FOCUSED FEASIBILITY STUDY REPORT
FOR
40TH AVENUE PROJECT AREA
IN THE ST. LOUIS RIVER AREA OF CONCERN

August 28, 2015

APPENDIX A. BOTANICAL COMMUNITIES AND SHORELINE HABITAT

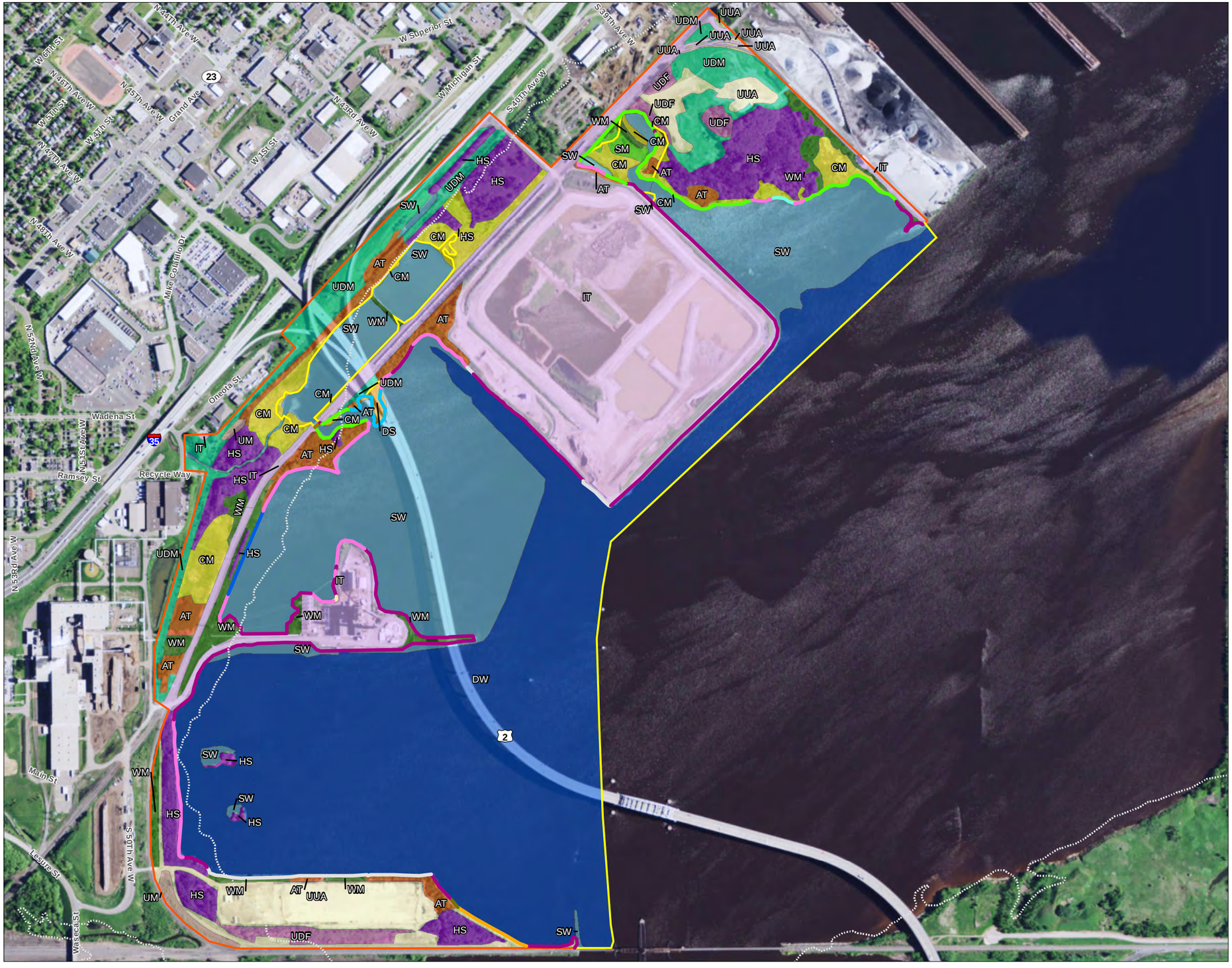


Figure No.

Appendix **A**- Figure 1

Title

Project Area Overview

Client/Project

U.S. Fish and Wildlife Service
40th Avenue West Remediation to Restoration Project
St. Louis River Estuary

Project Location

T49N, R14W, S07; 08; 17; 18
C. of Duluth, St. Louis Co., MN

193702726
Prepared by MCP on 2014-12-04
Technical Review by JS on 2015-03-26
Independent Review by JG on 2015-06-30

0 400 800 Feet

1:9,600 (At original document size of 11x17)

N

Legend

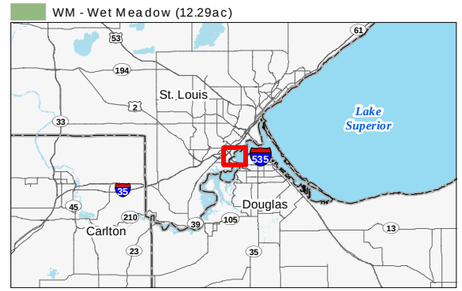
- Approx. Project Location
- Buffer Habitat Area
- 1861 Historical Shoreline

Shoreline Habitat

- Alder Thicket, Sparse Trees (4619.47ft)
- Common Reed (*Phragmites*) (183.85ft)
- Concrete Wall or Dock (2203.64ft)
- Power Plant Intake (51.28ft)
- Rock, Riprap, and Rubble (12165.02ft)
- Sand (632.06ft)
- Sand with Heavy Driftwood (97.38ft)
- Shallow Marsh: *Typha X glauca* (4082.75ft)
- Wet Meadow/Rocky (718.75ft)
- Wet Meadow/Sand-Gravel (867.07ft)
- Wood Trestle (52.97ft)

Botanical Community (Total Acres)

- AT - Alder Thicket (15.05ac)
- CM - Cattail Marsh (18.98ac)
- DW - Deep Water (194.90ac)
- DS - Disturbed Shoreline (0.87ac)
- HS - Hardwood Swamp (34.60ac)
- Industrial/Transportation (122.56ac)
- SM - Sedge Meadow (1.15ac)
- SW - Shallow Water (125.89ac)
- UDF - Upland Degraded Forest (5.88ac)
- UDM - Upland Degraded Meadow (25.18ac)
- UM - Upland Meadow (1.87ac)
- UUA - Upland Unvegetated Area (25.46ac)
- WM - Wet Meadow (12.29ac)



Notes

1. Coordinate System: NAD 1983 UTM Zone 15N
2. Data Sources Include: Stantec, Esri, Community GIS Services
3. Orthophotography: Esri

Stantec
JEWELL associates engineers, inc. Engineers - Surveyors - Architects
U.S. Fish & Wildlife Service

Stantec

Memo

To:	Jon Gumtow Stantec Consulting Services Inc. Green Bay, Wisconsin	From:	Joshua Sulman Stantec Consulting Services Inc. Cottage Grove, Wisconsin
File:	40th Avenue West Project: 193702726	Date:	April 2, 2015

Reference: 40th Avenue West Vegetation Survey
St. Louis River AOC

Introduction

Stantec Consulting was retained by Jewell Associates Engineers to conduct a vegetation survey prior to restoration activities on the St. Louis River Area Of Concern Project Area ("The Project Area"). The Project Area consists of approximately 326 acres in and adjacent to the St. Louis River, in the City of Duluth, St. Louis County, Minnesota. An adjacent Buffer Area ("Buffer") located to the north and west of the Project Area was evaluated, consisting of approximately 257 acres.

The purpose of this report is to summarize the vegetation conditions (e.g., floristic diversity, plant communities, rare plants, and invasive species) of the terrestrial and aquatic habitats and their potential for restoration within the Project Area and surrounding Buffer based on data collected during the 2014 field assessment and a review of existing data. This memorandum presents the project description, objectives, methods, and results of the vegetation survey effort. This evaluation is intended to complement previous investigations of terrestrial and aquatic habitats within the Project Area, and to support the planning process for aquatic and shoreline habitat restoration.

