Appendix F) The United States Department of Agriculture (USDA)plant codes are used in the document for mapping purposes. (Appendix G)

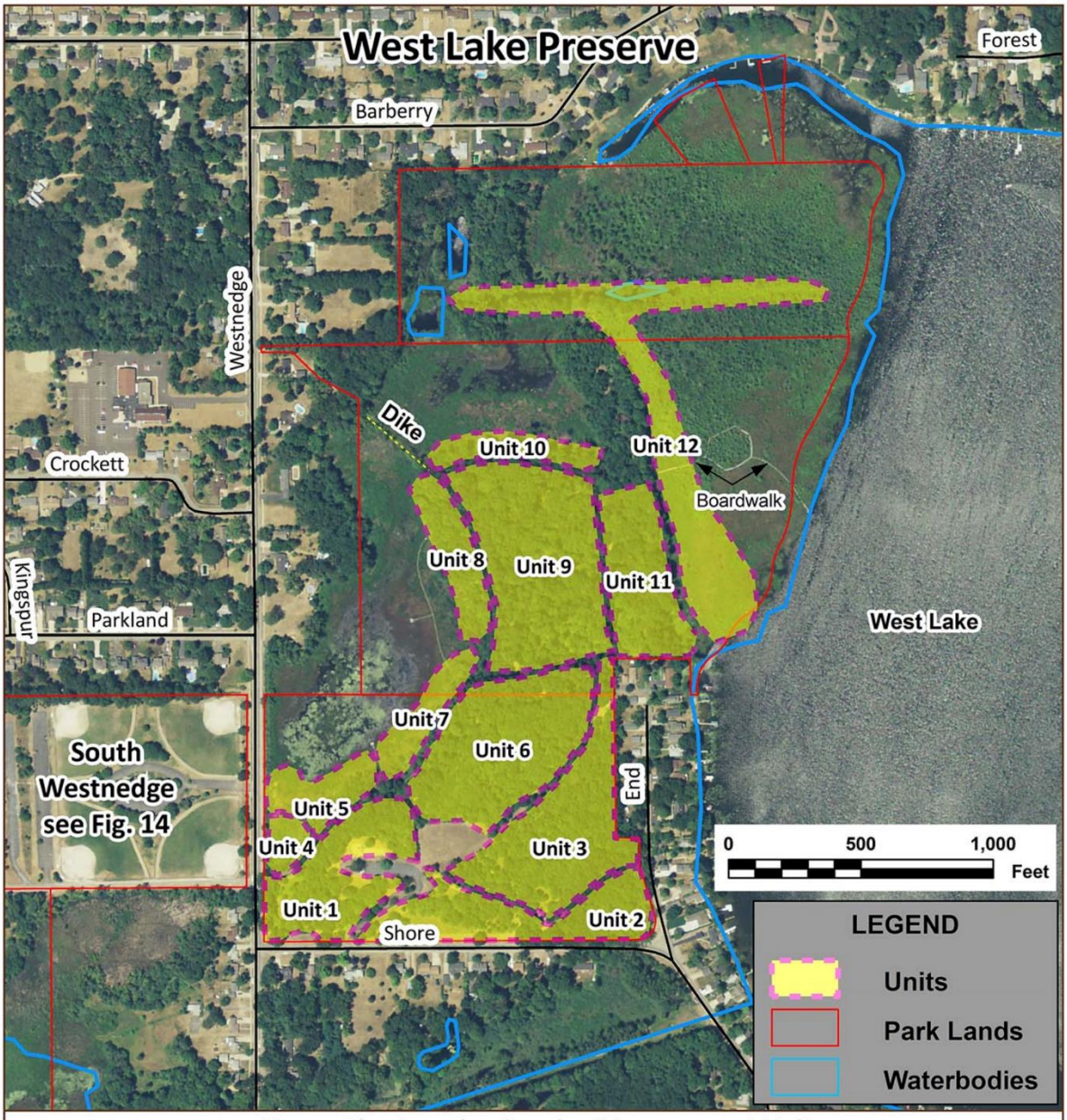
NOTE: Prioritization of Invasive species removal: Each of the parks have an accompanying map and list of species in need of removal by Unit. (NNI = non-native invasive)

The parks are listed as which should be attended to first. The following is the list in order of priority:

- **West Lake Preserve**
- **Bishops Bog**
- **Eliason Reserve**
- **Shrier Park**
- **Lakeview Park**
- **Lexington Green**
- **Ramona Park**
- **Oakland Drive**
- **Harbor West Park**
- **Central**
- **Liberty**
- **Bicentennial Trail -North Section**
- **Bicentennial Trail -South Section**
- **South Westnedge Park**
- **Haverhill Park**
- **Westfield**

A. Westlake Nature Preserve

This park has extensive NNI throughout the park. The biggest challenge is the Oriental bittersweet which has taken over large areas of mature trees. Autumn olive and honeysuckle dominate the understory through most of the upland. There are small patches of garlic mustard where trees have come down, opening up the canopy and allowing light through. Dame's rocket is prolific throughout the uplands, mostly along the trails. The wetlands along the west side of the trail has reed canary and minimal glossy buckthorn. KNC had done work on controlling the buckthorn in 2008 with success. Glossy buckthorn is found near the dike area and continuing to the bog boardwalk, which was not treated in 2008. The open water between the upland and the bog, is inundated with purple loosestrife. Biological control methods could greatly reduce this population.



Non-native Invasive Species Management Units
City of Portage Parks

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Project No. 170288

Figure No. 1

A. Bishops Bog

This park has a large area with glossy buckthorn. Glossy buckthorn is prevalent along the boardwalk and in some areas is dominant. The expansive area extends off of the Bishop's Bog parcel onto the adjoining Eliason Nature Reserve. Control of the glossy buckthorn here must consider the presence of rare plant species found in the bog. Access for work crews must be limited to foot traffic and sections or areas may need to be off limits to the public while work is ongoing. Some of the buckthorn stems near the boardwalk may be removed but in areas further away it would be necessary to pile stems.

The city-owned parcel at the north end of the rail near South Westndege Park has many NNIs, including Tree- of -Heaven, Siberian elm, Black Locust, Garlic Mustard and Vinca vine. This parcel connects the two nearby parks but also has a parks maintenance building on the northwest portion. A patch of knotweed near where the paved trail meets South Westnedge Park should be a priority to eradicate before it spreads as this species can damage paved trails or access roads.

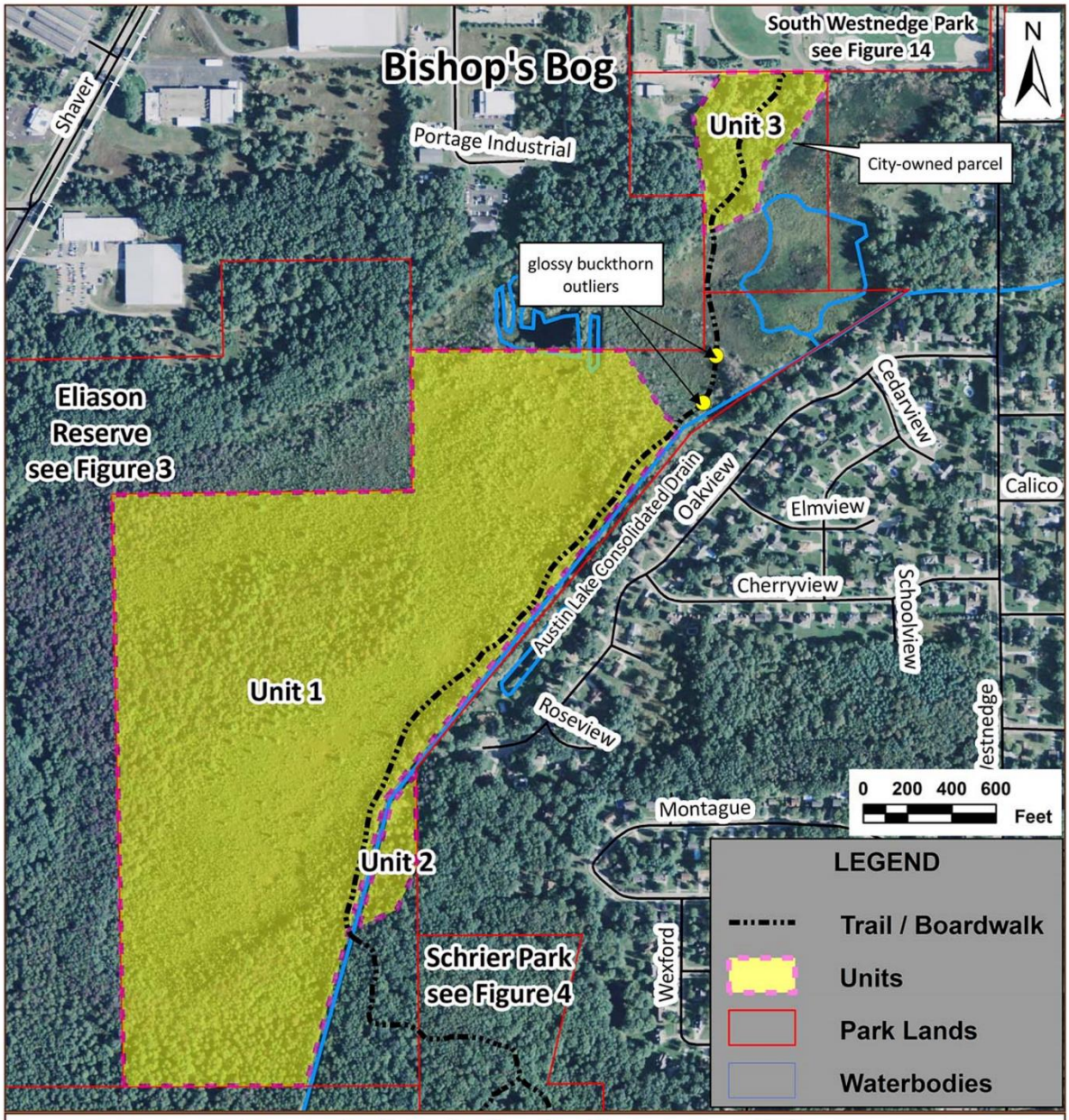

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Figure No. 2

B. Eliason Reserve

This park boarders Bishop's Bog and has dense glossy buckthorn along the east side of the park. Within the floodplain there are small seedlings of glossy buckthorn throughout. The upland areas of the park near the Ousterhout road entrance is scattered with Autumn olive, honeysuckle and Multiflora rose. Along the trail there is Autumn olive lining the area. The upland grassland which is on the westside of the trail has been taken over by the Autumn olive. Autumn olive is found throughout the edges of the trail and the woodlands.

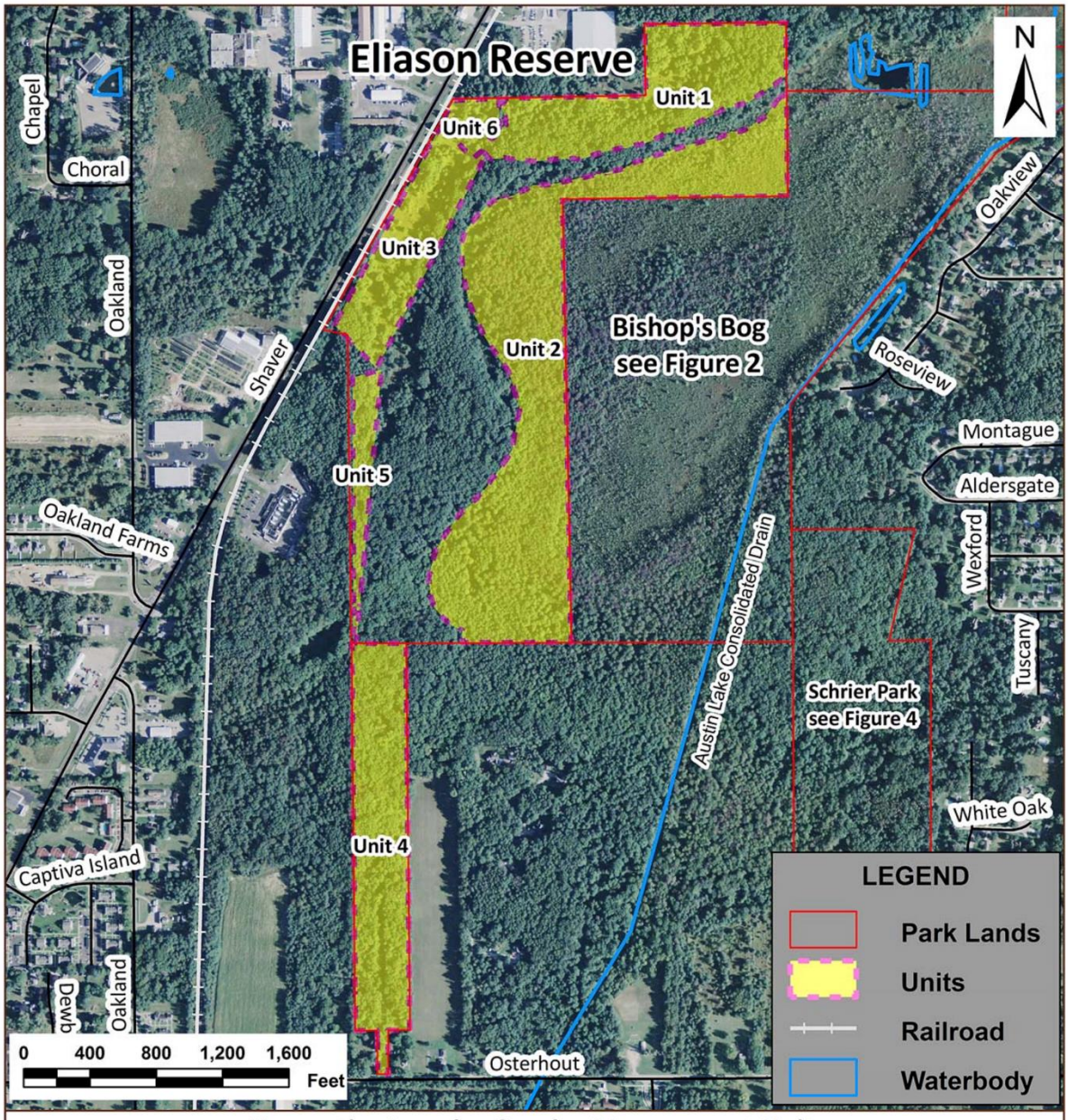

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Figure No. 3

C. Shrier Park

This park has dense glossy buckthorn along the west side that extend off of this park onto Bishop's Bog and adjoining private land. Some glossy buckthorn has also taken hold in openings in the silver maple/pin oak swamp. These areas of glossy buckthorn must be controlled when the water table is not above ground level (i.e., late summer or fall). After control efforts are made in these pockets seeding or planting them with native wetland shrubs (e.g., winterberry or buttonbush) may help reduce the amount of glossy buckthorn coming back and increase the diversity of native understory shrubs. Other NNIs observed include garlic mustard, honeysuckle shrubs, Oriental bittersweet and are primarily along the trails or next to private residences bordering the east side of the park. Similarly, a few small, scattered clusters or individual NNIs are located around the perimeter of the playground area and lawn at the south end of the park.

