memo

Project Name |	PLOC Channel & Vegetation Inspections	**Date** |	1/05/2021
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From / Contact info |	Mike Majeski		
Regarding |	Channel and Vegetation Inspections – 2020 Summary		

Background

The Prior Lake Outlet Channel (PLOC) has been routinely inspected twice annually, typically in the spring and fall, to document the channel condition, survey debris and log jams, and inspect culverts and road crossings for obstructions of flow. Starting in the fall of 2017, a vegetation assessment was conducted concurrently with the channel inspection to assess previously managed areas for target invasive plant species and search for any satellite populations of noxious weeds growing within the PLOC easements. Following the assessment, recommendations have been provided to address specific populations of noxious weeds growing along the outlet channel.

Methodology

The PLOC was assessed on foot from Segment 1 to Segment 7 on May 15, July 2, and September 28, 2020. Segment 8, which is under management by the United States Fish & Wildlife Service, was not assessed. Segment 5B was also not assessed due to the forthcoming Segment 5 Re-Meandering Project proposed by the City of Shakopee. For the spring and fall assessments, a series of photographs were taken in each segment to characterize the condition of the outlet channel, assess any new areas of bank erosion, and document any obstructions to flow such as down trees, debris jams, or culvert blockages. All images were collected working upstream to downstream in each segment to aid in channel reference. Due to the size and volume of images collected for this assessment, only the most relevant images pertaining to the channel condition were included in this memo. All other images collected for this effort were transferred to District staff (Jaime Rockney) via shared Microsoft® OneDrive links.

Per the Minnesota Noxious Weed Law (Minnesota Statutes 18.75-18.91), noxious weeds were surveyed along the PLOC during the channel inspections to help guide early detection and management of satellite populations of noxious weeds, particularly those species know to occur along the PLOC, including purple loosestrife (*Lythrum salicaria*), wild parsnip (*Pastinaca sativa*), spotted knapweed (*Centaurea stoebe*), Canada thistle (*Cirsium arvense*), and leafy spurge (*Euphorbia virgata*). The vegetation surveys targeted only noxious and early detection invasive species such as those found in the Minnesota Department of Agriculture list of noxious weeds and the Minnesota Department of Natural Resources list of terrestrial invasive species. Common non-native species such as lamb's quarters (*Chenopodium album*) common dandelion (*Taraxacum officinale*), common burdock (*Arctium minus*), velvetleaf (*Abutilon theophrasti*), broadleaf plantain (*Plantago major*), white clover (*Trifolium repens*), and other naturalized weeds were not assessed. For the vegetation assessments, a handheld Trimble GeoXH GPS unit was used to survey the locations of satellite populations of noxious weeds. Appendix A includes a summary of vegetation

management conducted in 2020 by Applied Ecological Services (AES) and Appendix B includes recommendations for continued channel and vegetation management in 2021.

Results

Segment 1 – Channel Condition

FEMA-funded bank repairs completed in 2019 included repair of boulder cross vanes, two bridge abutments near Jeffers Elementary School, and installation of boulder toe along previously eroded stream banks. However, the repaired cross vanes were not keyed into the bank sufficiently, resulting in flows around the sides of the vanes during high flow events. Downstream of the walking bridge, a 10-foot gap in the installed boulder toe has resulted in toe erosion and sloughing of the upper bank (Figure 1). There appears to be sufficient rock in the immediate vicinity to repair this bank without the need to import additional rock. In addition, bank erosion continues to occur along the right bank just upstream of the walking path at Fountain Hills Road (Figure 2). It is recommended the boulder toe rock be extended to the walking path culvert. Downstream of the walking path, the boulder cross vane has failed and has caused bank erosion along the right bank (Figure 3). It is recommended the cross vane be rebuilt with the low point of the cross vane in the center of the channel and the right wing of the vane keyed into the right bank a minimum of 3 feet to prevent flows from bypassing the vane.

Minor channel obstructions were observed in the same areas identified in previous surveys including several large tree trunks and branches found lying across and within the channel in the wooded area just upstream of County Road 42, and a small beaver dam located just downstream of Fountain Hills Road (Figure 4).

Segment 1 – Target Invasive Species

Several black locust (*Robinia pseudoacacia*) saplings continue to grow along the paved walking path west of Jeffers Pond Elementary School. Patches of wild parsnip persist in the areas managed in 2019 including the grassy area southwest of the intersection of Jeffers Pass NW and Eagle Creek Avenue, the area north of Fountain Hills Road, and in the grassy opening northeast of Chickadee Landing on Jeffers Pond Elementary property. In addition, Japanese hedge parsley (*Torilis japonica*) was discovered just north of Jeffers Pass during the July inspection. AES treated the wild parsnip in June & July, and hand-cut and removed Japanese hedge parsley seed heads in September. The patches of wild parsnip and Japanese hedge parsley should be closely monitored in the spring/early summer of 2021 to determine if any new plants exist in the area. Any young plants located should be treated with herbicide with follow-up inspections and treatments conducted in early July to prevent the plants from maturing and producing seed. Figure 5 and