Project Description

Planning for restoration of the aquatic habitats was initiated when the area was designated an Area of Concern in 1989. Impairments including chemical contamination, poor water quality, reduced fish and wildlife populations, and habitat loss were identified.

In 2002, the St. Louis River Alliance (SLRA) completed the Lower St. Louis River Habitat Plan, which identified the 40th Avenue West Habitat Complex ("the Project Area") as a priority area for remediation and restoration. The Project Area is located in and adjacent to the St. Louis River in the City of Duluth, St. Louis County, Minnesota (Figure 1). The Project Area contains three industrially influenced bays on the west shore of the St. Louis River (St. Louis River Citizens Action Committee [SLRCAC], 2002). The bays are formed between four points of land that extend into the river; from south to north, they are Grassy Point, the steam plant peninsula (Hibbard Energy Center), the Erie Pier Confined Disposal Facility, and Hallett Docks. Four ponds are located in the Project Area, all discharging into the St. Louis River via surface water outlets. The Project Area has been heavily industrialized for over 100 years, with a number of transportation, industrial, and shipping facilities immediately adjacent to the Project Area.

Methods

Prior to conducting field assessments, Stantec obtained and reviewed recent aerial photography and previously collected data on the aquatic plant communities. The vegetation survey was

conducted on September 30 and October 1, 2014 by Environmental Scientist Joshua Sulman and Environmental Technician Matt Knickelbine, of Stantec. Wetland, upland, and nearshore aquatic plant communities were visually surveyed to identify and characterize dominant species, tree, shrub and/or herbaceous strata, determine distribution of invasive species, past and current land uses, and relative plant community integrity. The approximate extent of plant communities were sketched onto aerial imagery and later digitized in GIS. Representative photographs were taken of plant communities. A meander survey was conducted of the Project Area, and vascular plant species were identified to species level. Species lists were recorded for each plant community. Plant specimens were collected as necessary for later identification and verification. Incidental wildlife observations, water depth, water quality, habitat quality, potential habitat value, and historical and ongoing impacts on the habitat (such as dumping, litter, contamination and current human uses) were recorded.

A Floristic Quality Assessment (FQA; Swink & Wilhelm, 1994) was used to assess the plant communities within the Project Area, using the meander species data collected for each community. The FQA calculation was conducted in the Universal FQA Calculator (Freyman & Masters, 2013), using the Coefficient of Conservatism value (C) assigned to each plant species in the Wisconsin – Northcentral-Northeast Region FQA Database (Parker et al., 2014). This database was selected as the most current and complete FQA Database available and applicable to the Project Area.

Buffer areas contiguous with the Project Area were evaluated for habitat potential based on field reconnaissance, comparison to similar habitat types evaluated onsite, and analysis of aerial imagery. Additional information on the Project Area was obtained from a review of previous studies, including: Lower St. Louis River Habitat Plan (SLRCAC, 2002); 40th Avenue West Remediation to Restoration Project: Biological Survey Results (Brady et al., 2010); An Ecological Design for the 40th Avenue West Remediation-to-Restoration Project (Host et al., 2012); a predictive model for floating leaved vegetation (FLV) in the St. Louis River estuary (USEPA, 2014); shoreline survey data provided by Jewell Associates, Engineers (Jewell); terrestrial and benthic topographic data (Jewell); and a digitized version of the 1861 William Hearding Duluth-Superior Harbor Chart (the Hearding chart), provided by Clinton Little of the Minnesota DNR Coastal Program. Additional information and mapping tools available through the website of the St. Louis River estuary project, (http://www.stlouisriverestuary.org/) were reviewed.

A review of Google Earth aerial imagery dated Aug. 28, 2010 was completed to estimate the extent of FLV within the Project Area. Light green areas visible in the imagery may represent either FLV or algae, or both; FLV tends to appear grainy, while algae has a nearly uniform color. The visually interpreted extent of FLV was delineated in Google Earth, and then overlain with the results of a United Stated Environmental Protection Agency predictive model for FLV in the St. Louis River (USEPA, 2014). The model estimated probability of FLV occurrence based on water depth and relative exposure index (taking into account wind direction, speed, and fetch).

Results

Terrain and Elevation

Terrain within the Project Area ranges from nearly level (0 to 2 percent slopes) to locally steeply sloping on banks, fill piles and berms. Ground elevations within the Project Area range from approximately 601.7 msl at the shore of the St. Louis River to 610 on the adjacent banks. Elevations

rise sharply to the northwest of the Project Area, reaching an elevation of 630 msl, approximately 100 ft. west of the Project Area boundary.

Surface Waters

At the time of sampling, Lake Superior levels were approximately 602.7 msl, or 1 ft. above the longterm average (NOAA, 2014). The vast majority of the surface waters within the Project Area have a depth of less than 12 ft. The greatest depths are found in the southeastern portion of the Project Area, reaching a maximum depth of approximately 27 ft. There are four ponds within the Project Area, all with surface water connections to the St. Louis River. Two ponds are located west of a rail line running from southwest to northeast, directly west of Erie Pier. These ponds originated as rectangular borrow pits of 8.2 acres (west) and 5.5 acres (east). The western pond is bounded by a railroad embankment on the southeast, a berm on the northeast, willow/alder thicket and wet meadow on the northwest, and cattail marsh on the southwest. Some floating aquatic vegetation was visible on this pond, and submerged vegetation was predominant. Relatively diverse emergent vegetation occurs along the shoreline at the base of the embankment. A perennial stream draining the urban uplands of Duluth flows into the southwest end of the western pond (Fig. 2). This stream is impacted by sedimentation, solid waste, and other pollutants. A substantial amount of floating garbage, possibly from the highway bridge above or from stormwater inputs, was seen in the pond itself.

The eastern pond is bounded by a railroad embankment on the southeast, cattail marsh on the northeast, willow/alder thicket on the northwest, and a berm on the southwest. A stream identified as intermittent on National Hydrography Data mapping flows into the northeast end of the eastern pond, draining the urban uplands to the west. The eastern pond drains into the western pond via a surface water connection at a break in the berm dividing the two ponds. The outlet from the western pond into the St. Louis River passes under a wood railroad trestle at the south end of the pond. The outlet forms a broad channel that flows eastward and discharges into the St. Louis River just west of the Highway 2 bridge. Fans of deposited sediment are clearly visible on aerial imagery at the outlet of the stream flowing into the western pond, and at the outlet of the channel into the St. Louis River.

Two smaller ponds are located at the west end of the bay north of Erie Pier. The northern pond (1.1 acre) is bounded by upland fill on the north, the railroad embankment on the west, and a berm on the southwest. No obvious surface water inputs were identified. A row of old wood pilings stand out of the pond, suggesting past industrial use. The pond's outlet to the St. Louis River consists of a broad channel lined with cat-tail marsh and alder thicket. The southern pond (0.4 acre) is bounded by the railroad embankment on the northwest, the Erie Pier embankment on the south, and cat-tail marsh on the north. The pond receives stormwater input via a culvert at its west end. This pond appears to be impacted by sedimentation and showed high turbidity. Additional surface waters identified within the buffer on aerial imagery, but not visited during the field survey, include a stream that flows north to south, discharging into the St. Louis River just south of Hallett Docks, and areas of ponding on the Erie Pier confinement facility.

Land Use

The terrestrial and aquatic communities of the Project Area and Buffer have been impacted and altered by over a century of industrialization (SLRCAC, 2002). Dredging, fill, and industrial development have transformed the lower St. Louis River from an extensive, shallow wetland estuary prior to development, to the highly altered navigable waterway that exists today (SLRCAC, 2002). In fact, nearly all the land within the Project Area and Buffer consists of fill, and was part of the St. Louis

River estuary when surveyed by Hearding in 1861 (Figs 1, 2, 3). The surrounding area continues to support active industrial and transportation infrastructure. Facilities within the immediate vicinity of the Project Area include a NewPage paper mill, Era Laboratories, and Bay Side Recycling, a scrap metal recycling facility, all located west of the Project Area. The US Army Corps of Engineers' Erie Pier Confined Disposal Facility forms a large rectangular extension into the St. Louis River in the center of the Project Area. Minnesota Power's Hibbard Renewable Energy Center power plant is located on a peninsula extending into the river in the southern portion of the Project Area. The Richard I. Bong Memorial bridge (US Highway 2) passes several hundred feet above the center of the Project Area, and its elevated interchange with Interstate Highway 35 extends over the Project Area's western pond. Rail lines serve the Hallett Docks shipping terminal, located just north of the Project Area. Historic industrial facilities onsite included sawmills, piers, and coal docks, that were concentrated within the bay south of the power plant peninsula. The islands in the bay represent remnants of these industrial uses. On the floor of the bay, the benthos has been altered by industrial waste, including contaminated sediments and wood waste. On land, dumping and fill is evident within the buffer. A dump, consisting of demolition debris, cans, bottles, and other household waste at least 50 years old, is located at the north end of the eastern pond west of the railroad tracks. The area west and south of Hallett Docks, all of which was part of the estuary prior to industrialization, is composed entirely of fill.