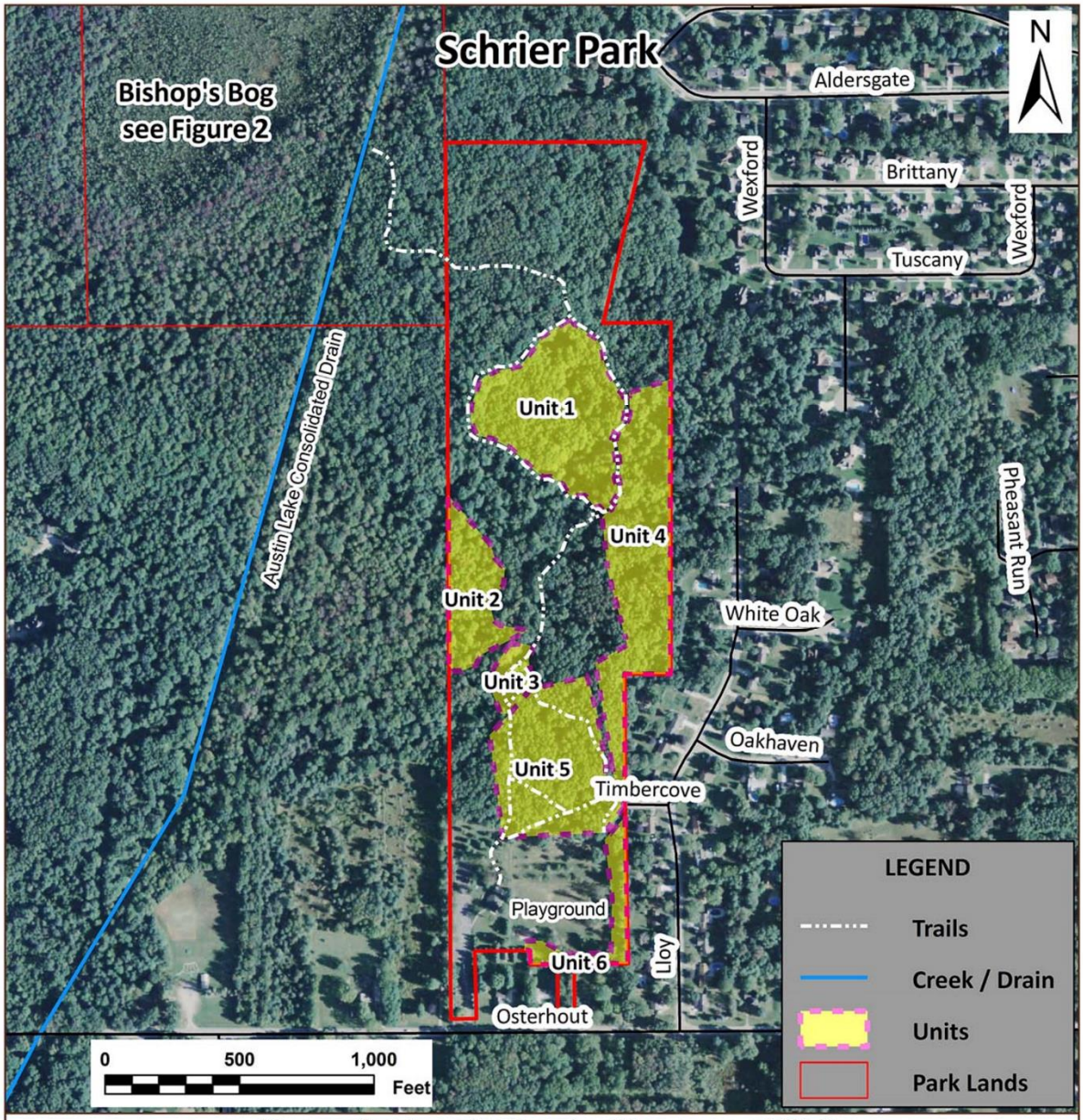

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Figure No. 4

D. Lakeview Park

Lakeview Park is primarily sports fields and paved drives/parking on the north section of the park. Most of the park is large trees and mowed grass. The primary areas for NNIs are the woodlot section on the north side of the parking lot. A variety of NNIs are located in the north woodlot. The highest priority invasive species here is Oriental bittersweet. Vinca vine covers a portion of the ground in this area. Along the shoreline is Purple loosestrife and Common buckthorn. Throughout the park particularly along the edges there are NNI's which can be controlled immediately to impede spreading.

Species Codes:

LYSA2 = purple loosestrife

CEOR7 = oriental bittersweet

COMA7 = lily-of-the-valley

RHCA3 = common or European buckthorn

ROMU = multiflora rose

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Figure No. 5

E. Lexington Green

Lexington Green has a variety of NNIs found in and along the wetland on the east side of the park and the Davis-Olmstead Drain. Reed canary grass is common in the wetland but may be hard to control because it is intermixed with native and non-native shrubs and water level control is not an option. Multiflora rose is located around the wetland on the east side and many re-sprouts were observed in the soil along the bank disturbed by recent drain cleaning activities. Efforts to control these small roses now would be a priority for this park before they regrow and begin producing seeds again. Bush honeysuckle and common buckthorn were also observed along many of the trails.

Species Code:

RHCA3 = Common Buckthorn

FRAL4 = Glossy Buckthorn

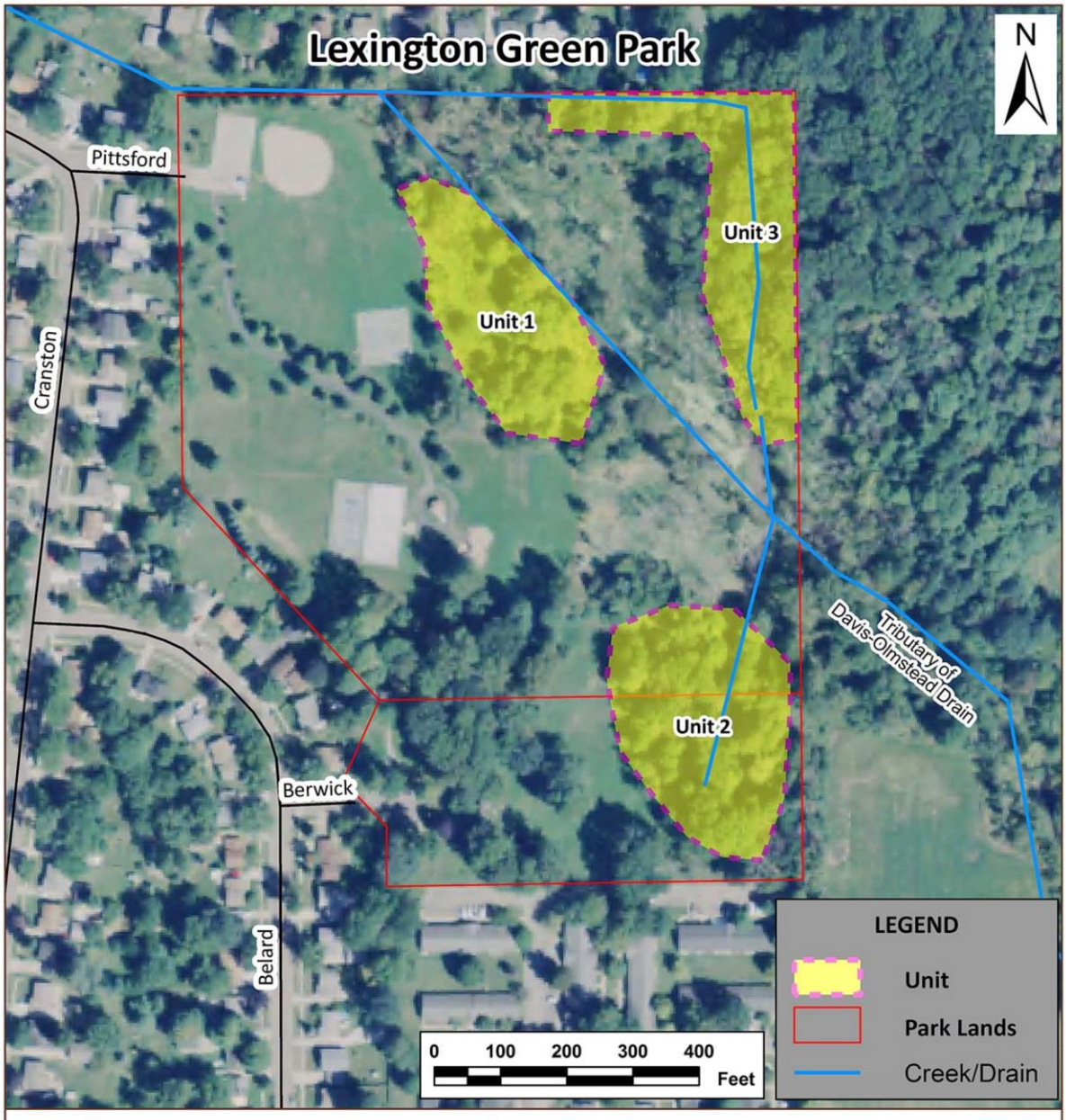

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Figure No. 6

F. Ramona Park

This park is primarily sports fields and paved drives/parking on the west section of the park. Near the beach and playground area at the east end along the lakeshore are large trees and mowed grass. The primary areas for NNIs are two woodlots on either side (north-south) of the east parking lots. A variety of NNIs are located in the north woodlot. The highest priority invasive species here is a large patch of knotweed at the southeast corner of the woodlot and another patch of knotweed in the south-central part of the woods. Numerous areas, some rather large, have vinca vine and/or wintercreeper vines covering the ground. Oriental bittersweet is present in some gaps in the tree canopy and scattered patches of jetbead are also located here. Scattered individual multiflora roses are present and are most common along the edge of the woodlots (especially along Zylman Ave.) and in a few of the small openings in the woodlots where overstory trees or large branches have fallen.

The south woodlot is bisected by a gravel drive with honeysuckle shrubs dominating the understory. Autumn olive is also present. Overstory trees on the west part of this wood lot are younger while the overstory on the east part are older. Many honeysuckle bushes along the lakeshore here are large ‘wolves’ crowding out native plants and preventing native plants establishing underneath them but other NNIs like vinca vine are established and growing underneath and around the honeysuckles. Honeysuckles along the lakeshore could be removed by hand and the use of herbicides on the stumps to avoid disturbing the soil with heavy equipment. A couple of smaller knotweed patches in the south woodlot should be a primary focus for eradication. A few scattered purple loosestrife were observed along the shoreline but no significant patches were observed.