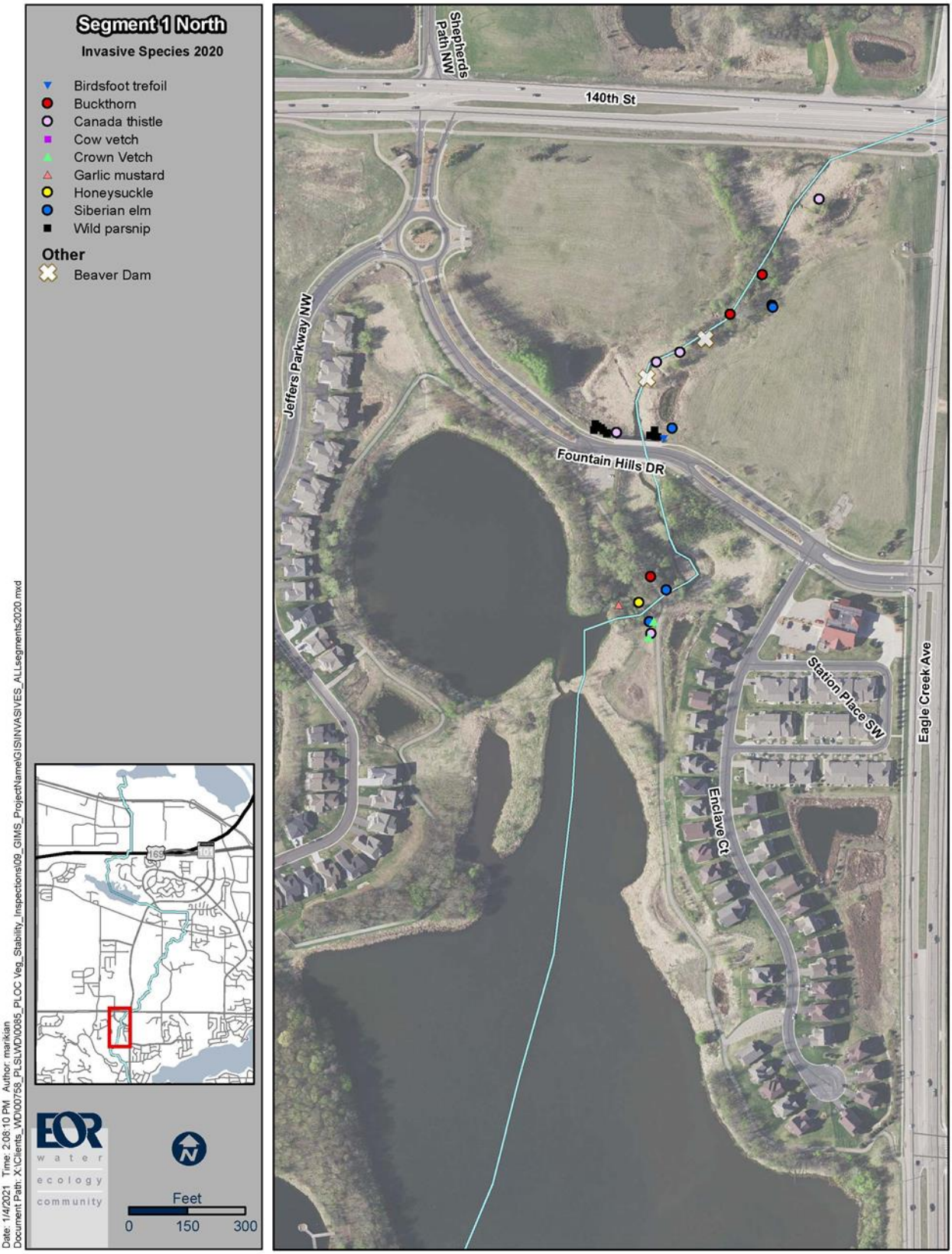

Figure 6 show the locations of target invasive species identified in this segment.

Figure 1. Gap in boulder toe near Jeffers Pond Elementary School

Figure 2. Bank erosion along right bank downstream of installed boulder toe

Figure 3. Failed cross vane downstream of the walking path, upstream of Fountain Hills Road

Figure 4. Beaver dam in channel downstream of Fountain Hills Road

Figure 5. Target invasive species along Segment 1 (South half)

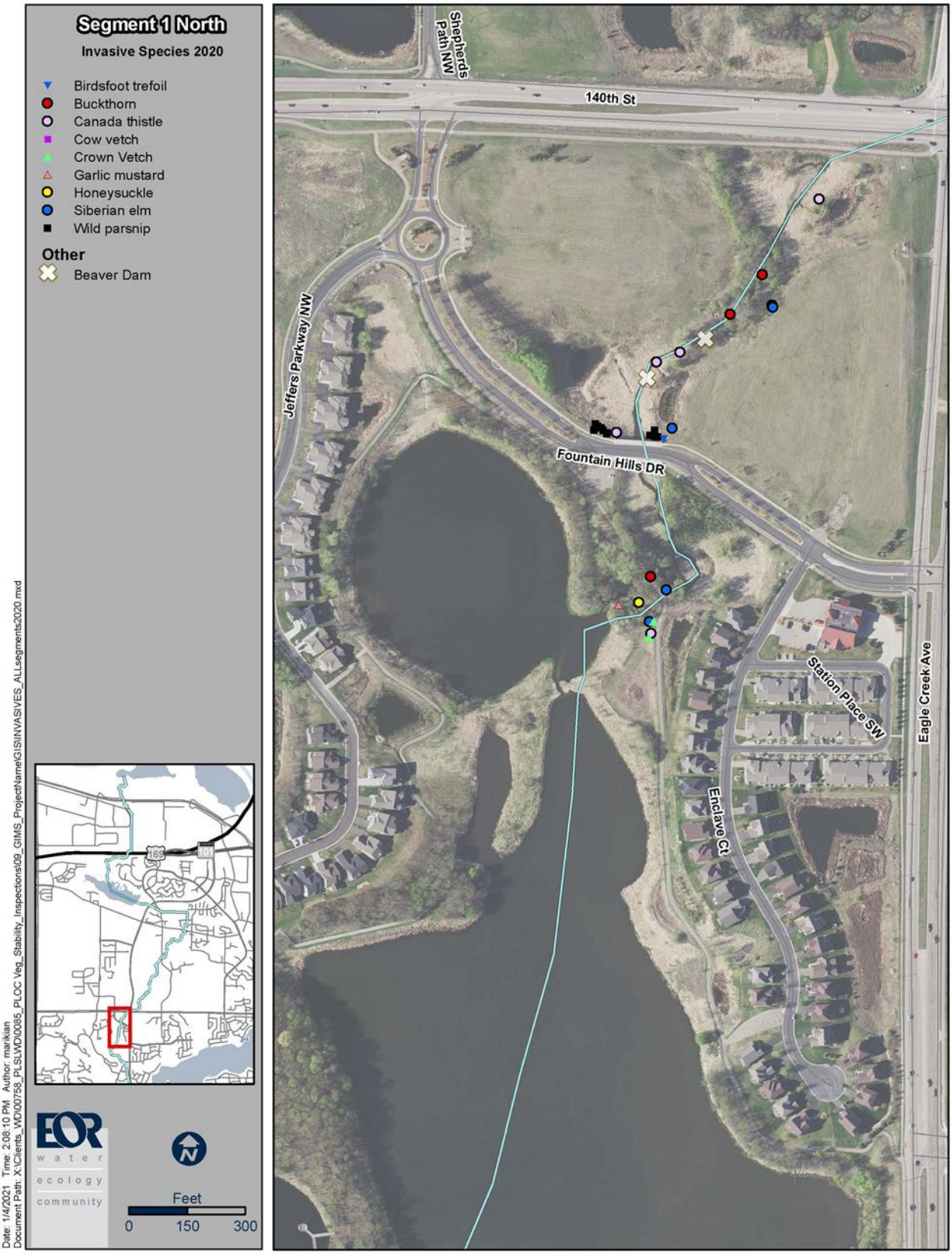

Figure 6. Target invasive species along Segment 1 (North half)

Segment 2 – Channel Condition

Numerous stream banks within this segment have been repaired since 2018 through the FEMA bank repair project (Figures 7-9). The primary bank stabilization practice implemented was the placement of boulder toe along the sides of the channel. Boulder cross vanes were also installed in several locations, but two cross vanes are beginning to fail due to flows around the edges of the vane wings (Figure 10). The bank repairs have reduced toe erosion throughout the segment, but some banks continue to erode in areas where bank repair activities have not occurred (Figures 11-12). It is recommended the large sediment delta at the inlet to Pike Lake be removed now that most of the channel banks in this segment have been repaired (Figure 13).