Plant Communities

A total of 13 plant communities were identified and mapped within the Project Area and Buffer. Floristic Quality Assessment metrics for the plant communities identified within the Project Area are summarized in Table 1. Plant community acreages within the Project Area and Buffer are provided in Table 2. The plant communities are characterized in detail in the following sections. Figures 1 and 2 illustrate the location and extent of each community. Figure 3 depicts the extent of FLV based on interpretation of aerial imagery and deep and shallow-water aquatic communities (Brady et al., 2010), in comparison with distribution of FLV as predicted by a model (USEPA, 2014). Figure 4 displays the extent of FLV and emergent aquatic vegetation. Plant species lists for communities surveyed within the Project Area are provided in Attachment A. Representative photographs are provided in Attachment B.

Table 1. Floristic Quality Assessment Metrics for Project Area Plant Communities

Community	Species Richness		Mean C		FQI	
	Native	All	Native	All	Native	All
Alder Thicket	23	28	5.2	4.3	24.9	22.8
Cattail Marsh	14	18	5.4	4.2	20.2	17.8
Disturbed Shoreline	5	12	3.8	1.6	8.5	5.5
Northern Sedge Meadow	34	41	5	4.1	29.2	26.3
Shallow Water	7	7	4.7	4.7	12.4	12.4
Wet Meadow	49	68	4.3	3.1	30.1	25.6

Reference: 40th Avenue West Vegetation Survey, St. Louis River AOC

Table 2. Plant Community Acreage

	Community	Project Area Acres	Buffer Acres	Total Acres
Aquatic	Deep Water	194.90	—	194.90
	Shallow Water	124.95	0.94	125.89
Wetland	Alder Thicket	0.24	14.81	15.05
	Cattail Marsh	3.25	15.73	18.98
	Disturbed Shoreline	0.87	—	0.87
	Hardwood Swamp	0.52	34.09	34.60
	Wet Meadow	0.70	11.58	12.29
	Sedge Meadow	0.91	0.24	1.15
Upland	Industrial/Transportation	—	122.54	122.56
	Upland Degraded Forest	—	5.88	5.88
	Upland Degraded Meadow	—	25.18	25.18
	Upland Meadow	—	1.87	1.87
	Upland Unvegetated Area	—	24.46	25.46
	Totals	**326.34**	**257.33**	**583.67**

Wetlands and Aquatic Plant Communities

Deep Water: submerged aquatic vegetation

This community occurs in areas of open water that are lacking in floating vegetation, with the greatest extent in areas with water depths greater than 6 ft. These open water aquatic areas were classified by Brady et al. (2010) as "Riverine Open Water" characterized by "little or no aquatic vegetation". No detailed floristic surveys were conducted in this community, but submerged species likely to occur include Canada waterweed (*Elodea canadensis),* slender naiad (*Najas flexilis),* and coontail (*Ceratophyllum demersum)*. Summer algae blooms may be extensive, especially in the ponds and bay north of the power plant peninsula.

Shallow Water: submerged and floating aquatic vegetation

This community is characterized by water less than 6 ft. in depth with vegetation composed of both floating and submerged species. This community is extensive within the industrially influenced bays and ponds of the Project Area. This community dominated the lower St. Louis River prior to industrialization, but has been substantially altered as a result of dredging, siltation, increased turbidity and wave action. Even within this community, the extent of floating vegetation is much lower than expected by recent predictive models (Host et al., 2012; USEPA, 2014). The St. Louis River habitat plan (SLRCAC, 2002) cited higher turbidity, rising water level due to isostatic rebound, and historic sawmill debris as three potential causes for lack of vegetation in otherwise suitable habitats. A severe rain event on June 19-20, 2012 resulted in a flush of debris and sediment into the system from streams, and may have caused a decrease in aquatic vegetation cover (C. Reschke, pers. comm.). Aerial imagery from Aug. 2010 (Google Earth) shows a greater extent of FLV in Project Area waters than was observed in the field in 2014. The drop in aquatic vegetation cover may be due to the impacts of the 2012 rain event as well as 2014 Lake Superior levels that were about one foot higher than average. Water clarity observed in October 2014 varied from clear and brown-

stained to highly turbid. Common species identified by Stantec included white water lily (*Nymphaea odorata),* duckweed (*Lemna minor),* Canada waterweed and naiad. Other species identified as abundant in these areas by Brady et al. (2010) include eelgrass (*Vallisneria americana),* long-leaf pondweed (*Potamogeton nodosus),* white-stem pondweed (*P. praelongus)* and narrow-leaf pondweeds (*Potamogeton* spp.), coontail, white waterlily, sago pondweed (*Stuckenia pectinata),* and water stargrass (*Heteranthera dubia)*.

Cattail Marsh

This community is composed of herbaceous emergent aquatic vegetation. The dominant species is hybrid cattail (*Typha X glauca),* an invasive species which forms dense colonies and reaches a height of over 6 ft. This is the dominant shoreline vegetation of ponds, channels and the St. Louis River within the Project Area, primarily occurring in water 0—3 ft. deep. Additional common species are reed canary grass (*Phalaris arundinacea)* and bluejoint grass (*Calamagrostis canadensis)*. There is frequent evidence of beaver activity; other wildlife observed included frogs and great blue heron.

Wet Meadow

This community occurs on the shorelines of ponds, including berms and excavated banks. Standing water is typically not present throughout the growing season. The vegetation is dominated by herbaceous species, with occasional shrubs and small trees. Common species in these areas include reed canary grass, fowl bluegrass (*Poa palustris),* grass-leaved goldenrod (*Euthamia graminifolia),* northern bugleweed (*Lycopus uniflorus),* sandbar willow (*Salix interior)* and balsam poplar (*Populus balsamifera)*.

Disturbed Shoreline

This community occurs on a small area of sandy shoreline extending into the St. Louis River under the Highway 2 bridge, forming a small spit at the outlet of the channel draining the ponds to the west. This area is subject to disturbances including flooding, sediment deposition, piled drift, runoff, road salt, litter and recreational use. Common species include cocklebur (*Xanthium strumarium),* common barley (*Hordeum jubatum),* narrow leaved cat-tail (*Typha angustifolia)* and alkali rayless aster (*Symphyotrichum ciliatum)*. Wildlife observed included leopard frog.

Alder Thicket

This wetland community is characterized by a shrub canopy of speckled alder (*Alnus incana*), an herbaceous understory, and up to 1 foot of standing water. Additional common species include bluejoint grass, red-osier dogwood (*Cornus alba),* crested fern (*Dryopteris cristata),* and sensitive fern (*Onoclea sensibilis)*. Much of the Project Area shoreline consists of a fringe of alder thicket growing on riprap or at the base of reinforced banks. Larger areas of alder thicket occur adjacent to streams, shorelines, and ponds on flat, seasonally inundated surfaces. There is evidence of extensive beaver activity in this community.

Northern Sedge Meadow

This community is characterized by herbaceous vegetation consisting of native sedges and grasses. Dominant species include tussock sedge (*Carex stricta)*, bluejoint grass, and woolgrass (*Scirpus cyperinus)*. Common forbs include marsh cinquefoil (*Comarum palustre*) and water dock (*Rumex britannica)*. This community occurs in a single location in the Project Area, at the west end of the bay north of Erie Pier. This community consists of an area of relatively high quality, intact wetland vegetation. Surface water was 1 ft. or more deep at the time of sampling. Beaver activity and seiche-related flooding may be preventing invasion of this community by woody vegetation.