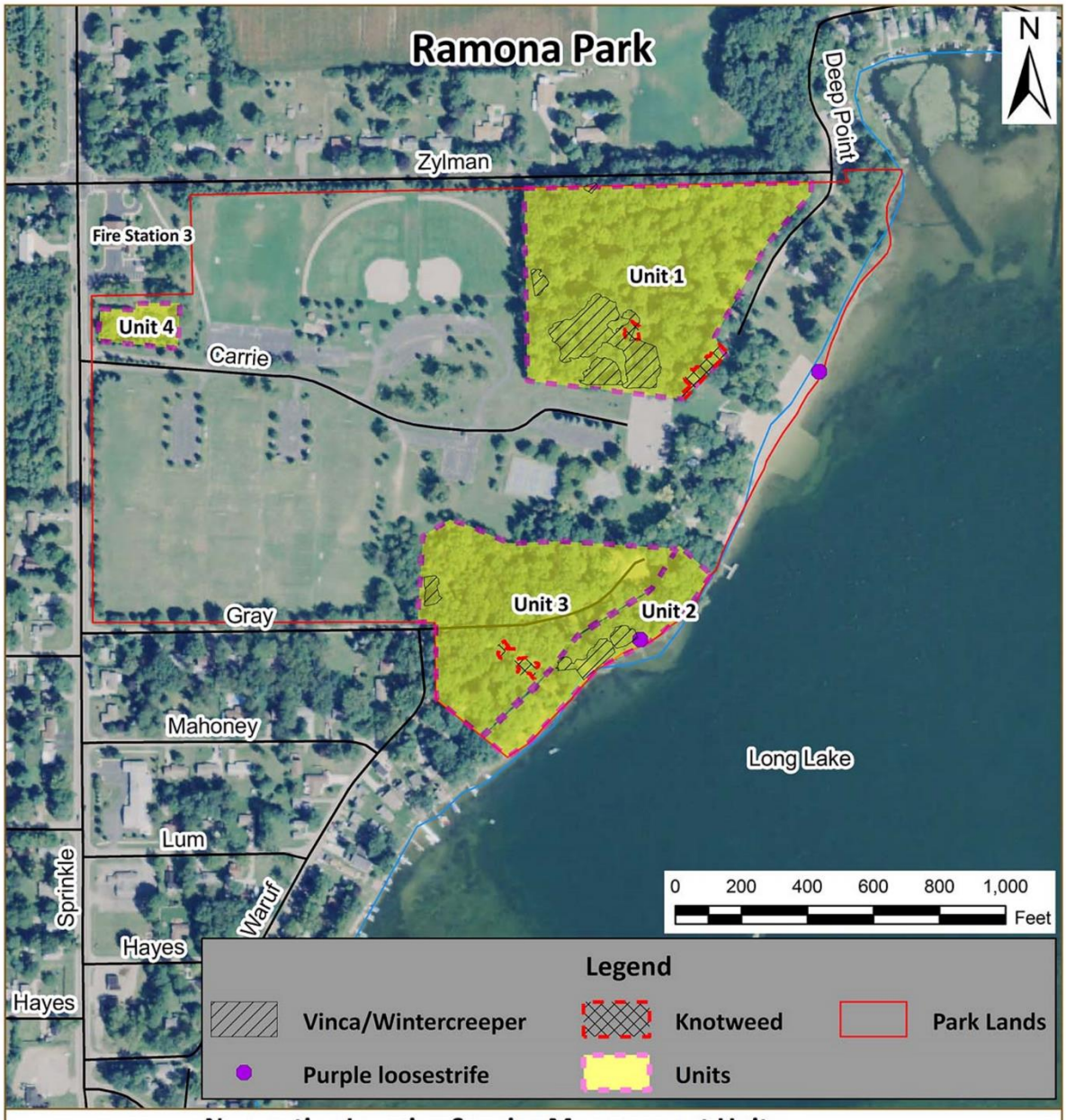

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Figure No. 7

G. Oakland Drive

In Oakland Park the best quality habitat is located in the forest on the north east side of the park. Some native understory includes hickory, oak, maple, cherry, sassafras, poplar, White pine, red bud, flowering dogwood, vaccinum, viburnum, dogwood, sumac, ribes, rubus, amelanchier, milkweed.

Begin invasive work here and work into more heavily invaded forest to the northwest. Invasives include Autumn olive, Glossy buckthorn, Multiflora rose, Oriental bittersweet, Japanese barberry, English ivy, privet. Typically, infestations are worse on the edges, and less dense in interior of patches.

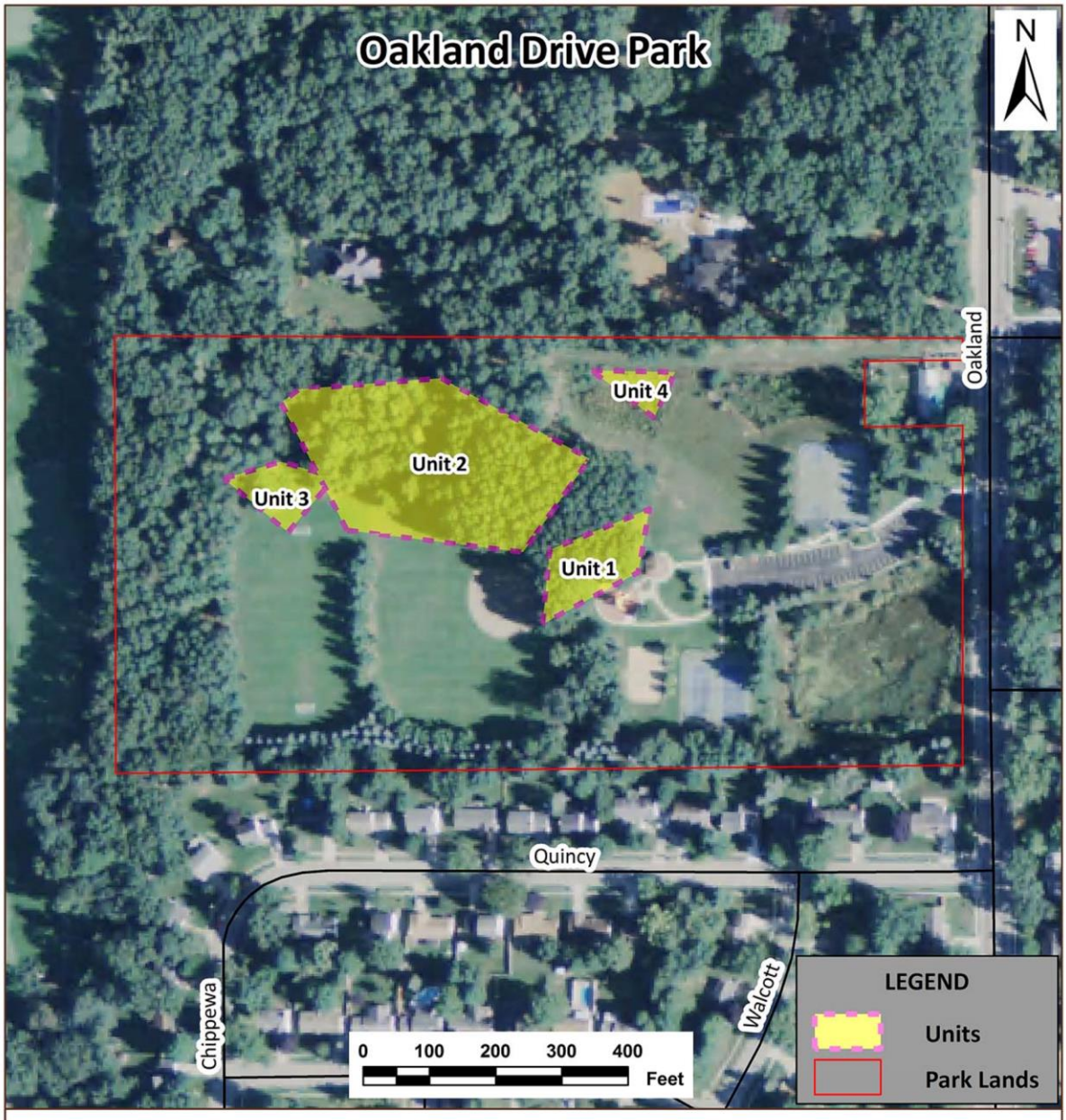

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Figure No. 8

H. Harbor West

Park Harbor West Park is predominantly mowed grass with paved walking trails and planted conifers around the border. No significant NNIs were found but several individuals were found near the borders and typically under landscape trees or along the fences. The species include autumn olive, honeysuckle, Glossy buckthorn, Siberian elm, and Spotted knapweed.

Code Key:

CEST8 = spotted knapweed

ELUM = autumn olive

FRAL4 = glossy buckthorn

LONIC = honeysuckle (Tartarian or Morrow's)

ROMU = multiflora rose

ULPU = Siberian elm

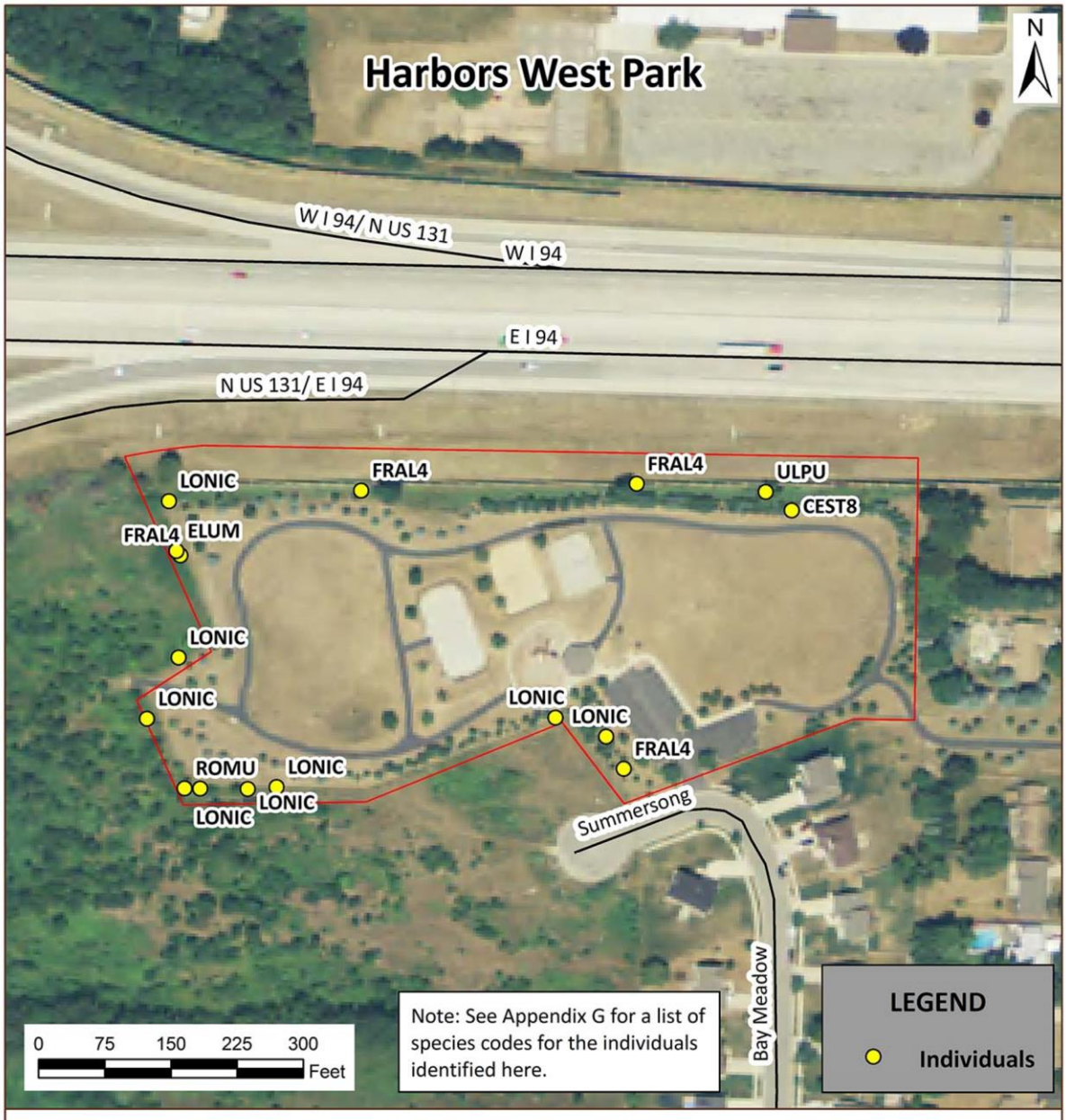

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Figure No. 9

J. Central

This park is a mowed area with an amphitheater. Portage Creek flows through the park. On the east side of the bank there is a small area of reed canary grass and cattails. The west end of the park had a bridge which gives on access to the wetland area but no trails are in that area. This area has mostly Reed canary and cattails. There is multiflora rose, Privet and Glossy buckthorn scattered throughout this area in very low densities which would be very easily treated by park personnel.