Segment 2 – Invasive Species

No new invasive species were found. Figure 14 shows the locations of target invasive species identified in this segment.

Figure 7. Boulder toe bank stabilization from the FEMA project

Figure 8. Boulder toe bank stabilization from the FEMA project

Figure 9. Boulder toe bank stabilization from the FEMA project

Figure 10. Cross vane beginning to fail, note the gap between the left side of the vane and the bank

Figure 11. Bank erosion in areas where no bank repair work was conducted

Figure 12. Bank erosion in areas where no bank repair work was conducted

Figure 13. Sediment delta at the inlet to Pike Lake

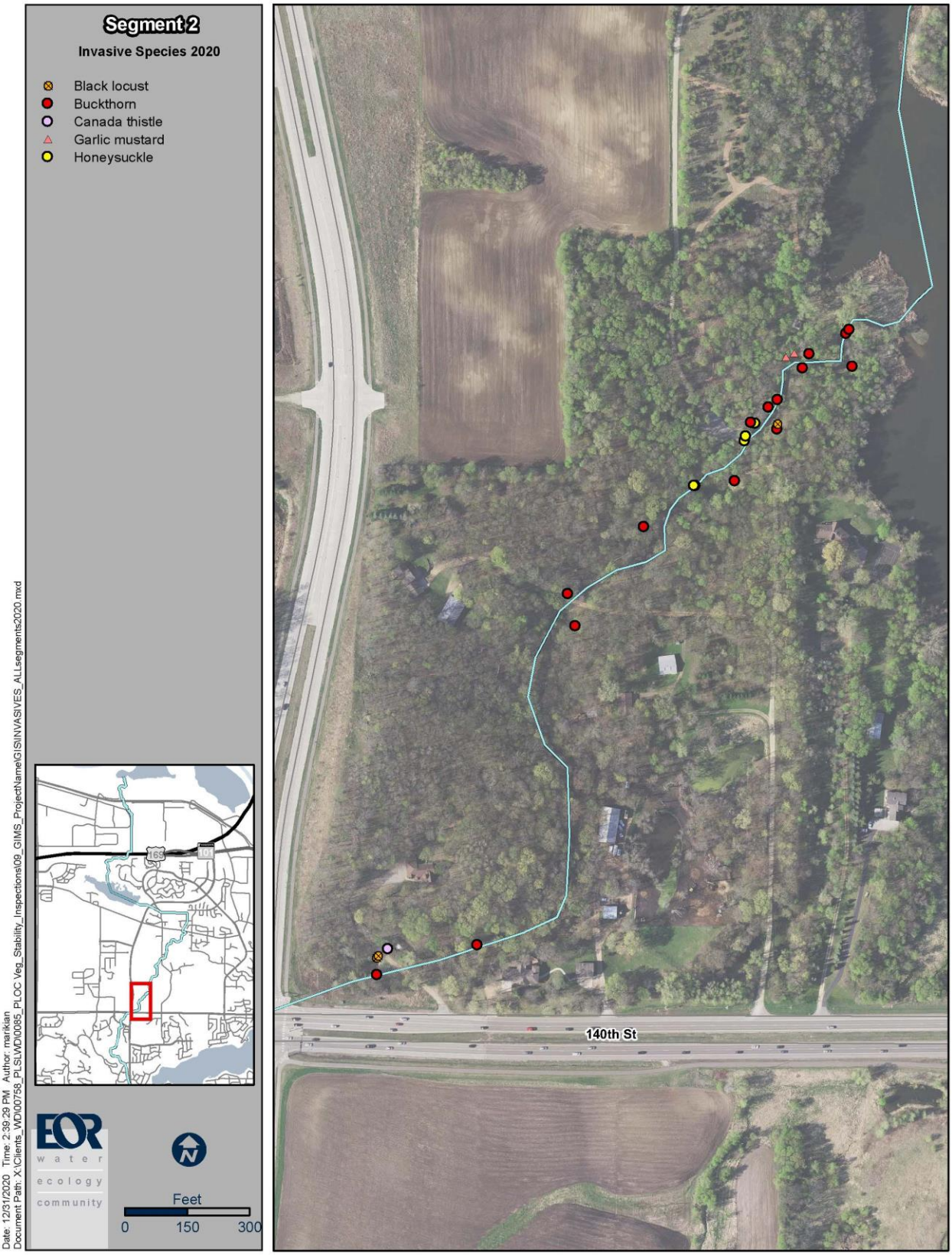

Figure 14. Target invasive species along Segment 2

Segment 3 – Channel Condition

Numerous stream banks within this segment were repaired in 2019, including the two road embankment slumps along the upstream end of the Kici Yapi property (Figures 15-16). The primary bank stabilization practice implemented was the placement of boulder toe along the sides of the channel (Figures 17-18). Boulder cross vanes were also installed in several locations to concentrate flows to the center of the channel (Figure 19). No major channel obstructions were found; however, a minor culvert blockage was observed at the upstream end of the private driveway crossing during the May inspection but was removed by the September inspection (Figure 20**Error! Reference source not found.**). Bank erosion continues to occur downstream of the private driveway crossing (Figure 21).

Segment 3 – Invasive Species

No new invasive species were found in this segment. Black locust, common buckthorn (*Rhamnus cathartica*) and bush honeysuckle (*Lonicera spp.*) saplings were observed in areas previously managed. Continued foliar spray treatments will be needed to reduce the population of the saplings in this segment. Figure 22 shows the locations of target invasive species identified in this segment.

Figure 15. Bank stabilization along the gravel road of the Kici Yapi property

Figure 16. Bank stabilization along the gravel road of the Kici Yapi property

Figure 17. Bank stabilization within the middle reach of the Kici Yapi property

Figure 18. Bank stabilization within the middle reach of the Kici Yapi property

Figure 19. Boulder cross vane within the middle reach of the Kici Yapi property

Figure 20. Partial culvert blockage at the private driveway crossing upstream of Pike Lake Road (May)

Figure 21. Bank erosion downstream of the private driveway crossing upstream of Pike Lake Road