Hardwood Swamp
This community occurs on two islands in the bay south of the power plant, and in scattered locations within the Buffer. It is characterized by a tree canopy of willows (*Salix* spp.), balsam poplar and green ash (*Fraxinus pennsylvanica),* with a shrubby understory composed of alder, willows, and red osier dogwood. This community consists largely of early successional assemblages established on sites with past disturbance. Non-native shrubs are frequent in the understory, including glossy buckthorn (*Frangula alnus)* and common buckthorn (*Rhamnus cathartica)*.

Uplands

Upland Meadow
This community is characterized by the presence of native prairie vegetation including grasses such as big bluestem (*Andropogon gerardi)*. This community was identified in two locations within the buffer, both consisting of small areas adjacent to active or abandoned railroads. Most likely, these prairie species dispersed here from farther south along the rail line.

Upland Degraded Meadow
This community is characterized by a mix of cool-season grasses and forbs including Kentucky bluegrass (*Poa pratensis),* timothy (*Phleum pratense)*, red clover (*Trifolium pratense),* Maximilian's sunflower (*Helianthus maximilianii)* and Canada goldenrod (*Solidago canadensis)*. This community occurs within the Buffer on mowed areas, fill material, old railroad beds and roadsides.

Upland Degraded Forest
This community is characterized by a canopy of species such as paper birch (*Betula papyrifera),* balsam poplar and green ash, with occasional Scotch pine (*Pinus sylvestris)*, and a shrubby understory composed of glossy buckthorn and tatarian honeysuckle (*Lonicera tatarica)*. This community occurs on disturbed areas within the Buffer, including mounded fill material associated with the Hallett Docks facility, and on graveled or paved surfaces associated with the old coal dock.

Upland Unvegetated Area
This area is characterized by recently disturbed soil, gravel, and rock with little or no perennial vegetation cover. This community occurs within the Buffer, on an area of active soil disturbance associated with the Hallett Docks facility, and on graveled and paved areas associated with the old coal dock.

Industrial/Transportation
This area consists of active industrial facilities and transportation infrastructure, including roads, parking areas, railroads and the Erie Pier facility. These areas support minimal natural vegetation cover, and are unlikely to be part of a habitat restoration.

Rare Species
No US or Minnesota listed threatened, endangered or special concern (TES) species were identified within the Project Area during the 2014 field investigation. However, previous studies have identified TES species in the area (e.g., observation of non-breeding piping plover at Erie Pier [SLRCAC, 2002]). A full site evaluation for TES species and rare plant communities, including a review of natural

heritage information system data and additional targeted surveys of the Project Area and Buffer, may be required.

Invasive Species

Invasive species are widespread within the Project Area and Buffer. Invasive species with significant populations include hybrid cat-tail, narrow-leaved cat-tail, reed canary grass, purple loosestrife (*Lythrum salicaria),* glossy buckthorn, common buckthorn and bush honeysuckle. Hybrid cat-tail is the most widely distributed of the invasive species identified within the Project Area. This species is dominant in marshy areas and shorelines of ponds, channels, and the St. Louis River. Reed canary grass is fairly common in wet meadow, cat-tail marsh, and alder thicket communities along shorelines throughout the Project Area. Reed canary grass and hybrid cat-tail likely benefit from nutrient-rich runoff associated with stormwater inputs. Populations of the other invasive species identified are more limited in extent. Narrow leaved cat-tail was uncommon within the Project Area, found at scattered locations in cat-tail marsh, and occurring locally on disturbed shoreline. Common reed (*Phragmites australis)* occurs locally on the shoreline; however, the plants that were observed in the field, on the northernmost pond north of Erie Pier, were identified as the native strain of this species. Purple loosestrife is occasional and scattered within the wet meadow and shoreline areas. Glossy buckthorn, common buckthorn and bush honeysuckle occur occasionally within the Project Area on drier positions within the alder thicket and wet meadow. These woody species were more widespread and occurred locally at higher densities within the Buffer, especially in hardwood swamp, upland degraded forest and upland degraded meadow. Giant Daisy (*Leucanthemella serotina)* is an introduced perennial forb that occurs in a population of approximately 100 stems in the Sedge Meadow. This species has been observed to be spreading in northern Wisconsin, and is potentially invasive (Steve Garski, pers. comm).

Potential for Restoration

The Project Area has been identified as a priority for restoration of aquatic and associated shoreline wetland habitats. The existing plant communities within the Project Area and Buffer are largely disturbed and altered as a result of past and ongoing land uses; small areas of relatively intact, high quality native plant community were identified.

The restoration and remediation of the St. Louis River Area of Concern presents an opportunity to enhance the biotic community while maintaining or improving value to industry, commerce and recreation. Terrestrial areas identified for preservation and enhancement are principally those portions of the Project Area and Buffer that are not currently used by industry or transportation. Because the buffer constitutes a contiguous block of naturally vegetated habitat, restoration and enhancement of the buffer may contribute substantially to the restoration of the aquatic habitats within the Project Area.

Several streams flowing into the Project Area carry polluted runoff that is impacting water quality. Addressing these water quality concerns will be important to the success of the restoration. Further investigation may identify additional nonpoint or point sources of pollution within or outside of the Project Area and Buffer.

Stream habitat has been severely degraded due to sedimentation, ditching, and debris in the channel. Enhancement of the channel, bank, and surrounding habitat may increase the value of the aquatic habitat and improve downstream water quality.

Reference: 40th Avenue West Vegetation Survey, St. Louis River AOC

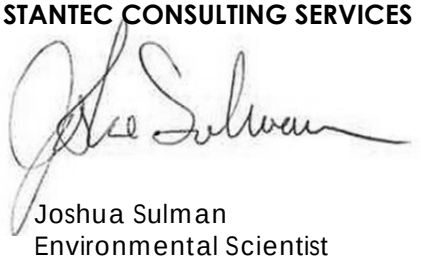
Existing high quality terrestrial habitats identified consist of relatively small areas of Northern Sedge Meadow, Upland Meadow, and portions of Alder Thicket. Enhancement of these communities could include management of invasive species and invading brush, vegetation management and restoration of hydrology in adjacent degraded habitats.

Bank stabilization, fill, and dredging have resulted in a loss of the natural shoreline elevation gradient in much of the Project Area. Restoration of a gradual shoreline elevation gradient will increase the available shoreline habitat area, and allow the vegetation to respond to fluctuations in Lake Superior water levels. Additional strategies for removing invasive species will likely need to be implemented, including mechanical removal and chemical treatment.

Conclusion

On September 30 and October 1, 2014 Stantec staff conducted a vegetation survey and assessment of habitat conditions on the St. Louis River AOC Project Area. Meander surveys identified 8 plant communities within the Project Area and 11 communities in the adjacent Buffer. No rare plant species were identified. The extent and distribution of 8 invasive species were assessed. Restorable habitats within the Project Area and Buffer should be evaluated for the presence of rare species and existing high quality habitats should be incorporated into restoration plans.

STANTEC CONSULTING SERVICES INC.



Joshua Sulman
Environmental Scientist
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References

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Reference: 40th Avenue West Vegetation Survey, St. Louis River AOC

Figures:
Figure 1—Project Area Overview
Figure 2—Botanical Communities and Shoreline Composition
Figure 3—Floating Leaved Vegetation Areas
Figure 4—Floating Leaved and Emergent Vegetation Areas

Attachments:
Attachment A—Species Lists
Attachment B—Photos

Figure No.