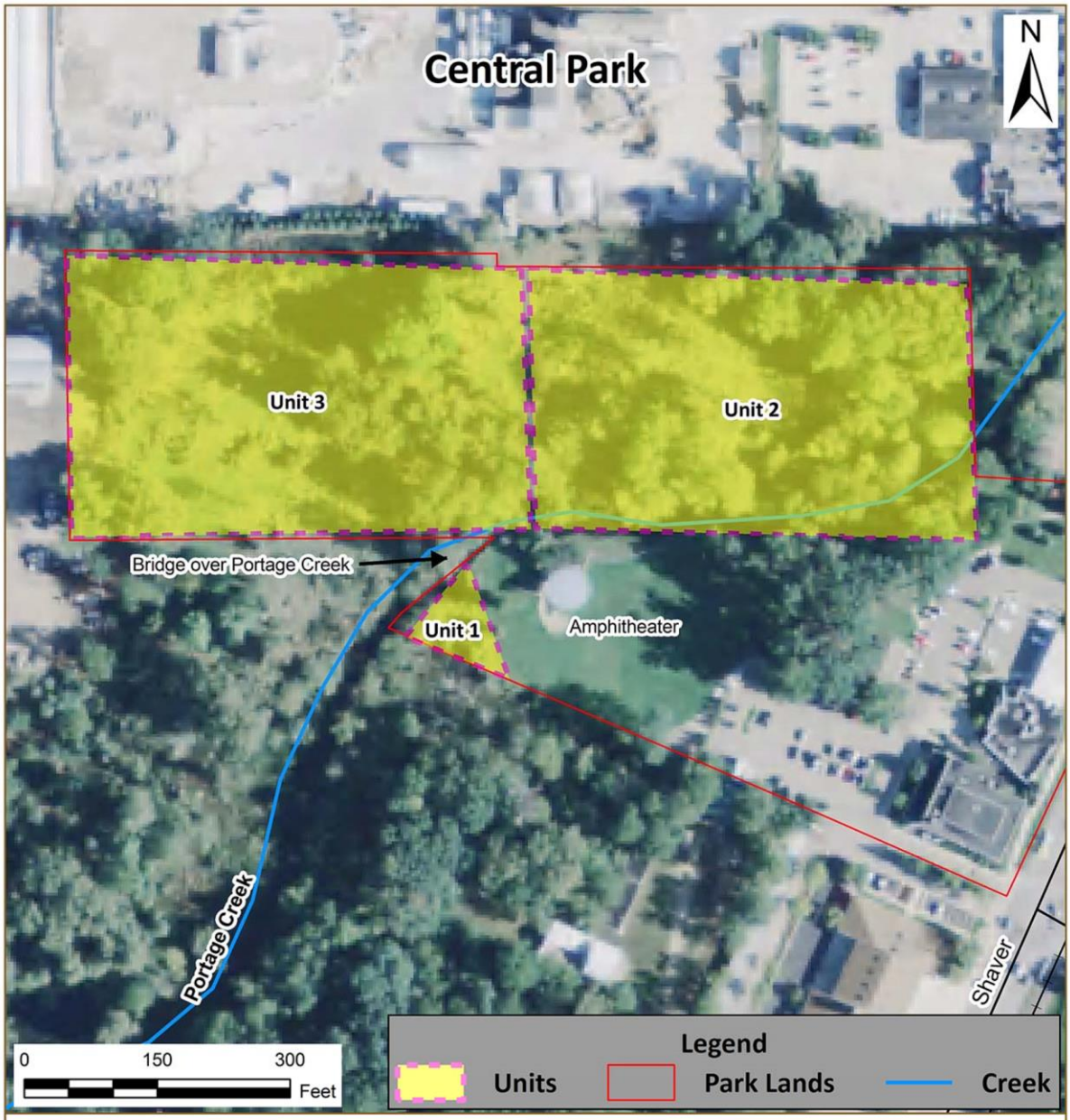

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Figure No. 10

K. Liberty

This is a small highly developed wedge between South Westnedge Road and the railroad. Portage Creek flows through the park going north and several storm water detention basins discharge to the creek. Small Siberian elm trees have become established in most of the planted areas. These trees should be cut and herbicided to prevent regrowth. A clump of phragmites is present at the north detention basin. Reed canary grass is present along the creek bank but removal of this grass must consider how to stabilize the bank to prevent erosion.

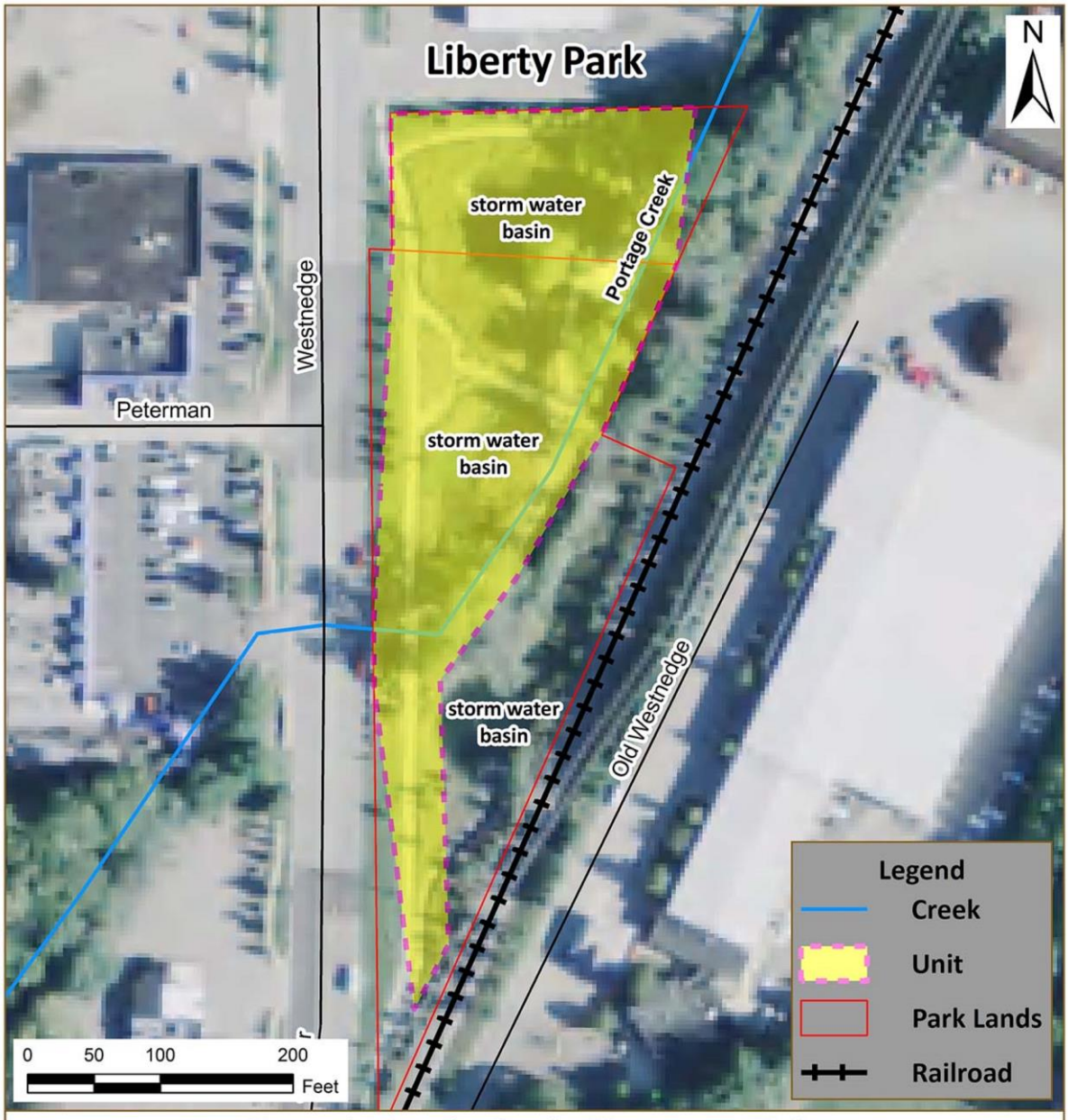

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Figure No. 11

L. Bicentennial Trail- North Section

Northern half of park, from Milham to Romence is heavily invaded with exotic shrubs. Garlic mustard is also abundant here in the ground layer. Garlic mustard is found throughout park in varying intensity. Long term control will be needed to exhaust seed bank for both invasive shrubs and ground layer plants.

The large populations of deer should be a factor when considering which plants to remove and when to plant native plants. Planting natives without protective cages may result in deer browse and project failure. Woodland edges tend to be more invaded and thickly wooded compared to interior areas of the park as well.

There is a small patch of phragmites and tree of heaven, both of which can be seen on the map. These small patches can be controlled easily if this work is undertaken soon. We recommend these projects be given first priority. The southern area of the park from Romence to Millenium Trail show good oak and maple tree coverage, as well as native Nannyberry shrubs (viburnum lentago) in shrub layer.

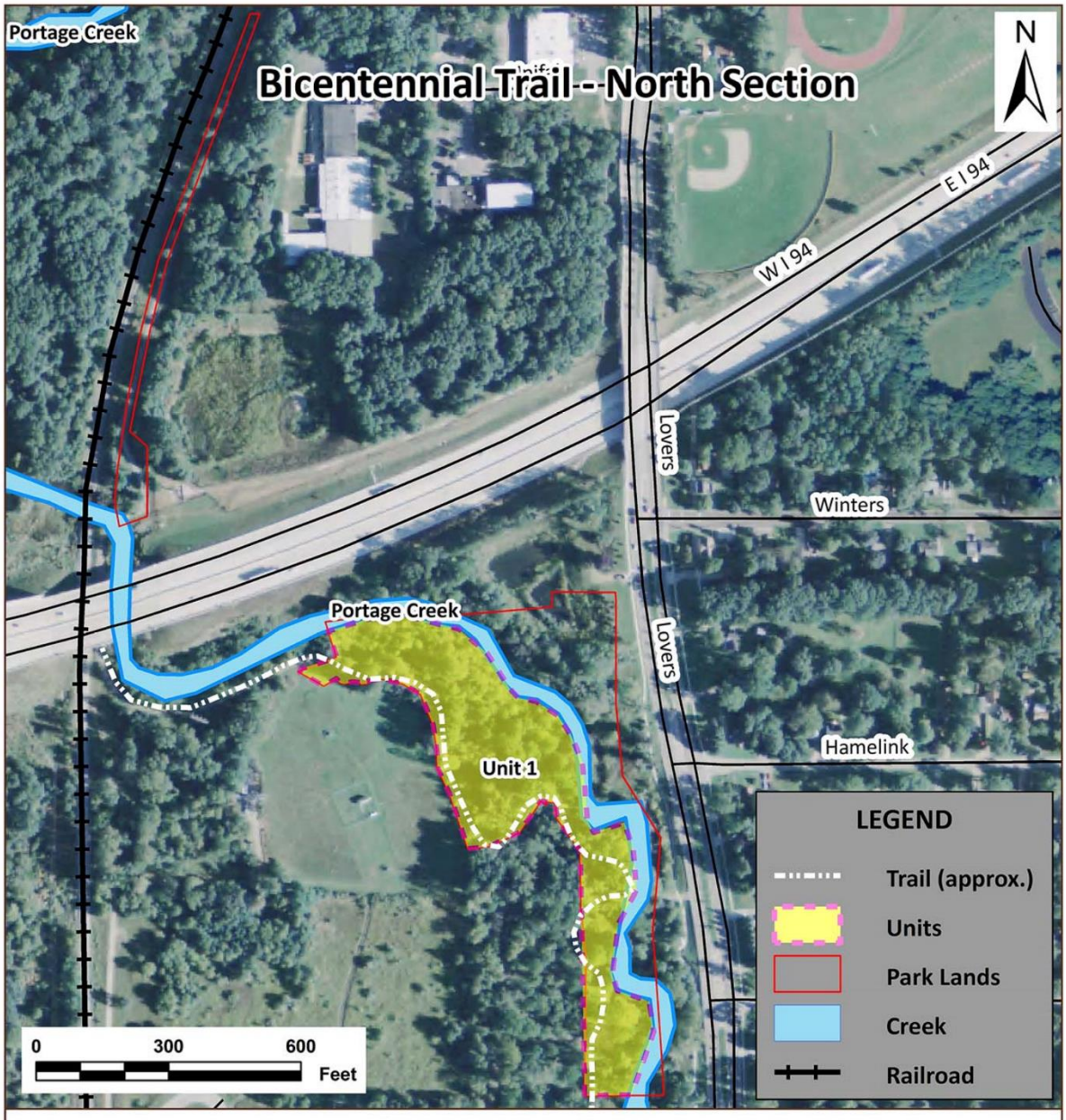

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Figure No. 12

M. Bicentennial Trail – South Section

The southern section of the trail the Norway spruce and Siberian elm are common. Prioritize native tree planting once these species are removed.

Some native trees and shrubs found here include: Burr, Red, and White oak, as well as good mature maple. A number of Tamarack trees with native understory remain on the southern end and when undertaking a major effort this area should be where invasive species removal begins. Also, focus on removing phragmites first, then cattails in this area. * Note: The map units are not solid due to an overlap of species with in the units.