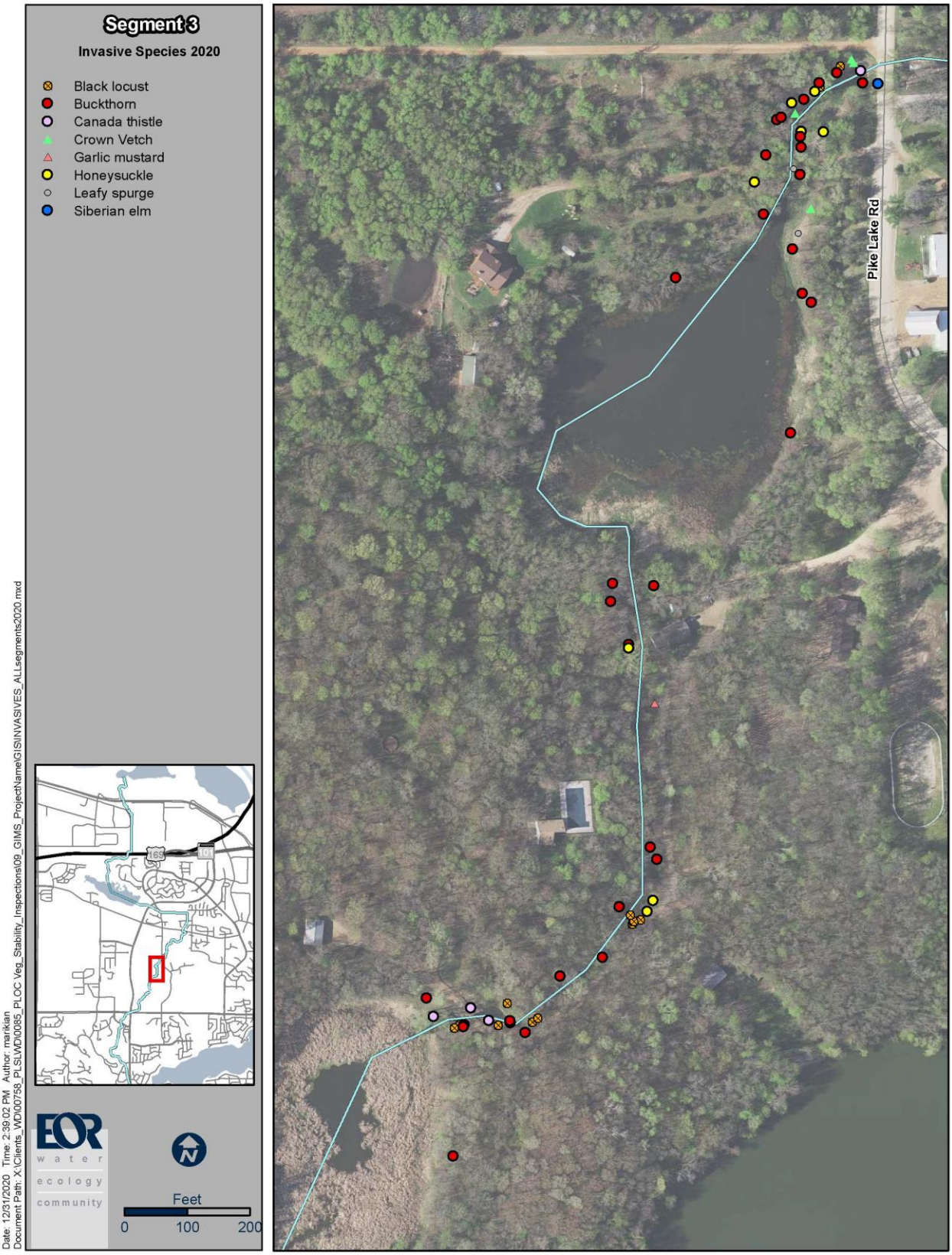

Figure 22. Target invasive species along Segment 3

Segment 4 – Channel Condition

The restored channel at the upstream end of Segment 4A is stable but would benefit from re-positioning of the existing riprap in the channel. There appears to be a sufficient volume of riprap along the south side of the channel to address the minor toe erosion along the north bank (Figure 23). Most of the previously documented eroded channel banks have been repaired in 2019 by the FEMA-funded project. Bank stabilization practices implemented included boulder toe, rock grade control structures and riffles, and installation of rootwads (Figures 24-25). Bank erosion continues to occur in areas where no bank stabilization work has been conducted (Figure 26). At the far downstream end of Segment 4A, the rootwads installed to stabilize the right bank have caused localized bank erosion upstream and downstream of the rootwads (Figure 27). The erosion appears to be the result of limited toe stabilization between the rootwads and eddy currents during high flow events. It is presumed this area will be repaired under warranty in 2021.

In Segment 4B, a large box elder tree has fallen across the channel at the upstream end of the segment and is beginning to collect debris (Figure 28). It is recommended this tree be removed before spring 2021 to prevent potential bank erosion during high flow events. The rootwads installed at the upstream end of the pasture appear stable with vegetation becoming well established on the restored bank (Figure 29). However, the rootwads installed at the downstream end of Segment 4B have erosion issues similar to the rootwads installed at the downstream end of Segment 4A that have erosion occurring between the rootwads (Figure 30). It is presumed this area will also be repaired under warranty in 2021. Interesting, groundwater seepage has increased in the middle of the pasture reach of Segment 4B. The seepage has significantly softened the bank soils, which now have the consistency of muck (Figure 31). These soft bank soils will likely erode if high flows continue through the outlet channel.

Segment 4 – Invasive Species

During the May channel inspection, several wild parsnip basal rosettes were found at the upstream end of Segment 4A. In addition, several patches of garlic mustard (*Alliaria petiolata*) continue to persist in areas where it was previously managed. Reconnaissance for purple loosestrife was conducted in July and one plant was found just downstream of Pike Lake Road along the right bank. In addition, one Japanese hedge parsley plant was found downstream of Pike Lake Road. Monitoring and treatment for wild parsnip, garlic mustard, Japanese hedge parsley, and purple loosestrife should continue in 2021 to limit the spread of these species. The plants should be treated with herbicide prior to seed development, and follow-up inspections should be conducted in early July to determine treatment effectiveness. Should any plants be discovered that are blooming or producing seed, it is recommended the seed heads be hand cut and removed the from site. Woody invasive species such as Siberian elm (*Ulmus pumila*), common buckthorn, and bush honeysuckles should be targeted in the fall of 2021, particularly in the wooded reach upstream and downstream of the Gonyea culvert. Figure 32 and Figure 33 show the locations of target invasive species identified in this segment.

Figure 23. Toe erosion along the north bank of Segment 4A downstream of Pike Lake Road

Figure 24. Boulder toe & grade stabilization downstream of the Jackson Trail culvert.