1

Title

Project Area Overview

Client/Project

U.S. Fish and Wildlife Service
40th Avenue West Remediation to Restoration Project
St. Louis River Estuary

Project Location

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- 1861 Historical Shoreline

Shoreline Habitat

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- Common Reed (*Phragmites*) (183.85ft)
- Concrete Wall or Dock (2203.64ft)
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- Sand (632.06ft)
- Sand with Heavy Driftwood (97.38ft)
- Shallow Marsh: *Typha X glauca* (4082.75ft)
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- DS - Disturbed Shoreline (0.87ac)
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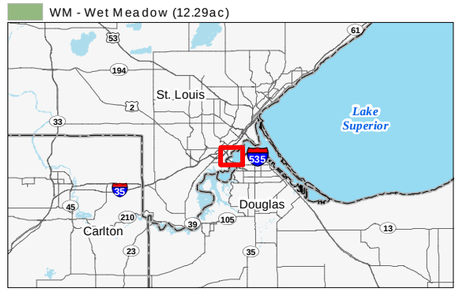

Notes

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Stantec

JEWELL associates engineers, inc.
Engineers - Surveyors - Architects

U.S. FISH & WILDLIFE SERVICE

Figure No.
2

Title
Botanical Communities and Shoreline Composition

Client/Project
U.S. Fish and Wildlife Service
40th Avenue Restoration
St. Louis River Estuary

Project Location
T49N, R14W, S07; 08; 17; 18
C. of Duluth, St. Louis Co., MN

193702726
Prepared by MCP on 2014-12-01
Technical Review by AJW on 2014-12-01
Independent Review by JG on 2015-06-30

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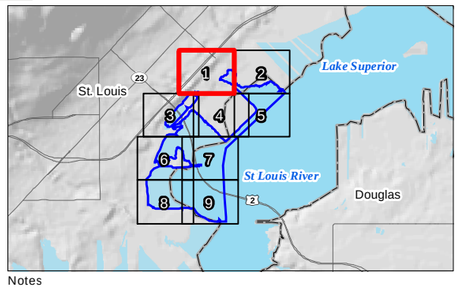

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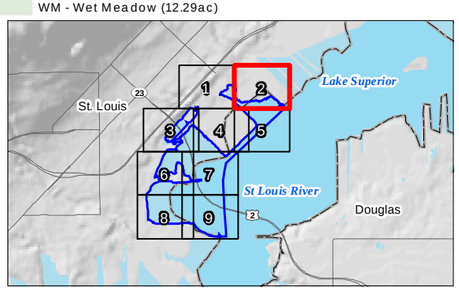

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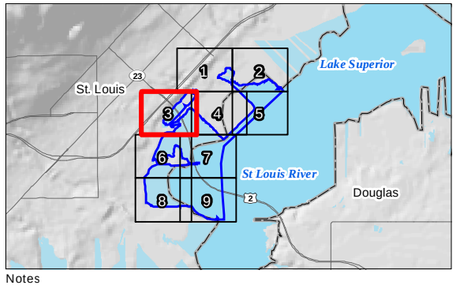

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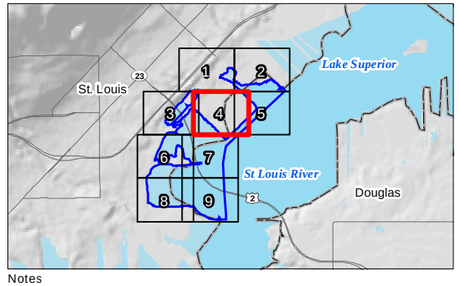

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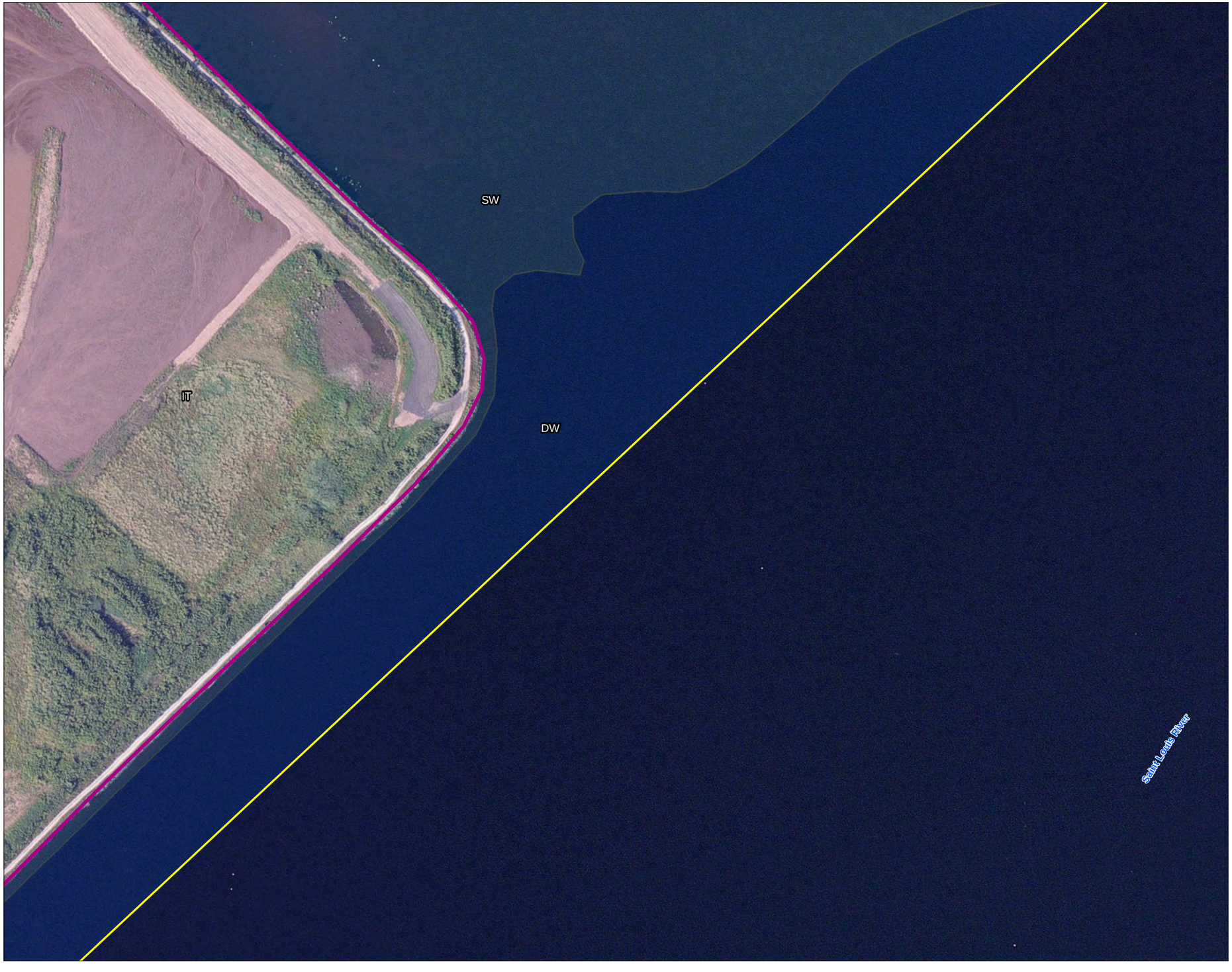

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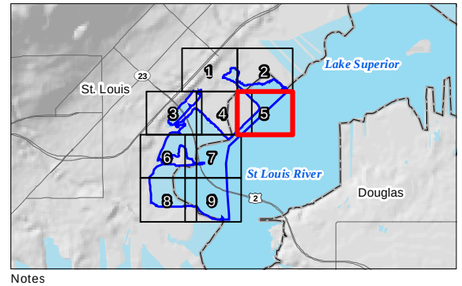

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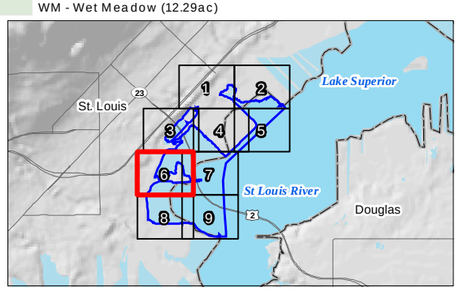