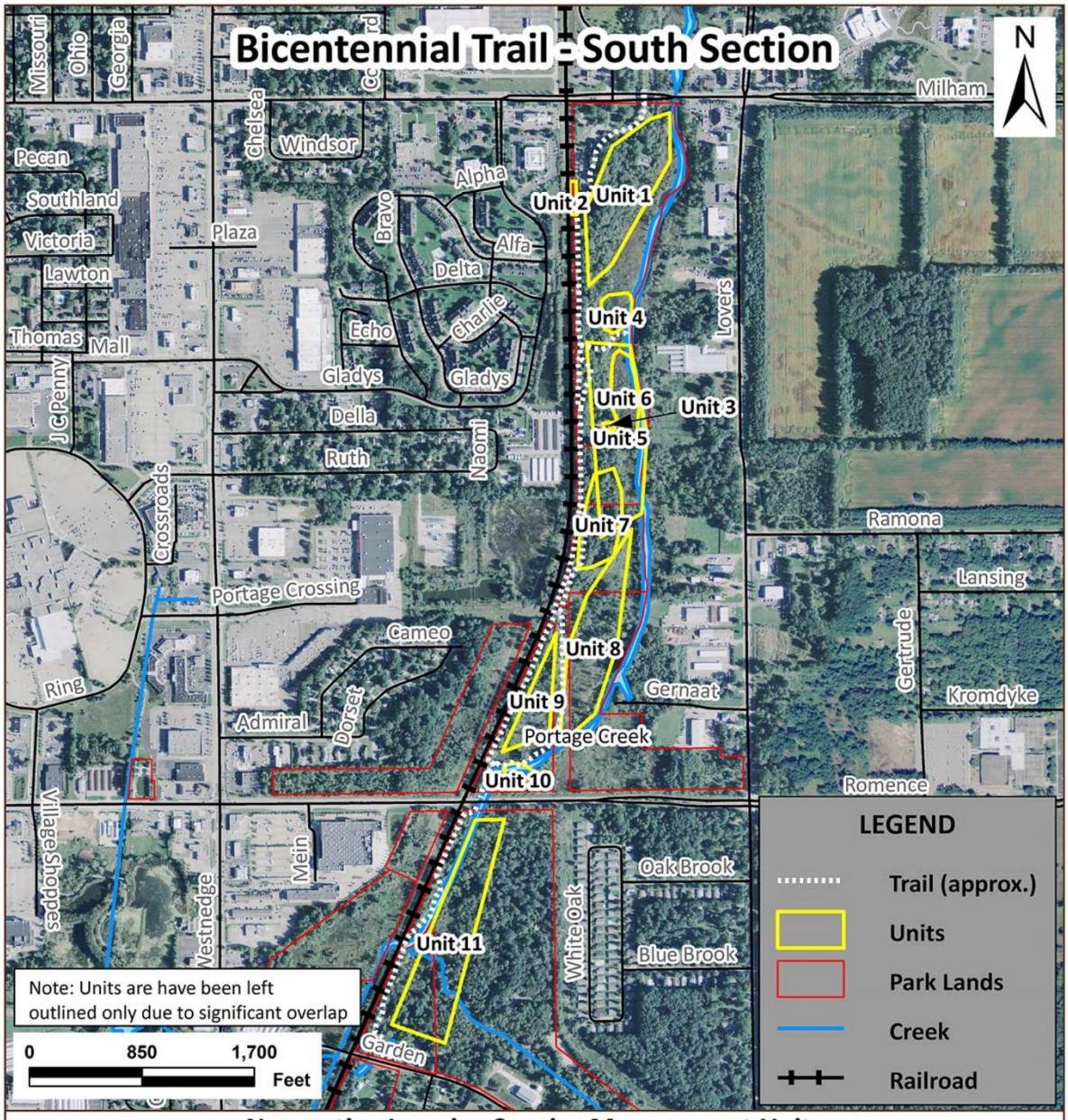

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Figure No. 13

N. South Westnedge Park

South Westnedge Park consists of four ball diamonds surrounding a building and parking on the east half with two ball diamonds, parking, a dog park and skate rink on the west half. The NNIs observed were primarily along the north boarder with adjoining private residences and along a steep slope separating the east and west halves of the park. Many instances of vines or shrubs growing on or through the fence were noted. Any removal of NNIs along the northern border should take into account that eradication may not be possible. Residence there may want plants for visual screening and/or sound barriers from the park and they may not provide access to remove NNIs on their private land. This may result in the NNIs there recolonizing the park in the near future. A small woodlot area at the west end of the north boundary has a variety of NNIs on what appears to be old fill material.

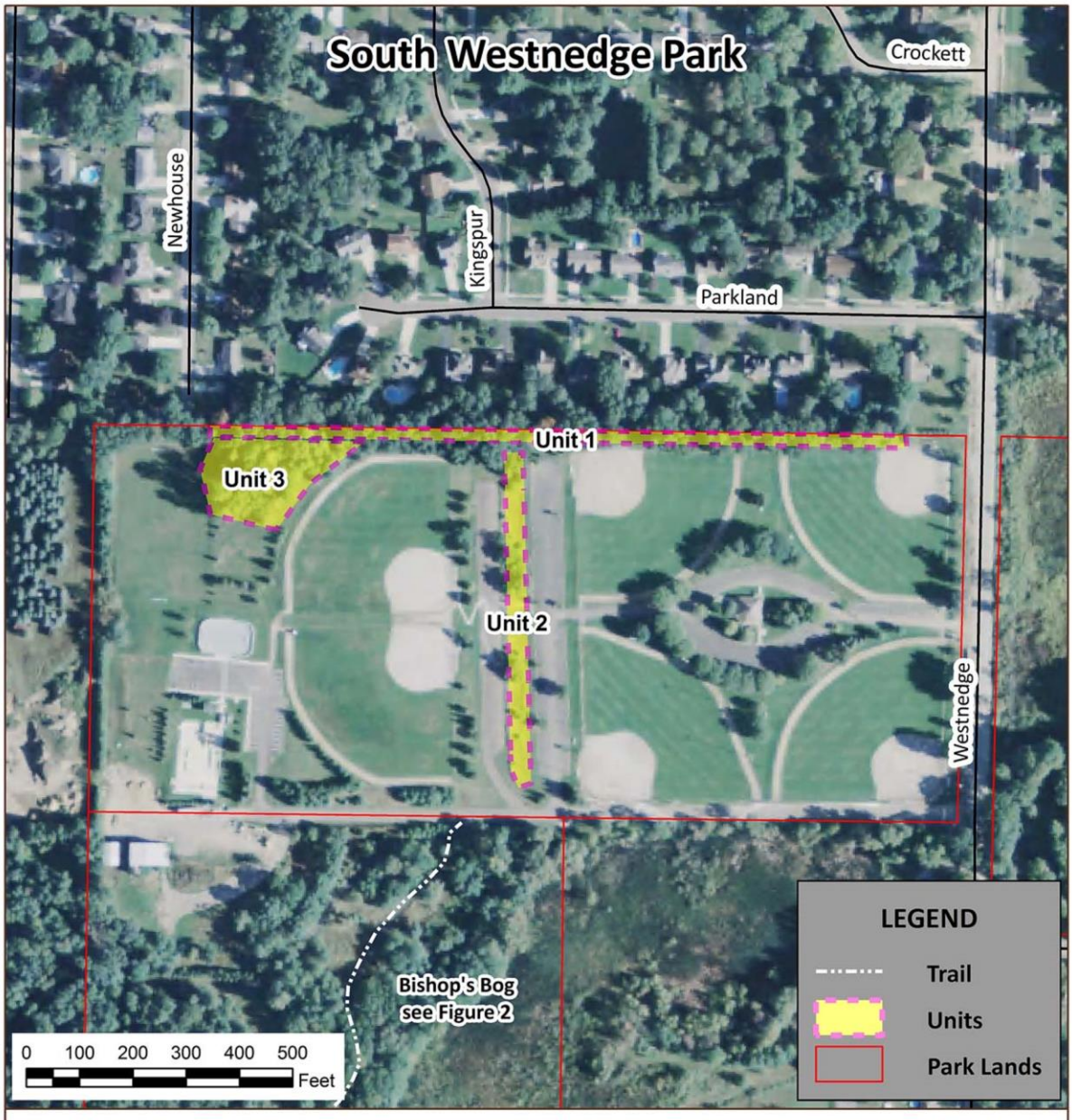

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Figure No. 14

O. Haverhill

This park is a small area which is bounded by the Bicentennial Park trail. It has a mowed area with evergreens ringing the area. There is a small oak woodlot with no understory. NNIs are found on the surrounding properties and along the trail. Keeping close watch in the oak area for encroachment by NNIs. This area should be part of the monitoring program.

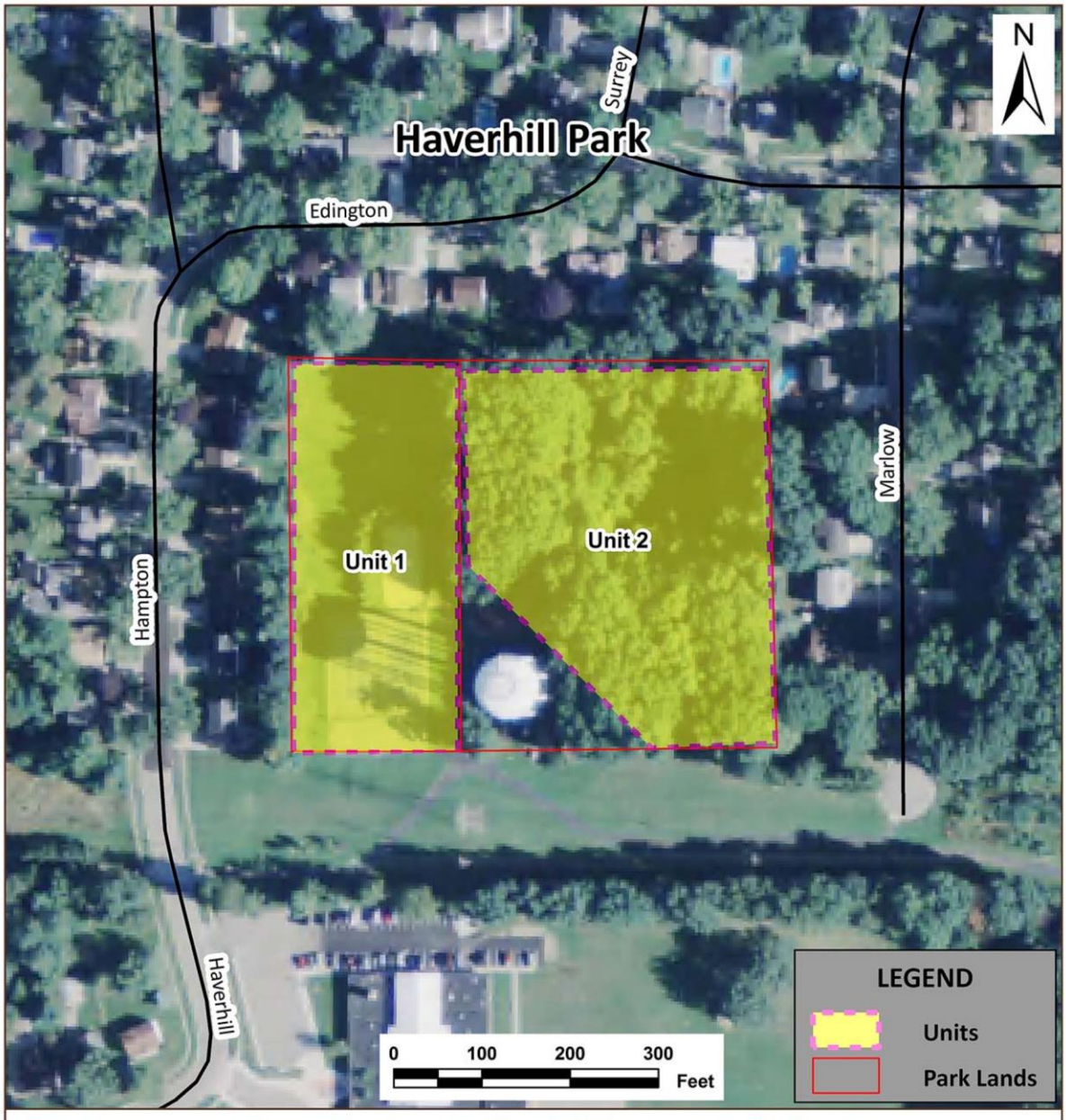

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Figure No. 15

P. Westfield- No map included

This park is predominantly mowed grass with paved walking trails and planted conifers around the border. No significant NNIs were found.

XIV. Recommendations for Invasives Removal by Park

These recommendations listed in priority as to significance as a high-quality area and ability to provide said treatment over the next 5 years. It will be important to monitor work done in the previous season or later in the same season, depending on when work is completed. Photomonitoring will allow the parks to see progress from the investment made on each of the parks. It is recommended that the concentration of effort be in Westlake, Bishop's Bog, Eliason and Schrier Parks. The other remaining parks have some areas which can be treated by current staff or small crews. Bishop's Bog has the most work needed and thus the most expensive and will take the most intensive time to complete. Westlake is listed as the first in the priority list because of it extensive amount of Oriental Bittersweet which needs to be immediately controlled and used as an educational tool to inform the public.

Monitoring before and after is imperative. This will allow the city and citizen to see the progress that has been made and monitor yearly changes. Monitoring points should be set up by a professional and park staff trained/or volunteers used to take photos and record data.

The cost estimates are based on unit acreage and percentage of species found within. Costs can vary based on which method is used, size of area, and price per unit by a professional restoration contractor. The Parks Department may choose to conduct removal in smaller units based on availably of monies and professional restoration contractors availability. Cost estimates should be reviewed annually.

These cost estimates include all equipment, preparation, travel, fuel, insurance, staff time). Estimates are based on the following:

Monitoring estimates are based on one staff at $50/hr.

Prescribed Fire estimates are based on a crew of 5 at $90/hr.

Manual Control is based on a crew of 5 at $50/hr.

Forest Cutter is based on one driver at $150/hr.

Recommendations

A. Westlake Nature Preserve

West Lake was chosen as number one in priority due to the ability to gain control of the most invasive species in quick manageable timeframe. The park can be used to educate the public about what is happening in this removal and restoration process, through social media and education open houses or walks.

The most important invasives to be removed are the Oriental bittersweet, Autumn Olive, Honeysuckle. The most cost-effective method is by Prescribed fire. Purple Loosestrife, found along the shore of West Lake and bog perimeter, should also be controlled through use of bio-control. There are some areas where if rapid response spot treatments were used immediately, it would prevent the further spread.