Figure 25. Boulder grade control installed within the middle reach of Segment 4A

Figure 26. Continued bank erosion within the middle reach of Segment 4A

Figure 27. Rootwads and bank erosion at the downstream end of Segment 4A

Figure 28. Fallen box elder tree over the channel at the upstream end of the pasture in Segment 4B

Figure 29. Rootwads installed along the left bank at the upstream end of Segment 4B

Figure 30. Rootwads and bank erosion at the downstream end of Segment 4B

Figure 31. Groundwater seepage along the south bank of the pasture reach in Segment 4B

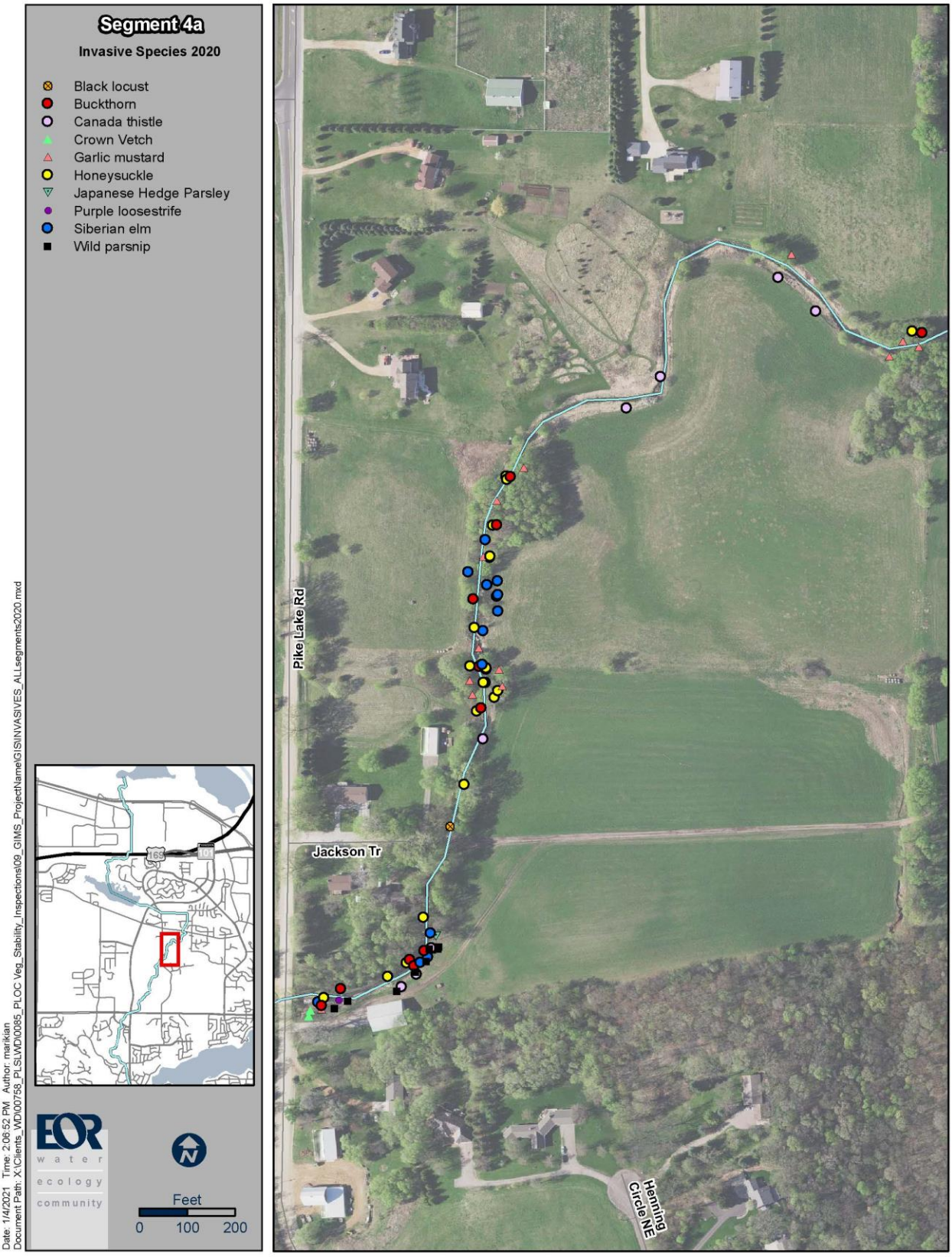

Figure 32. Target invasive species along Segment 4A

Figure 33. Target invasive species along Segment 4B

Segment 5 – Channel Condition

In Segment 5A, two beaver dams were found in the channel between the stormwater ponds. One of the dams has partially failed with water flowing around the side of the dam (Figure 34). Several muskrat tunnels also exist between the stormwater ponds and the PLOC. The tunnels occur under the earthen berm that divides the PLOC from the stormwater ponds and are functioning like culverts which have largely drained the east pond (Figure 35). In Segment 5B, a partial culvert obstruction was found at the upstream end of the twin culverts where the channel bends 90-degrees to the west (Figure 36). In addition, several fallen trees were found lying across and within the channel which are partially affecting flow (Figure 37). The channel banks throughout this segment are in fair condition with reed canary grass (*Phalaris arundinacea*) and tree roots providing ample surface protection in most areas. However, stream banks that were damaged by previous flood events continue to erode. Beaver activity has increased significantly this year in Segment 5B with six beaver dams found. The largest dam occurs just upstream of Pike Lake Road which has an approximate 1-foot surface water drop over the dam (Figure 38). The sediment delta continues to advance downstream of Pike Lake Road in Segment 5C (Figure 39).

Segment 5 – Invasive Species

The management efforts to treat purple loosestrife located downstream of the CR 16 box culverts in Segment 5A were successful. No purple loosestrife plants were found during the July inspection in Segment 5A; however, over 25 plants were found within the wetland adjacent to the sediment pond in Segment 5C. In addition, a small patch of invasive common reed (*Phragmites australis*) was found adjacent to the west stormwater pond in Segment 5A. Both the purple loosestrife and common reed populations were treated with herbicide in July & September by AES. These areas should be monitored closely again in the summer of 2021 and any new plants should be promptly treated or removed before seeds develop. Purple loosestrife and phragmites management in this segment is particularly important since the site is located just upstream of Deans Lake, which contains a large wetland complex vulnerable to loosestrife and phragmites invasion. Figures 40-42 show the locations of target invasive species identified in this segment along with the locations of the beaver dams in Segment 5A and Segment 5B.

Figure 34. Beaver dam in Segment 5A, note the blowout around the side of the dam

Figure 35. Low surface water elevation in the east stormwater pond due to muskrat drainage tunnels