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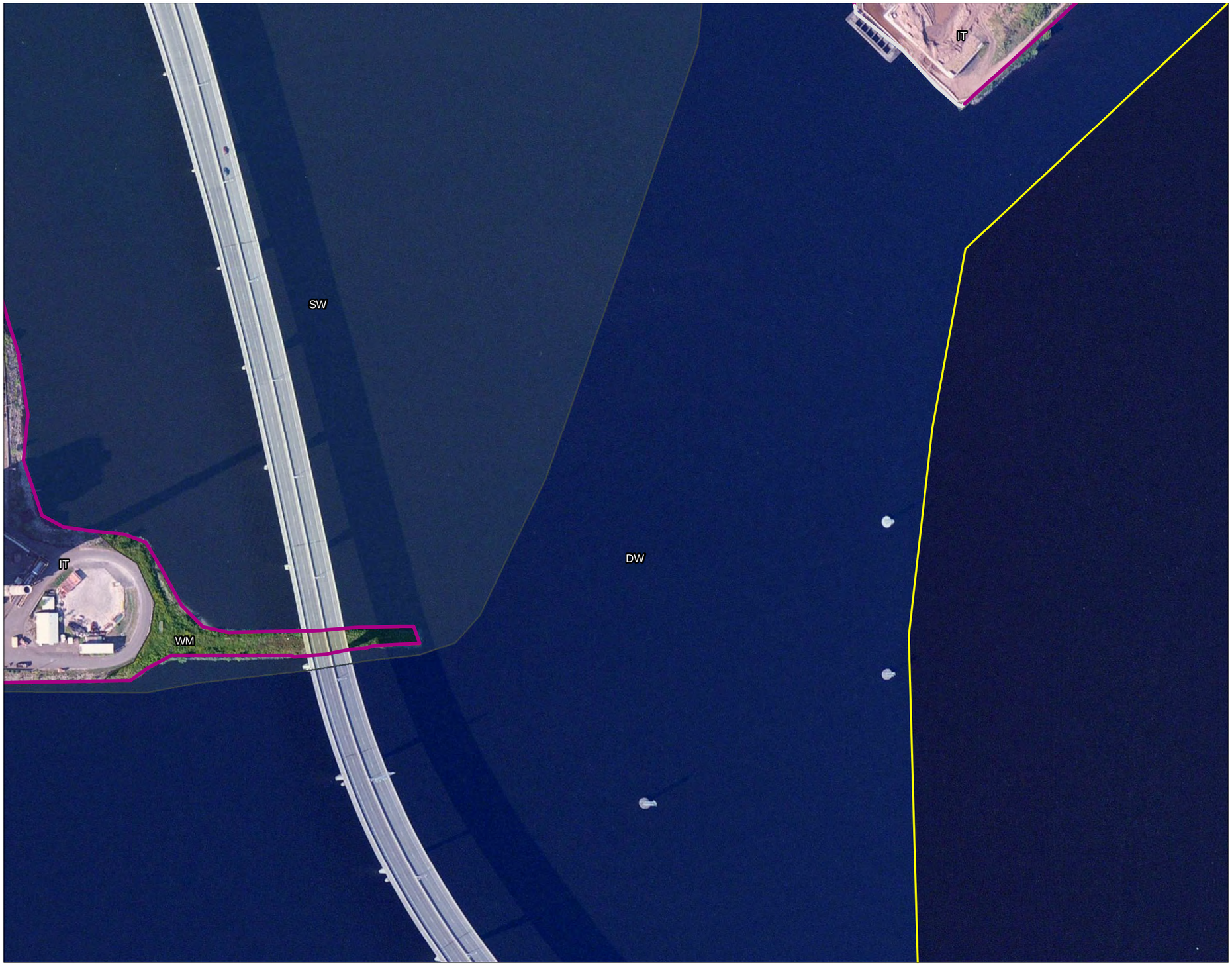

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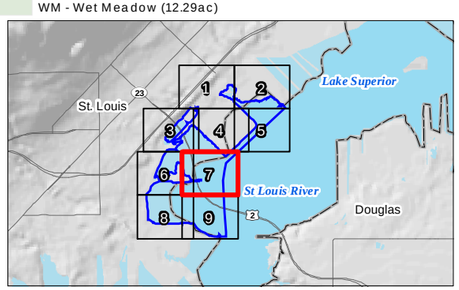

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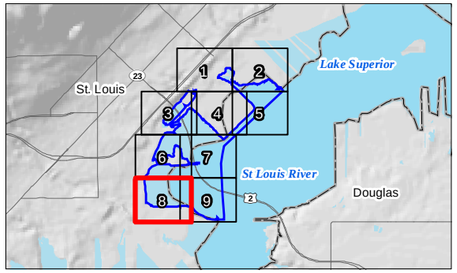

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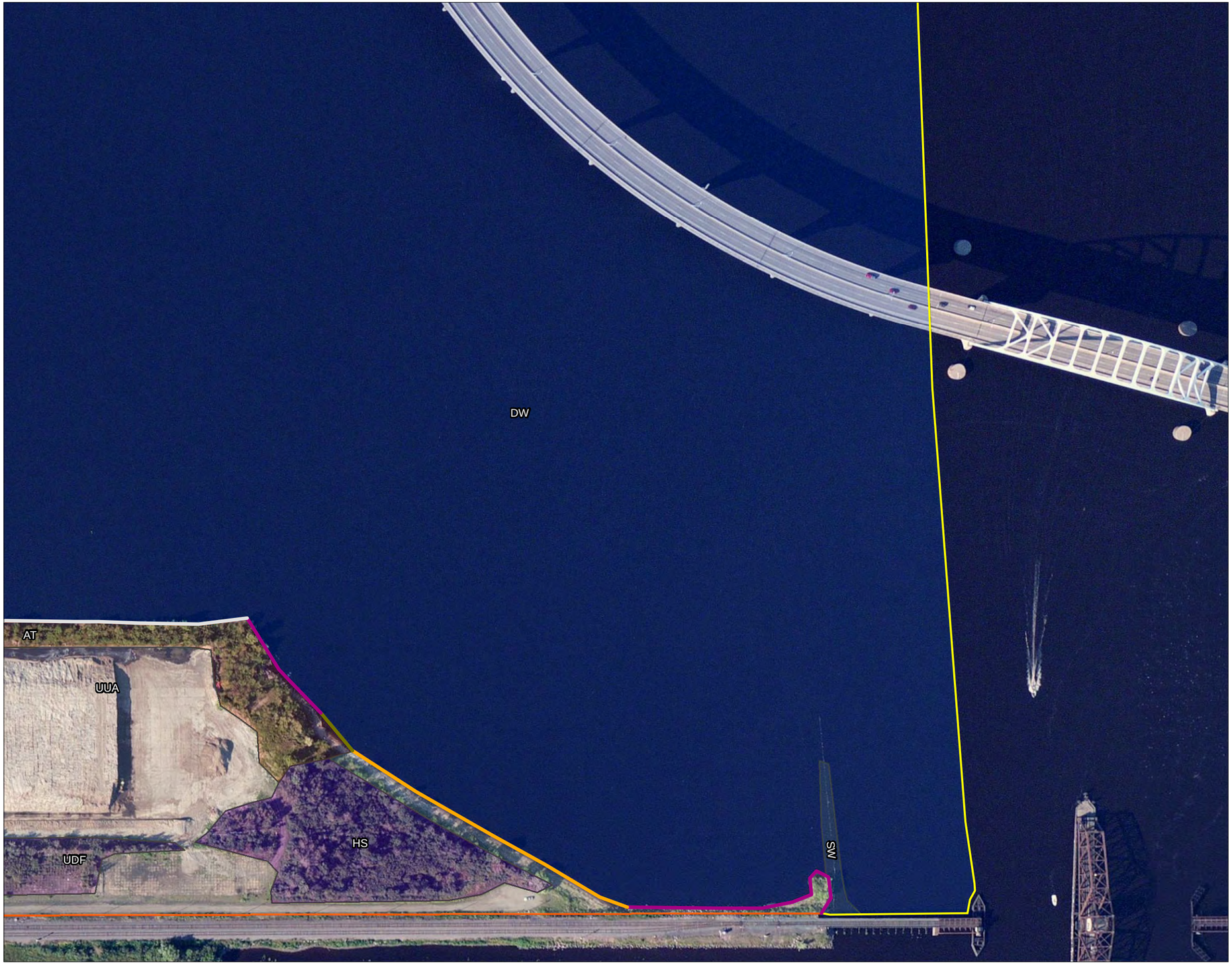

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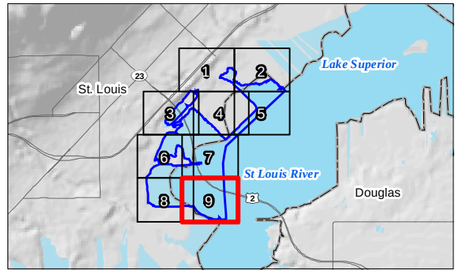