Year 1

Monitoring:

- **Photomonitoring point areas:** Should be set up prior to removal work to be conducted.

Professional: (staff time, materials, year 1 photos)
Cost Estimate: 8 hours x $50/hr. = $300

Removal:

- **Units 1, 2 ,3, 4, 6, 9, 11:** 16 ac **(**Autumn Olive, Oriental Bittersweet, honeysuckle)
  1. Prescribed Fire: 10 hrs. for all units combined.
     Cost Estimate: $4,500
     Or
  2. Manual Control: 70 hours

Cost estimate: $ 17,5000

- **Unit 12:** 5 ac
  Release beetles

  Cost estimate: $45 pot for 4 pots= $180, One staff ,3 hours = $150 Total = $330

Year 2

Monitoring:

- **Units 1, 2, 3, 4, 6, 9, 11:** Monitor and Spot treat burned area
- **Unit 11:** Monitor Purple Loosestrife Beetles
- **All Units:** Professional: (staff time, materials, year 1 photos)
  Cost Estimate: 8 hours x $50/hr. = $300

Removal:

Units 8,10: 13 ac (Buckthorn)
Manual: 10 hours
Cost estimate: $ 2,500

Year 3

Monitoring:

- **All Units:** Photomonitoring by one staff
  Cost Estimate: 16 hours: $800

Removal:

- **Units 5,7,8**: 10 ac (Reed Canary grass)
  Prescribe Fire:
  Cost Estimate: 10 hours: $4,500

Year 4

Monitoring:

- **All Units:** Photomonitoring by one staff
  Cost Estimate: 10 hours: $500

Removal:

- **Unit 11:** Possible reintroduction of beetles
  Cost estimate: $45 pot for 4 pots= $180, One staff ,3 hours = $150
  Total: $330

Year 5

Monitoring:

- **All Units:** Photomonitoring by one staff
  Cost Estimate: 10 hours: $500

****Note**: Garlic Mustard is found in units 9 predominately. This could be affected by the fire or could be pulled by volunteers and monitored on a yearly basis. This area is less than an acre.

A. Bishop's Bog

This preserve is in need of most intensive removal and will be the costliest. It is ranked at number 2 but is equal to the needs of West Lake Preserve. Without removal of the buckthorn ringing the preserve this unique and high-quality habitat will be lost. The removal needed could be completed through a number of methods. It also could be dissected into smaller portions based on funding.

Units 1,2: 105 ac (100% buckthorn)

Year 1
Monitoring

- **Photomonitoring point areas:** Should be set up prior to removal work to be conducted.

  Professional: (staff time, materials, year 1 photos)
  Cost Estimate: 16 hours x $50/hr. = $800

Removal
Total Cost for Units 1 and 2: $180,000. This work could be divided into yearly increments. In this scenario it has been divided into 6 years due to the high cost of

removal. Two options are proposed. Manual control or Forest Cutter. The Forest Cutter would have to be used in frozen conditions as to not damage the bog ecosystem and may limit how much can be accomplished due to amount of time the area is frozen.

Year 1:

1. Manual Control**:** 3 weeks, 12 acres removed
   Cost Estimate: $30,000
   Or
2. Mechanical: (Forest Cutter) 4 weeks,16 acres
   Cost Estimate: $24,000

Year 2

Monitoring

- **All Units:** Photomonitoring by one staff
  Cost Estimate: 16 hours: $800

Removal

3. Manual Control**:** 3 weeks, 12 acres removed
   Cost Estimate: $30,000
   Or
4. Mechanical: (Forest Cutter) 4 weeks,16 acres
   Cost Estimate: $24,000

Year 3

Monitoring

- **All Units:** Photomonitoring by one staff
  Cost Estimate: 16 hours: $800

Removal

1. Manual Control: 3 weeks, 12 acres removed
   Cost Estimate: $30,000
   Or
2. **Mechanical** (Forest Cutter) 4 weeks,16 acres

Cost Estimate: $24,000

Year 4

Monitoring

- **All Units:** Photomonitoring by one staff
  Cost Estimate: 16 hours: $800

Removal

1. **Manual Control:** 3 weeks, 12 acres removed
   Cost Estimate: $30,000
   Or
2. **Mechanical** (Forest Cutter) 4 weeks,16 acres
   Cost Estimate: $24,000

Year 5

Monitoring

- **All units:** Photomonitoring by one staff
  Cost Estimate: 16 hours: $800

Removal

1. Manual Control: 3 weeks, 12 acres removed

Bishop's Bog (cont.)

Cost Estimate: $30,000

Or

2. Mechanical: (Forest Cutter) 4 weeks,16 acres
   Cost Estimate: $24,000

Year 6

Monitoring

- **All Units:** Photomonitoring by one staff
  Cost Estimate: 16 hours: $800

Removal

1. Manual Control: 3 weeks, 12 acres removed

Cost Estimate: $30,000

Or

2. Mechanical: (Forest Cutter) 4 weeks,16 acres
   Cost Estimate: $24,000

**Note: Garlic Mustard is found in units 3, 30% of 6 ac

B. Eliason Reserve

The east boundary of the Reserve is Bishop's Bog, so a large amount of Buckthorn and Buckthorn seedlings are found there. There is also a grassland which has been taken over by Autumn olive. If this were to be removed the quality of this area would be greatly improved and add diversity to the area. Also, a large amount of Autumn olive and honeysuckle line the trail, which could be easily remove by a Forest cutter.

Year 1

Monitoring

- **Photomonitoring point areas:** Should be set up prior to removal work to be conducted.
  Professional: (staff time, materials, year 1 photos)
  Cost Estimate: 16 hours x $50/hr. = $800

Removal

- **Unit 2:** 44ac (100%Buckthorn)
  - Manual Control**:** 3 weeks, 12 acres removed
    Cost Estimate: $30,000

    Or
  - Mechanical: (Forest Cutter) 4 weeks,16 acres
    Cost Estimate: $24,000
- **Unit: 3,5:** 14 ac (95%Autumn olive, honeysuckle)
  1. Mechanical: (Forest Cutter) 4 weeks,16 acres
     Cost Estimate: $24,000

Year 2

Monitoring

- **All Units:** Photomonitoring by one staff
  Cost Estimate: 16 hours: $800

Removal

- **Units 3,5:**
  1. Mechanical: (Forest Cutter) 4 weeks,16 acres
     Cost Estimate: $24,000

Year 3

Monitoring

- **All Units:** Photomonitoring by one staff
  Cost Estimate: 16 hours: $800

Removal

- **Units 3,5:**
  2. Mechanical: (Forest Cutter) 4 weeks,16 acres
     Cost Estimate: $24,000

Year 4

Monitoring

- **All Units:** Photomonitoring by one staff
  Cost Estimate: 16 hours: $800

Removal

- **Unit 1**: spot treat Autumn olive, Japanese Barberry
- **Unit 6**: Remove Red Pines

Year 5

Monitoring

- **All Units:** Photomonitoring by one staff
  Cost Estimate: 16 hours: $800

Removal

- **Units 4:** 18 ac (20% Autumn olive, honeysuckle)

C. Schrier Park

The park has Buckthorn, Multiflora rose, honeysuckle and Autumn olive as the dominate invasives. They are in high densities within the units.

Year 1

Monitoring:

- **Photomonitoring point areas:** Should be set up prior to removal work to be conducted.

Professional: (staff time, materials, year 1 photos)
Cost Estimate: 16 hours x $50/hr. = $800

Removal:

- **Unit 3:** 0.66ac (100% Oriental bittersweet)
  Manual Control: 10 hours
  Cost Estimate: $ 2,500

- **Unit 2:** 2 acres (100% Buckthorn)
  Manual Control: 20 hours
  Cost Estimate: $ 5000

Year 2:

- **All Units**: Photomonitoring
  Cost estimate: $400
- **Unit 5:** 5 ac (85 % Buckthorn, Multiflora rose, honeysuckle)
  Manual Control: 40 hours
  Cost Estimate: $10,000

Year 3:

- **All Units**: Photomonitoring:
  Cost estimate: $400
- **Unit 1:** 5 ac. (35 % Buckthorn, Multiflora rose)

Manual Control: 10 hours

Cost Estimate: $ 2,500

Year 4:

- **All Units**: Photomonitoring
  Cost estimate: $400
- **Unit 4:** 6 ac (40% Buckthorn, Multiflora rose, honeysuckle)
  Manual Control: 15 hours
  Cost estimate: $3,750

Year 5:

- **All Units**: Photomonitoring
  Cost estimate: $400

**Note: Garlic Mustard is found in unit 4 with 20% of 6 ac. Coverage. This could be pulled by volunteers and monitored on a yearly basis.

Additional Parks

The remaining parks estimates have not been included. From the assessment these top 4 parks, due to their high quality, should be the focus of your removal of invasive species.

In the other parks, park staff could become proficient in identifying and removing individual plants and small areas of invasives. The maps and the corresponding unit percentages chart can lead them to these areas and individuals.

The invasive species found in the parks listed below could be treated as time and resources allow.

D. Lakeview

- **Units 1,2,3, 4:** 1 ac (90% Bittersweet, Autumn Olive)10 hours: $1250
- **Units 5:** Purple Loosestrife: release beetles 2 pots x $45/pot = $90
- **Unit 6:** (25% Buckthorn) 5hours= $1,250
- **Unit 7:** Spotted Knapweed: mow weekly

The remaining parks (Lexington Green, Ramona, Oakland Drive, Harbor West, Central,
Liberty, Bicentennial trail (North and South), South Westnedge, Haverhill and Westside Parks have invasives but in small proportions and the nature of their use and management at this time does not need to be a high priority.

XV. References

Books, Pubications, URL:

Extension, Michigan Natural Features Inventory. "A Field Identification Guide to Invasive Plants in Michigan's Natural Communities.Michigan". State University, 2009.
https://mnfi.anr.msu.edu/invasive-species/InvasivePlantsFieldGuide

Michigan Department of Agriculture and Rural Development Michigan Department of Environmental Quality Michigan Department of Natural Resources Michigan Department of Transportation In Consultation and Partnership with Other Interested Parties. "Michigan's Terrestrial Invasive Species State Management Plan**".** Michigan Department of Natural Resources. 2013.

https://www.michigan.gov/documents/dnr/Terrestrial_invasivesp_plan_618659_7.pdf

Michigan Natural Feature Inventory- Specific species listing
http://www.misin.msu.edu/facts

Wisconsin Department of Invasive Species Resources:
https://dnr.wi.gov/topic/Invasives/, (2018)
https://dnr.wi.gov/topic/Invasives/publications.html, (2018)

Chemical Treatments:
Michigan Natural Features Inventory
https://mnfi.anr.msu.edu/invasive-species (2018)

Renz, Mark (2013), "Herbicide effectiveness on invasive plants in Wisconsin". (A3893), *https://learningstore.uwex.edu/Assets/pdfs/A3893.pdf,*
University of Wisconsin Extension Cooperative Extension.

Grazing:

U.S. Fish and Wildlife Service, Managing Invasive Plants: Concepts, Principals and Practices.
http://www.fws.gov/invasives/staffTrainingModules/methods/grazing/.htm

Salter, Michael, MacDonald, Eric, Richardson, Zackary "Prescribes Goat Grazing in Urban Settings : A Pilot Study of the Legal Framework in Nine Cities". University of Georgia, College of Environment and Design, 105A Denmark Hall, Athens, GA, 30602.

Monitoring:

Monitoring and Measuring Plant Populations, Bureau of Land Management
https://www.blm.gov/nstc/library/pdf/MeasAndMon.pdf

U.S. Fish and Wildlife. "A Weed Manager's Guide to Remote Sensing and GIS — Mapping & Monitoring"
https://www.fs.fed.us/eng/rsac/invasivespecies/mapping_main.htm

XVI. Appendices

Appendix A List of Organizations as Resources

- **BCK CISMA Barry Calhoun and Kalamazoo Counties Cooperative Invasive Species Management Area:** https://www.michiganinvasives.org/bckcisma/
- **Michigan Invasive Species Network(MISN):** https://www.misin.msu.edu/
- **Michigan Natural Features Inventory(MNFI):** https://www.msue.msu.edu/mnfi
- **Michigan Department of Nature Resources(MDNR): Invasive species information:**www.michigan.gov/invasives
- **Wisconsin Department of Natural Resources (WDNR):** https://dnr.wi.gov/topic/Invasives/
- **Southwest Michigan Land Conservancy (SWMLC):** https://www.swmlc.org
- **Kalamazoo Nature Center(KNC):** https://www.NatureCenter.org
- **Wild Ones:** https://www.wildones.org/connect/chapters/michigan-chapters/
- **Western Michigan University Natural Areas Department:** https://wmich.edu/facilities/landscape/natural-areas

Appendix B

Species of Highest Threat Statewide

Invasive Species "Watch List"

The invasive species included on the watch list are priority species that have been identified as posing an immediate and significant threat to Michigan's natural resources. These species have either never been confirmed in Michigan or have very limited distribution or are localized.

Early detection and timely reporting of occurrences of these species is crucial for increasing the likelihood of stopping an invasion and limiting negative ecological and economic impacts.