Figure 36. Culvert obstruction at the twin 90-degree culverts in Segment 5B

Figure 37. Several fallen trees over the channel in Segment 5B

Figure 38. Large beaver dam near the downstream end of Segment 5B

Figure 39. Sediment delta located downstream of Pike Lake Road in Segment 5C

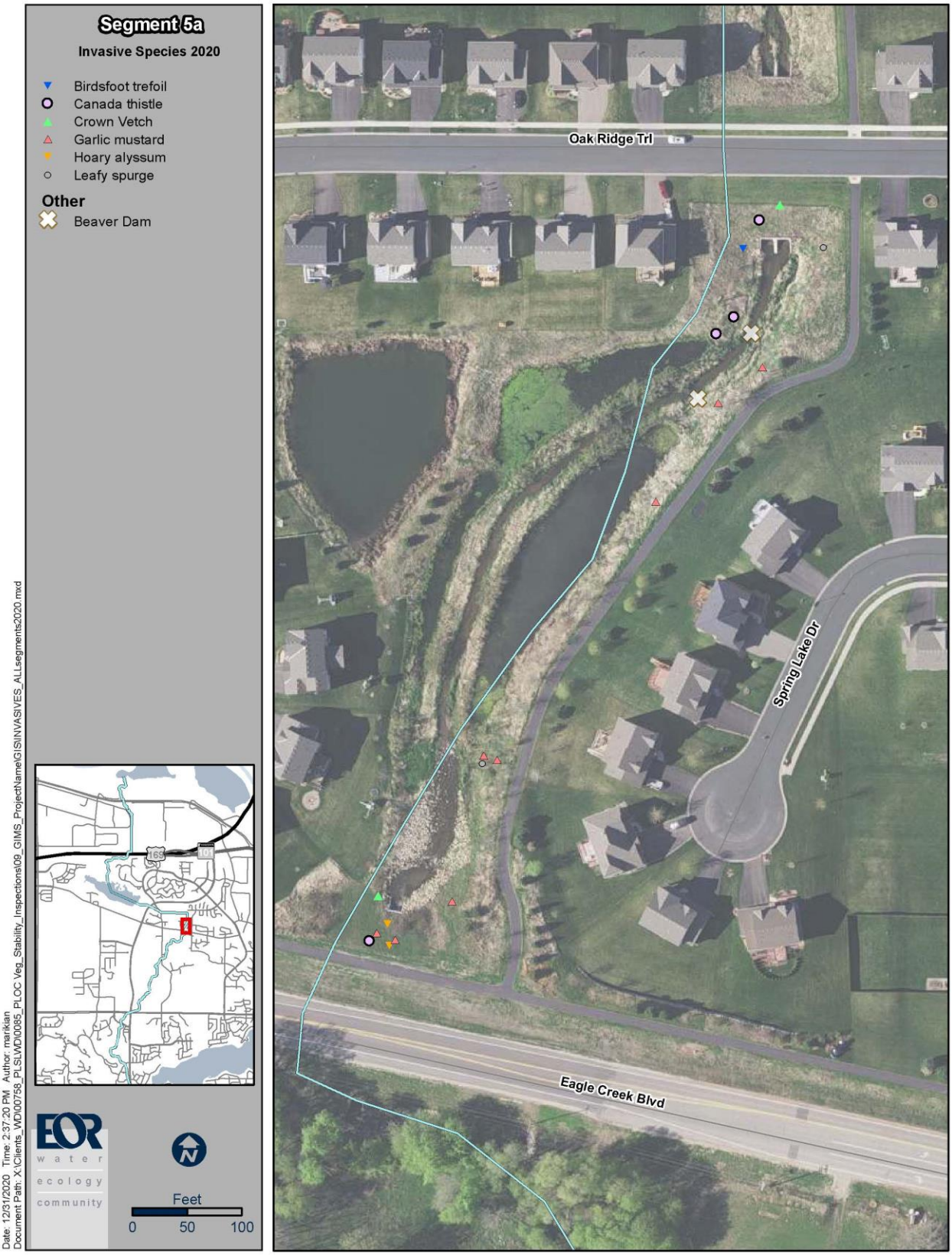

Figure 40. Target invasive species along Segment 5A

Figure 41. Beaver dams located along Segment 5B

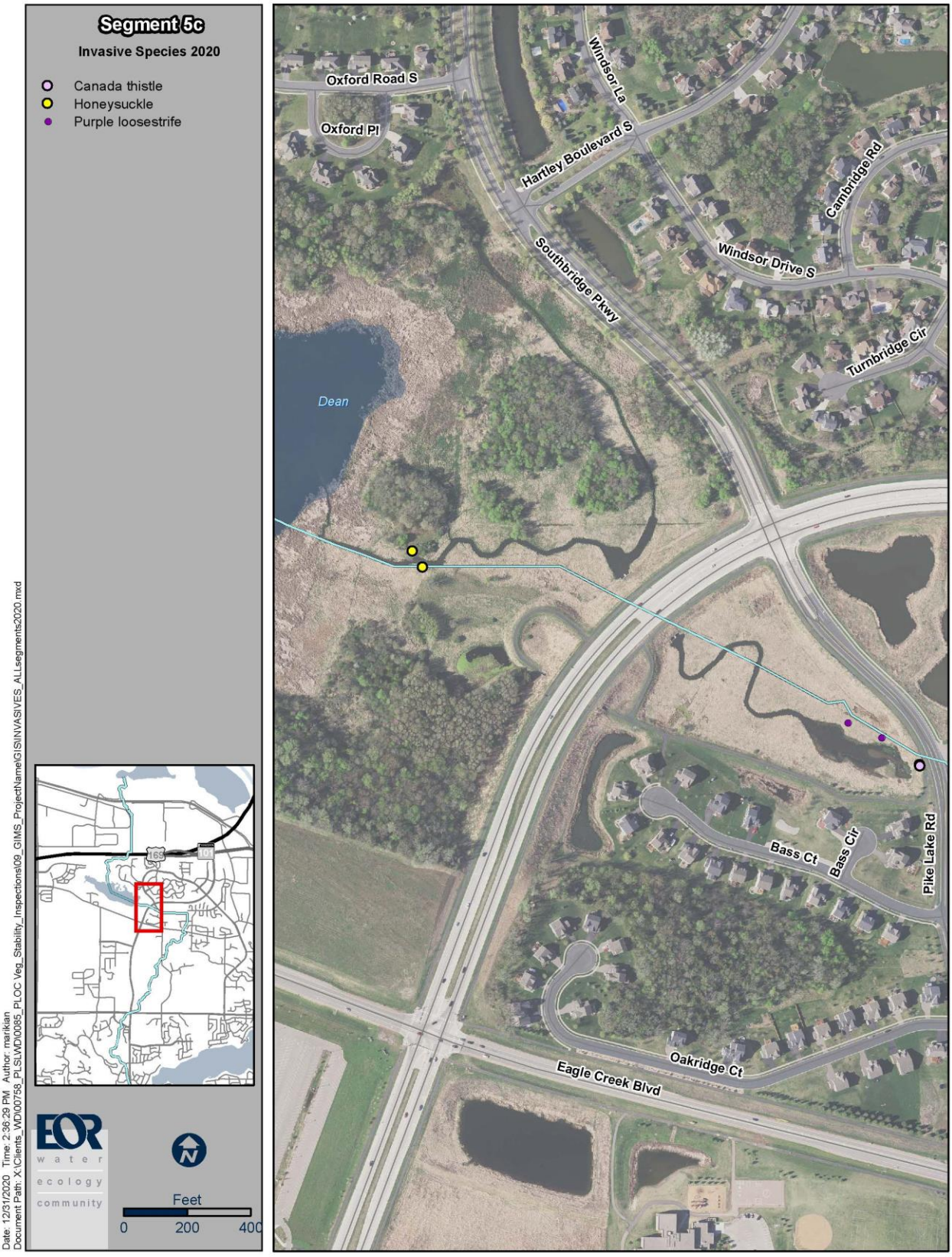

Figure 42. Target invasive species along Segment 5C

Segment 6 – Channel Condition

The sediment delta at the inlet to the Deans Lake bypass channel documented in 2018 continues to expand. The sediment delta bridges the entire mouth of the bypass channel and directs low flows into Deans Lake (Figure 43). Although the bypass channel still functions during high flow events through the PLOC, it is recommended the sediment delta be removed to increase flows through the bypass channel and reduce nutrient loading to Deans Lake. No other channel obstructions were found in this segment. The Deans Lake weir appears to be in good condition and was free of debris at the time of the surveys. The channel banks throughout this segment are well vegetated and show little evidence of bank erosion (Figure 44 and Figure 45Figure 45).