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2. Data Sources Include: Stantec, Esri, Community GIS Services, USGS
3. Orthophotography: Esri

Stantec

Figure No.
3

Title
Floating Leaved and Emergent Vegetation Areas

Client/Project
U.S. Fish and Wildlife Service
40th Avenue West Remediation to Restoration Project
St. Louis River Estuary

Project Location
T49N, R14W, S07; 08; 17; 18
C. of Duluth, St. Louis Co., MN

193702726
Prepared by MCP on 2014-12-17
Technical Review by AJW on 2014-12-17
Independent Review by JG on 2015-06-30

0 100 200 Feet

1:2,400 (At original document size of 11x17)

N

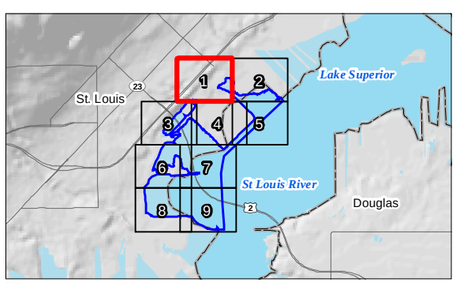
Legend

- Approximate Project Location
- Buffer Habitat Area

Plant Community [Stantec]
- Emergent Vegetation (18.98ac) (Field Survey Data, 10/14/15)
- Floating Leaved Vegetation (2.22ac) (Aerial Interp., Google Earth, imagery date 8/28/10)

Plant Community (Brady et al., 2010)*
[extent, NRRI 2010 naming convention in brackets]
- DW - Deep Water (194.90ac) [Riverine Open Water]
- SW - Shallow Water (125.89ac) [Lake Superior Coastal Marsh]

*Following NRRI community mapping; as Riverine Open Water and Lake Superior Coastal Marsh (Brady et al., 2010)



Notes
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JEWELL associates engineers, inc. Engineers - Surveyors - Architects
U.S. FISH & WILDLIFE SERVICE

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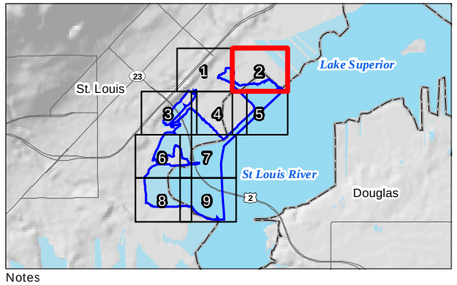

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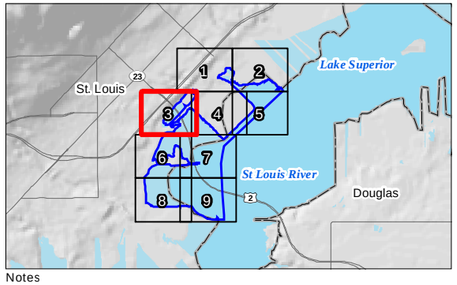

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JEWELL associates engineers, inc.
Engineers - Surveyors - Architects
U.S. Fish & Wildlife Service

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St. Louis River Estuary

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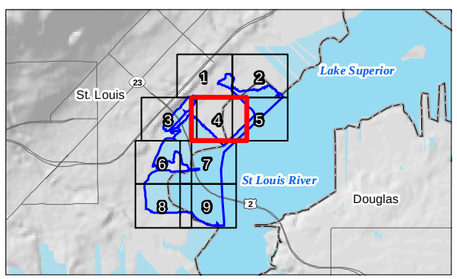

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U.S. FISH & WILDLIFE SERVICE

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40th Avenue West Remediation to Restoration Project
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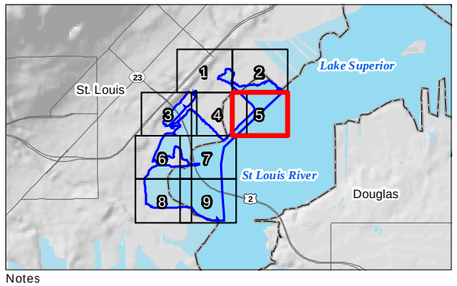

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U.S. FISH & WILDLIFE SERVICE

Figure No.
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Client/Project
U.S. Fish and Wildlife Service
40th Avenue West Remediation to Restoration Project
St. Louis River Estuary

Project Location
T49N, R14W, S07; 08; 17; 18
C. of Duluth, St. Louis Co., MN

193702726
Prepared by MCP on 2014-12-17
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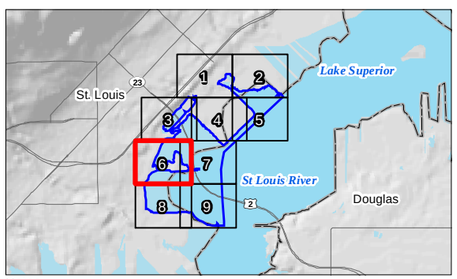

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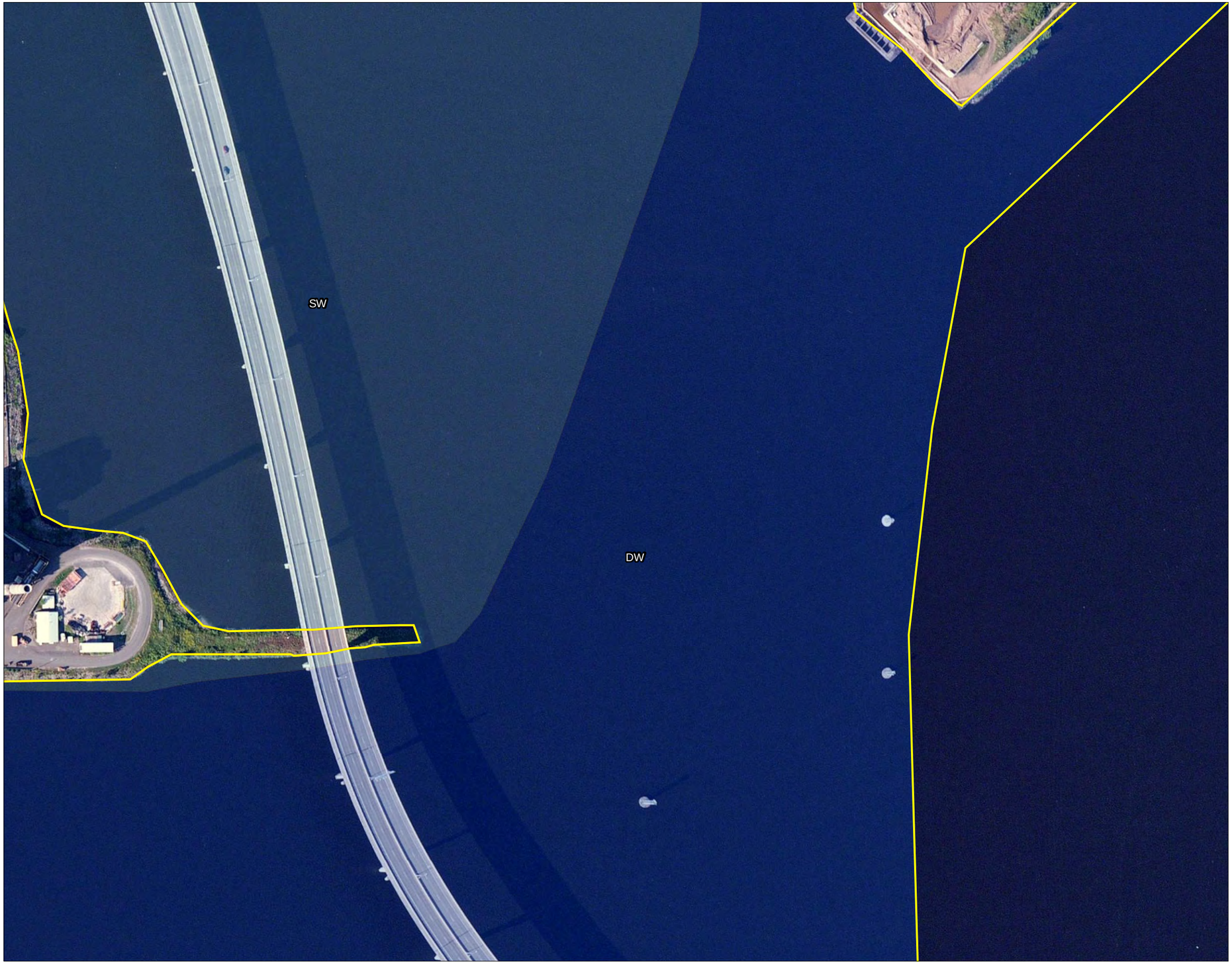