Insects and Tree Diseases (Tree diseases list the scientific name for the pathogen or fungus associated with the disease)

- Asian longhorned beetle (*Anoplophora glabripennis*)

- Balsam wooly adelgid *(Adelges piceae)*

- Hemlock wooly adelgid (*Adelges tsugae*)

- Thousand cankers disease (*Geosmithia morbida*)

Terrestrial Plants

- Asiatic sand sedge (*Carex kobomugi* Ohwi)

- Chinese yam (*Dioscorea oppositifolia* L.)

- Himalayan balsam (*Impatiens glandulifera*)

- Japanese stiltgrass (*Microstegium vimineum* (Trin.) A. Camus)

- Kudzu (*Pueraria montana* var. *lobata*)

- Mile-a-minute weed (*Persicaria perfoliata*)

Aquatic Animals

- Red swamp crayfish (*Procambarus clarkii*)

- New Zealand mud snail (*Potamopyrgus antipodarum)*

Appendix C Treatment Matrix

Scientific Name	Common Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Frangula alnas/R	Glossy Buckthorn	Cci	Cci		Nfp	Nfp	Mh, Nfp, C	Mh, Nfp, C	Mh, Nfp, C	Mh, Nfp, C	Mh, Ccki	Mh, Ccki	Mh, Ccki
Hamnuscathartica	Common Buckthorn	Cci	Cci		Nfp	Nfp	Mh, Nfp, C	Mh, Nfp, C	Mh, Nfp, C	Mh, Nfp, C	Mh, Ccki	Mh, Ccki	Mh, Ccki
Celastrus orbiculatus	Oriental Bittersweet	Cc	Cc		Np	Np	Np, Cfc	Np, Cfc	Np, Cfc	Cck	Cck	Cck	Cck
Lonicera spp.	Inv. Honeysuckle Spp.	Cci	Cci		Nfp	Nfp	Nfp, Cfcgki	Nfp, Cfcgki	Nfp, Cfcgki	Nfp, Ccgki	Ccki	Ccki	Ccki
Berberis thunbergii	Japanese barberry												
Alliaria petiolata	Garlic Mustard	Cf	Cf	Cf	Mh	Mh	Mh					Cf	
Centaurea maculosa	Spotted Knapweed	Cf	Cf	P	P	Cf	Cbf, Mhs	Cbf, Mhs	Cbf, Mhs	Cf, Mhs	Cf, Mhs		
Cirsium arvense	Canada Thistle						Msh, Cf	Msh, Cf	Msh, Cf	Msh, Cf			
Coronilla varia	Crown Vetch				Cf	Cf	Cf						
Elaeagnus umbellata	Autumn Olive	Cc	Cc				Cc	Cc	Cc	Cc	Cc	Cc	
Lythrum salicaria	Purple Loosestrife						Cbcf	Cbcf	Cbcf	Cbcf			
Melilotus alba	W. Sweet Clover						Mb	Mh	Mbh				
Phragmites australis	Giant Reed								Cbf	Cbf			
Robinia pseudoacacia	Black Locust	Cd	Cd				Cd	Cd	Cd	Cd	Cd	Cd	
Rosa multiflora	Multiflora Rose	Cc	Cc	P	P	Cc	Cc	Cc	Cc	Cc	Cc	Cc	
Morus alba	White Mulberry			Ccd	Ccd	Ccd	Ccd	Ccd	Ccd	Ccd	Ccd	Ccd	

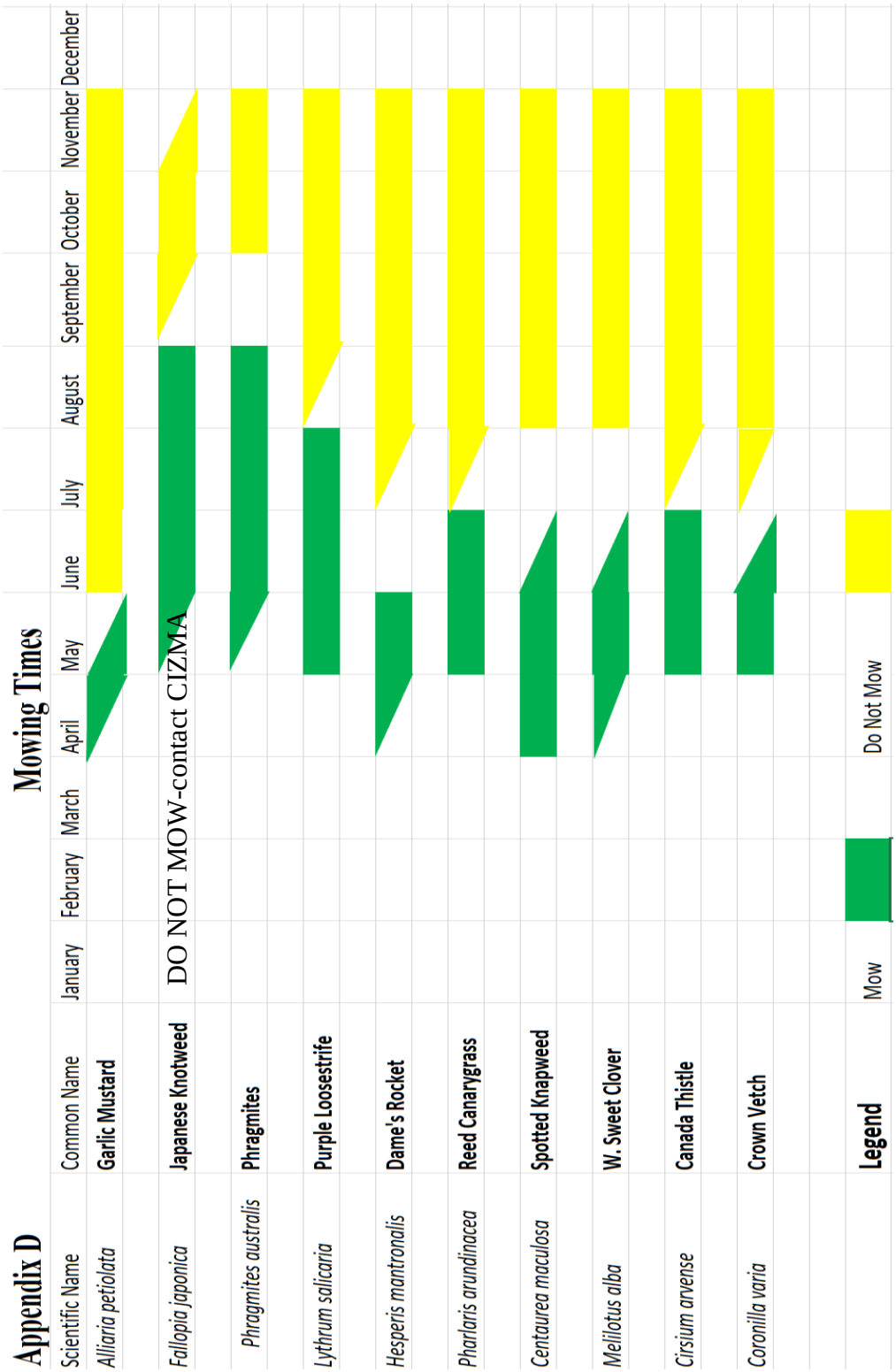
P= Prescribed burn

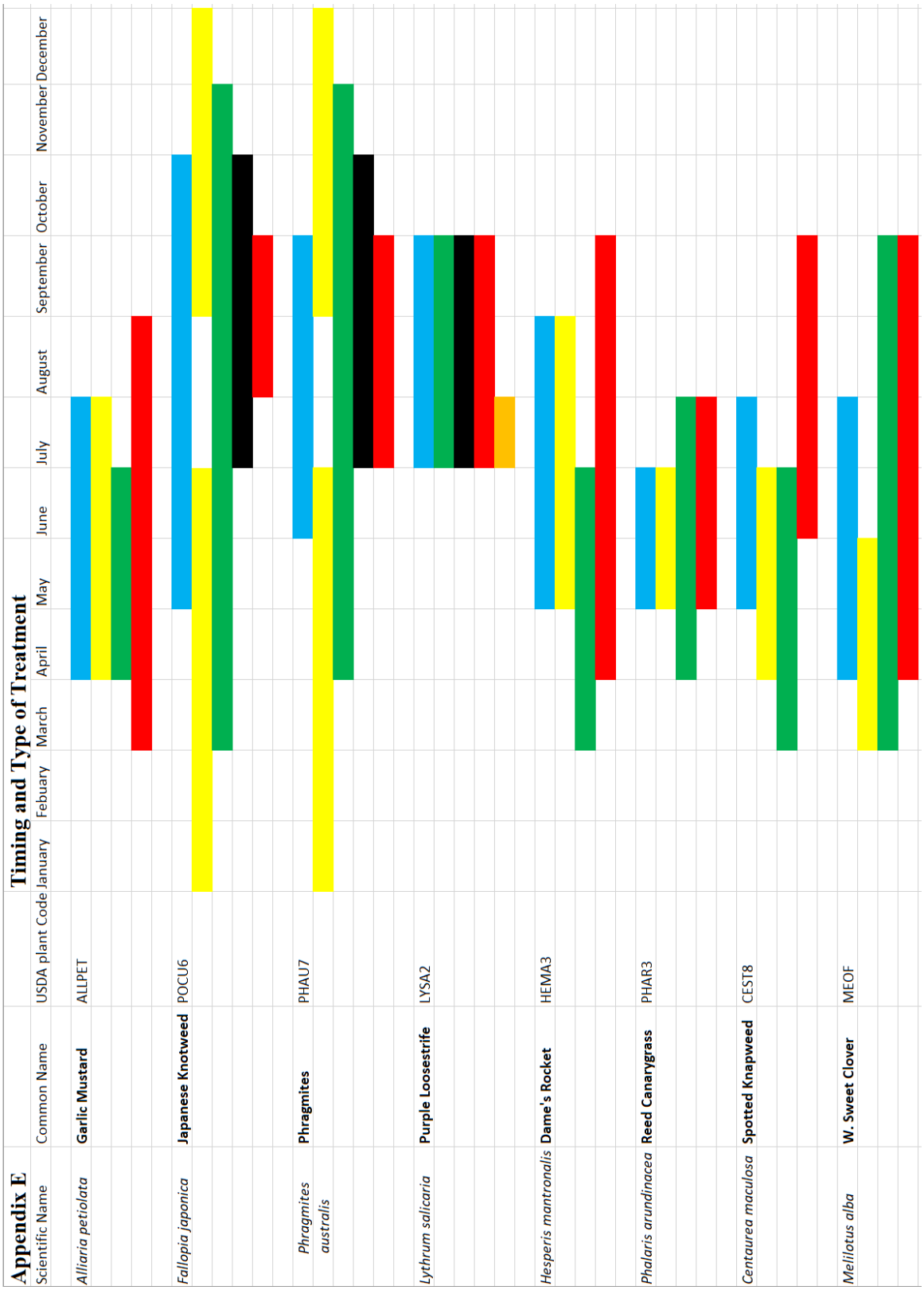
M = Mechanical; b = cut @ b=cut @ base h= hand pulling, s = cut below soil level M = Mowii, M=mow

C = Chemical; b = bloody glove, c = cut stump treatment, f = foliar spray, i = injector gun