Segment 6 – Invasive Species

No purple loosestrife plants were found downstream of the Deans Lake weir where management was conducted in 2017. Although no loosestrife plants were found since 2018, it is recommended this area continue to be monitored due to the recent discovery of purple loosestrife just upstream in Segment 5C. Figure 46 shows the locations of target invasive species identified in this segment.

Figure 43. Channel downstream of County Road 21 & sediment delta in bypass channel

Figure 44. Stable, vegetated stream banks downstream of the Deans Lake weir

Figure 45. Stable, vegetated stream banks upstream of Highway 169

Figure 46. Target invasive species along Segment 6

Segment 7 – Channel Condition

The channel banks downstream of Highway 169 are well vegetated and show little evidence of bank erosion (Figure 47). The sheet pile weirs located in Segment 7A were mostly free of debris during the surveys; however, one small beaver dam occurred on top of the upstream-most sheet pile weir. In addition, a second beaver dam was located just upstream of Hwy 101 in Segment 7B. At the far downstream end of Segment 7A, just upstream of the railroad tracks, a large tree has fallen into the channel and is partially blocking flow.

Numerous stream banks within the wooded reaches of Segment 7A & 7B were repaired in 2019, including the large bank blow-out upstream of Quarry Lake Park (Figure 48). The primary bank stabilization practices implemented in Segment 7 included boulder grade control structures (Figure 49) and placement of boulder toe along the sides of eroded channel banks (Figure 50 and Figure 51). Rock deflectors were also installed in several locations to deflect high flows away from the channel banks (Figure 52).

Segment 7 – Invasive Species

Several purple loosestrife plants were found in the areas where the species was documented in 2017 as well as in new locations upstream of Quarry Lake Park. Although a significant decline in the population of purple loosestrife was observed in the wetland complex located immediately west of Segment 7A, it is likely some seeds have migrated out of the wetland complex and may be the source of the plants found in 2020. The wetland complex west of Segment 7A was managed with both biological control (purple loosestrife beetles and weevils) and herbicide treatments since 2018 and will need to continue for the next several years to control further spread within the segment. Any loosestrife plants should be treated with herbicide prior to seed development, and follow-up inspections should be conducted in early July to determine treatment effectiveness. Should any plants be discovered that are blooming or producing seed, it is recommended the seed heads be hand-cut and removed the from site.

EOR staff collected several hundred leafy spurge flea beetles from a site just west of Deans Lake on July 2. Most of the flea beetles collected were *Aphthona lacertosa*, but some *Aphthona nigriscutis* beetles were also collected. The beetles were released in two separate locations to support previous beetle release efforts in the area.

The proliferation of the invasive species crown vetch (*Coronilla varia*) that was documented in 2016 continues to spread along the segment, particularly along the paved path that parallels the PLOC by Quarry Lake Park. In addition, garlic mustard, common buckthorn and bush honeysuckle saplings were found in areas previously managed. Continued foliar spray treatments will be needed to reduce the population of these species in this segment. Figure 53 and Figure 54 show the locations of target invasive species identified in this segment.

Figure 47. Vegetated stream banks in the upper reach of Segment 7A

Figure 48. Bank stabilization upstream of Quarry Lake Park in Segment 7A (previous blow-out area)

Figure 49. Rock grade control "cross vane" in the wooded reach of Segment 7A

Figure 50. Boulder toe bank stabilization & re-graded floodplain bench in the wooded reach of Segment 7A

Figure 51. Boulder toe bank stabilization in Segment 7B just downstream of the railroad tracks