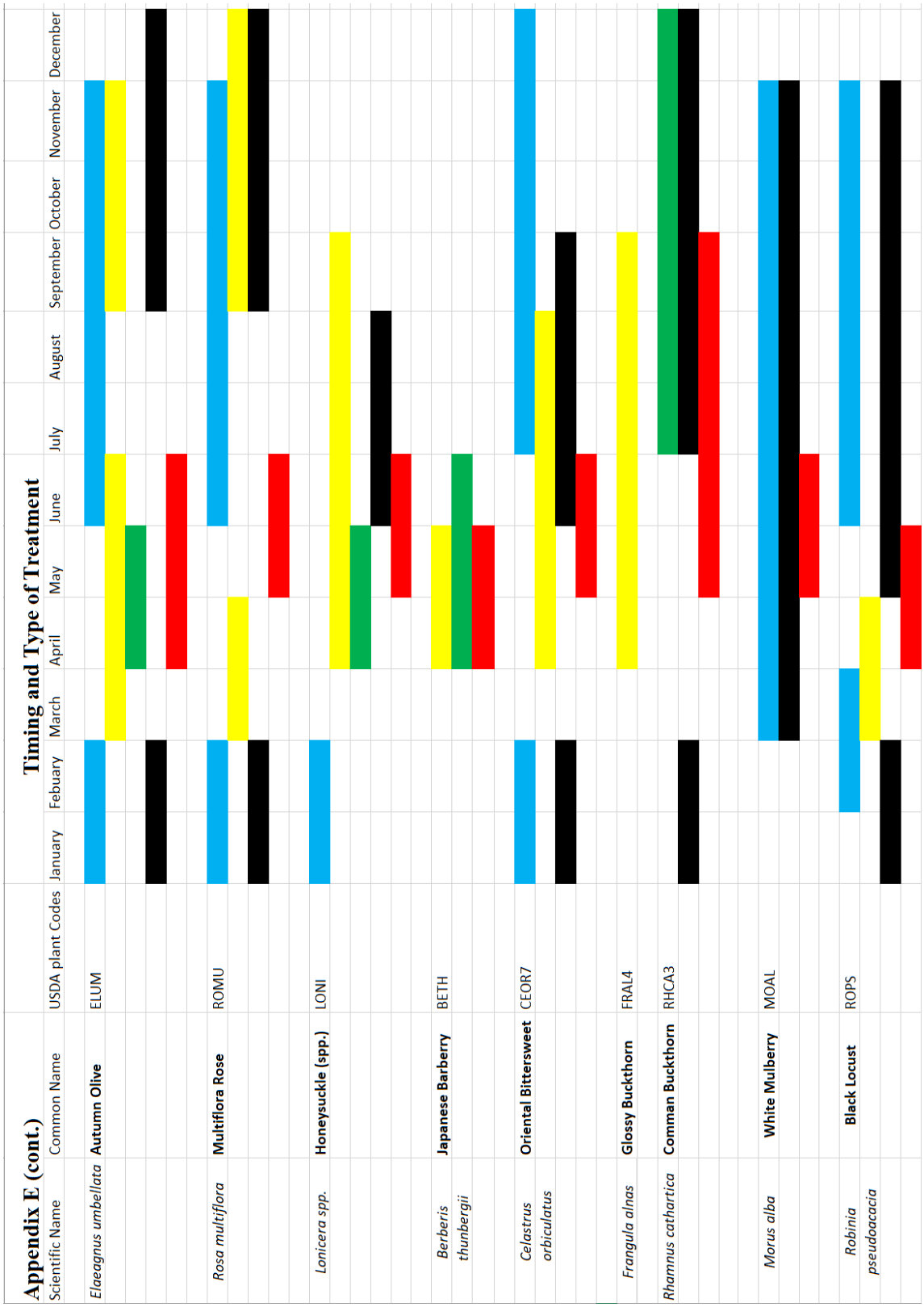
g= girdle, k = basel bark

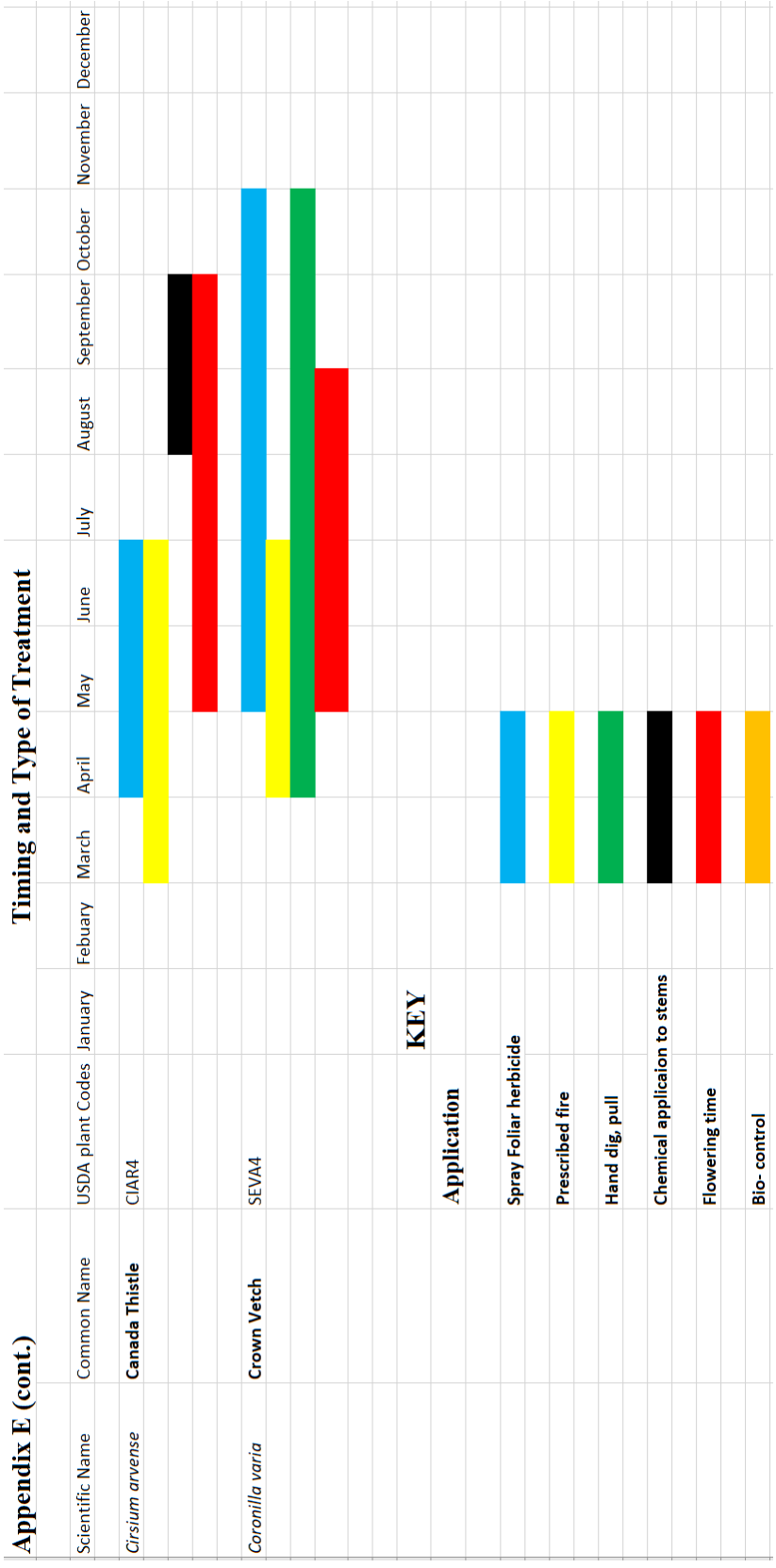
N = Natural Process; p = prescribed fire; f = flooding; g = grazing


Appendix D
Mowing Times
Scientific Name
Common Name
January
February
March
April
May
June
July
August
September
October
November
December
Alliaria petiolata
Garlic Mustard
Fallopia japonica
Japanese Knotweed
DO NOT MOW-contact CIZMA
Phragmites australis
Phragmites
Lythrum salicaria
Purple Loosestrife
Hesperis mantronalis
Dame's Rocket
Pharlaris arundinacea
Reed Canarygrass
Centaurea maculosa
Spotted Knapweed
Meliotus alba
W. Sweet Clover
Cirsium arvense
Canada Thistle
Coronilla varia
Crown Vetch
Legend
Mow
Do Not Mow


Appendix E
Timing and Type of Treatment
Scientific Name
Common Name
USDA plant Code
January
Febuary
March
April
May
June
July
August
September
October
November
December
Alliaria petiolata
Garlic Mustard
ALLPET
Fallopia japonica
Japanese Knotweed
POCU6
Phragmites australis
Phragmites
PHAU7
Lythrum salicaria
Purple Loosestrife
LYSA2
Hesperis mantronalis
Dame's Rocket
HEMA3
Phalaris arundinacea
Reed Canarygrass
PHAR3
Centaurea maculosa
Spotted Knapweed
CEST8
Melilotus alba
W. Sweet Clover
MEOF

Appendix E (cont.)




Appendix E (cont.)
Timing and Type of Treatment
Scientific Name
Common Name
USDA plant Codes
January
Febuary
March
April
May
June
July
August
September
October
November
December
Cirsium arvense
Canada Thistle
CIAR4
Coronilla varia
Crown Vetch
SEVA4
KEY
Application
Spray Foliar herbicide
Prescribed fire
Hand dig, pull
Chemical applicaion to stems
Flowering time
Bio- control

Appendix F

Appendix F Species and Percentage of NNI by Park

Park	Unit	Acres	honeysuckle LONIC_perc	multiflora rose ROMU_perc	glossy buckthorn FRAL4_perc	common buckthorn RHCA3_perc	Oriental bittersweet CEOR7_perc	garlic musterd ALLPET_perc	tree-of-heaven AIAL_perc	spotted knapweed CESTS_perc	Siberian elm ULPU_perc	Japanese knotweed POCU_perc	periwinkle VINCA_perc
Bicentennial - Nor	1	5.02	10	20	25	5	20						
Bishop's Bog	1	103			50-75								
	2	2.04			100								
	3	5.99	5					30	2		2	1	1
S Westnedge	1	0.67	20			5	50						
	2	0.52	25	1				2	25	30	50		1
	3	0.76	20	10			2	2	10		30		
Lexington Green	1	1.55		5	50	10							
	2	1.89	10	5		10		5	2		5		
	3	1.84	10	2									
Liberty	1	1.84	5	1		2				1	75		
Harbors West	1		individuals only of any species w/ yellow highlight										
Ramona	1	9.6	50	20		1	10	10				3	15
	2	2.21	60	20			1						15
	3	6.29	75		1	1	1	5			1	3	5
	4	0.65					1				5		
Schrier	1	5.57		5	30								
	2	2.25			100								
	3	0.69		10	30		100						
	4	5.77	5	10	20	5		20					
	5	5.02	40	25	20								
	6	1.14	10	5			1						5
Haverhill	1	1.88											
	2	2.9											
Bicentennial - Sou	1	9.78	75	75	75			90					
	2	0.3											
	3	0.1							25				
	4	1.3						100					
	5	11.4	75	75	75			90					
	6	2.45			25			90					
	7	4.2			75								
	8	8.73		75	75								
	9	3.06		90				90			40		
	10	0.8											
	11	12.4	75	50	75								
Central	1	0.15											
	2	3.32											
	3	3.64											
Oakland	1	0.33	10										
	2	1.89		75	75		75						
	3	0.21											
	4	0.1								50			
Eliason	1	18											
	2	44.2			100								
	3	10.9											
	4	18.1		10	1		1						
	5	3.52	20				20						
	6	2.07											
West Lake	1	1.62											
	2	1.63					20						
	3	2.3					80						
	4	2.61					75						
	5	6.58											
	6	2.57					95						
	7	5.85					Upland RR						
	8	7.96			20								
	9	3.16					50	15					
	10	5.47			10								
	11	1.45		5			30						
	12	3.28											
Lakeview	1	0.1											95
	2	0.15					95						
	3	0.36					85						5
	4	0.09					10						
	5	0.48											
	6	0.68			25								
	7	0.01								10			

Park	Unit	purple loosestrife LYSA2_perc	autumn olive ELUM_perc	jetbead RHOSCA_p	lily of the valley COMA7_p	English ivy HEHE_perc	privet LIVU_perc	Japanese barberry BETH_perc	forsythia FORSY_perc	reed canary grass PHAR3_perc	black locust ROPS_	commo n reed PHAUA7_perc
Bicentennial	1		2				2	2		2		
Bishop's Bog	1											
	2											
	3										5	
S Westmedge	1		2									
	2											
	3		50					1			10	1
Lexington G	1											
	2											
	3						1					
Liberty	1	1	1									1
Harbors Wes	1											
Ramona	1		10	2	1			1	1			
	2	1	5		1							
	3		2		1							
	4	5										
Schrier	1											
	2											
	3											
	4		5			1						
	5		10					1				
	6											
Haverhill	1											
	2											
Bicentennial	1											
	2											100
	3											
	4											
	5	40					75			90		
	6	25										
	7		75				75					
	8									95		15
	9											
	10											10
	11		50				75					
Central	1									90		
	2											
	3									75		
Oakland	1		10									
	2					75	75	75				
	3					75						
	4											
Eliason	1		5					1				
	2											
	3		75									
	4		10									
	5											
	6											
West Lake	1		10									
	2		40									
	3		20									
	4											
	5									40		
	6											
	7									100		
	8									50		
	9		10									
	10											
	11	10										
	12	90										
Lakeview	1											
	2	40										
	3											
	4											
	5	85										
	6											
	7											

Appendix G USDA Plant Codes

COMMON NAME	GENUS	SPECIES	SCI NAME	CODE
Purple loosestrife	Lythrum	salicaria	*Lythrum salicaria*	LYSA2
Oriental bittersweet	Celastrus	orbiculatus	*Celastrus orbiculatus*	CEOR7
Common buckthorn	Rhamnus	*cathartica*	*Rhamnus cathartica*	RHCA3
Glossy buckthorn	Frangula	alnus	*Frangula alnus*	FRAL4
honeysuckle	Lonicera	spp.	*Lonicera spp.*	LONI
Garlic mustard	Alliaria	petiolata	*Alliaria petiolata*	ALLPET
Autumn olive	Elaeagnus	umbellata	*Elaeagnus umbellata*	ELUM
lily of the valley	Convallaria	majalis	*Convallaria majalis*	COMA7
Jetbead	Rhodotypos	scandens	*Rhodotypos scandens*	RHOSCA
Siberian elm	Ulmus	pumila	*Ulmus pumila*	ULPU
Tree-of-heaven	Ailanthus	altissima	*Ailanthus altissima*	AIAL
Multiflora rose	Rosa	multiflora	*Rosa multiflora*	ROMU
English ivy	Hedera	helix	*Hedera helix*	HEHE
Japanese knotweed	Polygonum	cuspidatum	*Polygonum cuspidatum*	POCU6
Spotted knapweed	Centaurea	stoebe	*Centaurea stoebe*	CEST8
Periwinkle	Vinca	spp.	*Vinca spp.*	VINCA
Japanese Barberry	Berberis	thunbergii	*Berveris thunbergii*	BETH
red pine	Pinus	resinosa	*Pinus resinosa*	PIRE
Reed Canary Grass	Phalaris	arundinacea	*Phalaris arundinacea*	PHAR3