Figure 52. Boulder toe & rock deflectors along the right bank in Segment 7B

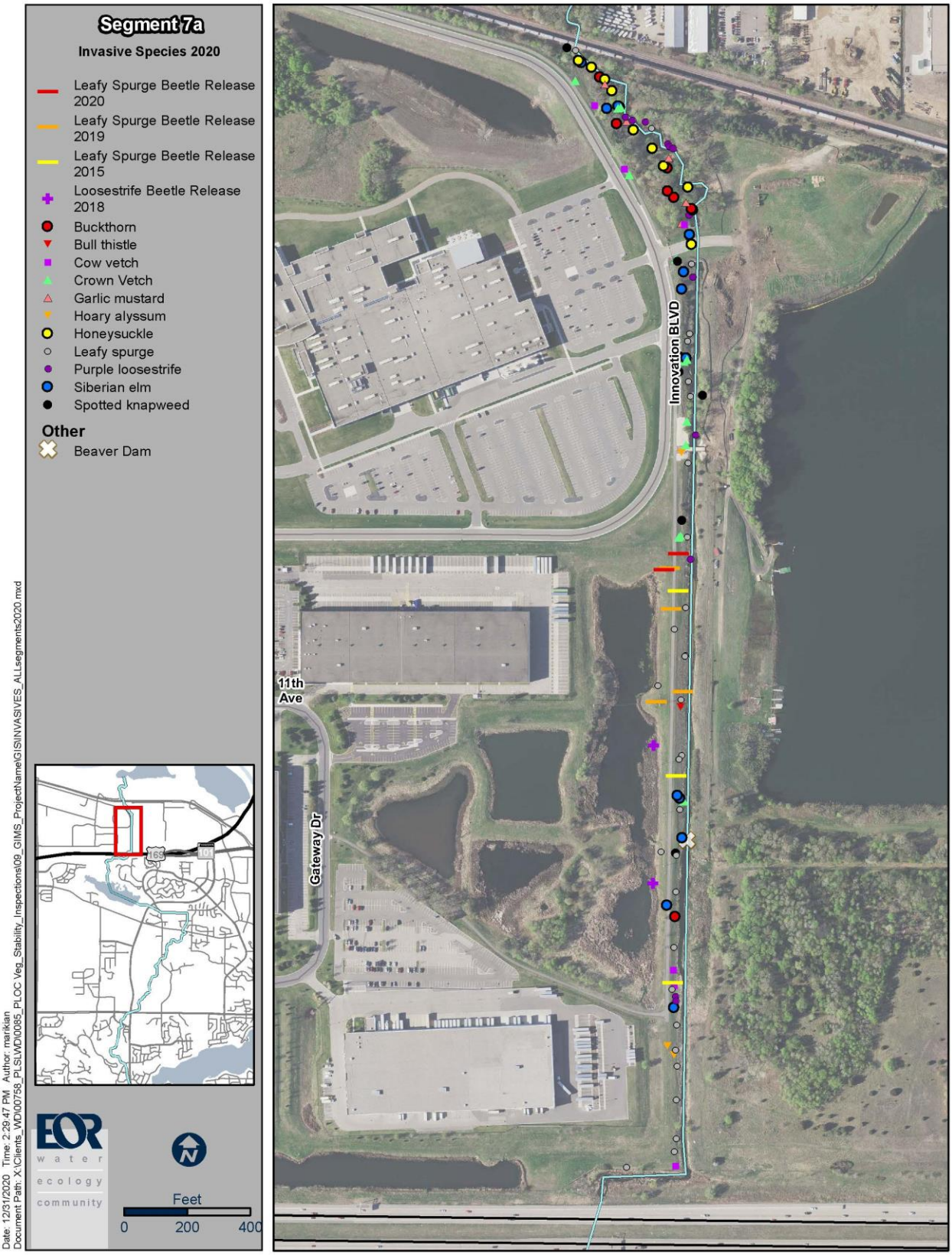

Figure 53. Target invasive species along Segment 7A

Figure 54. Target invasive species along Segment 7B

Appendix A

Vegetation Management Conducted in 2020

Segment 1

- Three wild parsnip populations were treated by AES staff in June & July, including the area just north of Jeffers Pass NW, the area east of Chickadee Landing on Jeffers Pond Elementary property, and at the east and west sides of the channel just north of Fountain Hills Road. In addition, the wild parsnip population located southwest of the intersection of Jeffers Pass NW and Eagle Creek Avenue was treated in June/July
- Black locust sapling treatment in October
- Two Siberian elm trees were cut down near Chickadee Landing and were placed within Jeffers Pond for turtle loafing logs
- Japanese hedge parsley was hand-removed by AES in late September/ early October

Segment 2

- Garlic mustard in Pike Lake Park was treated by AES staff in late May/ early June
- Foliar treatments for woody invasive species were conducted by AES staff in October

Segment 3

- EOR scouted for garlic mustard in the Kici Yapi area previously managed by hand-pulling efforts. Two garlic mustard plants were found in May 2020 and were hand-pulled
- No other herbaceous management was conducted in 2020
- Foliar treatments for woody invasive species were conducted by AES staff in October

Segment 4

- Foliar treatments for herbaceous invasive species were conducted by AES staff in late May/early June for garlic mustard and June/ July for wild parsnip. One purple loosestrife plant and one Japanese hedge parsley plant was hand-clipped in late August/ early September
- Foliar treatments for woody invasive species were conducted by AES staff in October

Segment 5

- Foliar treatments for garlic mustard were conducted by AES staff in late May/ early June
- Purple loosestrife plants in Segment 5C were treated by AES in July
- The phragmites patch in Segment 5C was treated by AES staff in late September/ early October

Segment 6

- Foliar treatments for herbaceous invasive species were conducted by AES staff in June/ July

Segment 7

- Foliar treatments for garlic mustard were conducted by AES staff in late May/ early June and purple loosestrife in July. Additional purple loosestrife plants were hand-clipped in late September
- Foliar treatments for woody invasive species were conducted by AES staff in October
- Hand-pulling of invasive species from the rare plant community in Segment 7A was completed by EOR & AES staff in July/ August
- Several hundred leafy spurge flea beetles were collected by EOR staff from a known population west of Deans Lake and were released in two separate locations where dense patches of leafy spurge were found. The beetle collection and release were conducted on July 2

Appendix B

Channel and Vegetation Management Recommendations for 2021

Segment 1

Channel

- Continue inspections in 2021 and monitor FEMA-funded bank repair work
- Remove blown-out culvert located upstream of CR 42 (old field crossing culvert) to reduce potential for channel obstruction during high flows

Vegetation

- Foliar spray/ cut stump treatment of black locust and white poplar near Jeffers Pond Elementary School
- Request removal of remaining large Siberian elm tree near Chickadee Landing
- Scout and treat target invasive species, especially wild parsnip, Japanese hedge parsley, and Queen Anne's lace. Conduct the work in June & July to prevent plants from maturing and producing seed

Segment 2

Channel

- Continue inspections in 2021 and monitor FEMA-funded bank repair work
- Remove the sediment delta at the outlet of Segment 2 in Pike Lake

Vegetation

- Scout and treat for woody invasive species in previously managed areas
- Scout and treat target invasive species in FEMA-funded bank repair areas
- Herbaceous treatment for garlic mustard in Pike Lake Park

Segment 3

Channel

- Continue inspections in 2021 and monitor bank repair work

Vegetation

- Scout and treat for woody invasive species in previously managed areas
- Scout and treat target invasive species in bank repair areas

Segment 4

Channel

- Re-position existing riprap along restored channel in Segment 4A
- Continue inspections in 2021 and monitor FEMA-funded bank repairs

- Remove fallen trees within the channel between the Gonyea culvert and the pasture in Segment 4B

Vegetation

- Scout and treat for woody invasive species in areas not addressed by the FEMA bank repair work
- Scout and treat target invasive species, especially wild parsnip, purple loosestrife, Japanese hedge parsley, and garlic mustard. Conduct the work in May & June to prevent plants from maturing and producing seed

Segment 5

Channel

- Continue inspections in 2021
- Repair the earthen berm to restore the normal surface water elevation in the east stormwater pond

Vegetation

- Scout and treat for target invasive species in Segment 5A and 5C, particularly purple loosestrife. Conduct the work in June & July to prevent plants from maturing and producing seed

Segment 6

Channel

- Remove the sediment delta at the upstream end of the Deans Lake bypass channel located downstream of County Road 21. Continue inspections in 2021

Vegetation

- Scout and treat for target invasive species around the Deans Lake outlet. Conduct the work in June & July to prevent plants from maturing and producing seed

Segment 7

Channel

- Continue inspections in 2021 and monitor FEMA-funded bank repairs

Vegetation

- Scout and treat for target invasive species throughout the segment. Conduct the work in June & July to prevent plants from maturing and producing seed

- Scout and treat for woody invasive species in areas not addressed by the FEMA bank repair work
- Collect and distribute additional leafy spurge flea beetles in areas containing dense populations of leafy spurge
- Hand-pull invasive species (primarily spotted knapweed, hoary alyssum, and sweet clover) in the remnant sand prairie containing rare species