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Client/Project
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40th Avenue West Remediation to Restoration Project
St. Louis River Estuary

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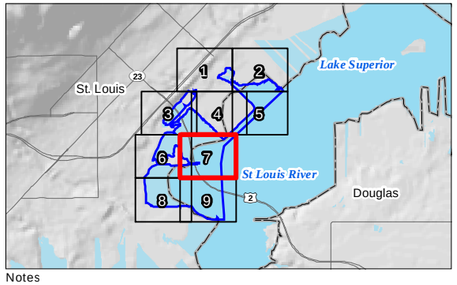

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U.S. FISH & WILDLIFE SERVICE

Figure No.
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Floating Leaved and Emergent Vegetation Areas

Client/Project
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St. Louis River Estuary

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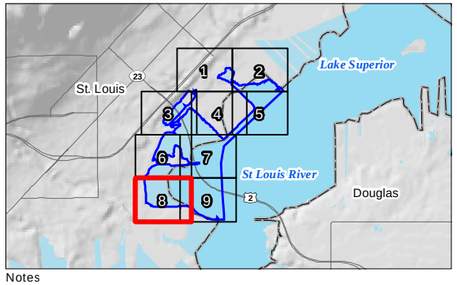

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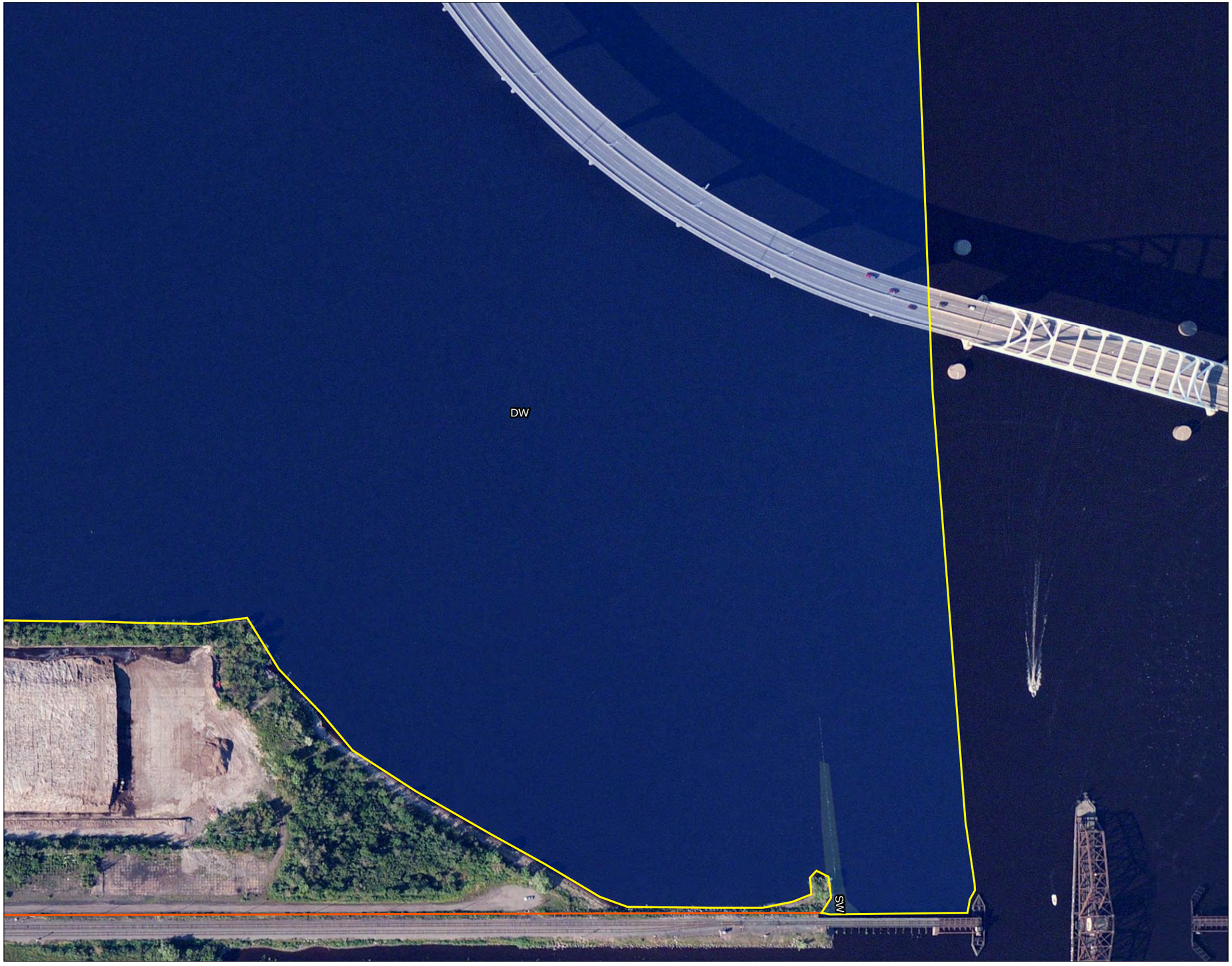

Figure No.
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Floating Leaved and Emergent Vegetation Areas

Client/Project
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St. Louis River Estuary

Project Location
T49N, R14W, S07; 08; 17; 18
C. of Duluth, St. Louis Co., MN

193702726
Prepared by MCP on 2014-12-17
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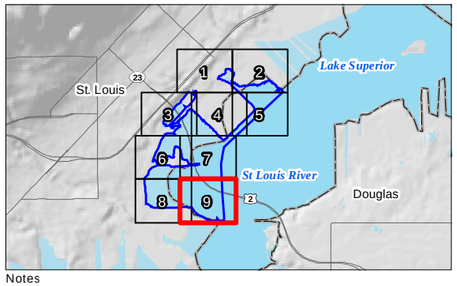

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Figure No.
4

Title
Floating Leaved and Emergent Vegetation Areas Overview Map

Client/Project
U.S. Fish and Wildlife Service
40th Avenue West Remediation to Restoration Project
St. Louis River Estuary

Project Location
T49N, R14W, S07; 08; 17; 18
C. of Duluth, St. Louis Co., MN

193702726
Prepared by MCP on 2014-12-17
Technical Review by JS on 2015-03-26
Independent Review by JG on 2015-06-30

0 400 800 Feet

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N

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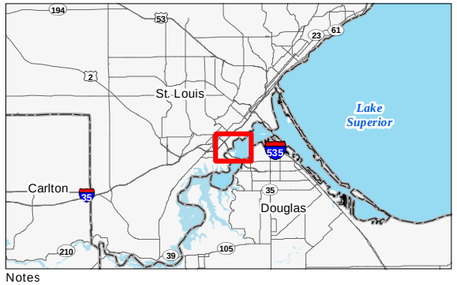

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U.S. FISH & WILDLIFE SERVICE

2014 Species List - Alder Thicket

Scientific Name	Common Name	Native	Physiognomy	Coefficient of Conservatism	Region 3 Wetland Coefficient
Alnus incana	speckled alder	native	tree	4	-3
Athyrium angustum	common lady fern	native	fern	5	0
Calamagrostis canadensis	blue-joint grass	native	grass	5	-5
Callitriche palustris	common water-starwort	native	forb	8	-5
Campanula aparinoides	marsh bellflower	native	forb	7	-5
Carex bebbii	bebbs oval sedge	native	sedge	4	-5
Chelone glabra	turtlehead	native	forb	7	-5
Cicuta bulbifera	bulblet water-hemlock	native	forb	7	-5
Cirsium arvense	canada thistle	non-native	forb	0	3
Comarum palustre	marsh cinquefoil	native	shrub	8	-5
Cornus alba	red-osier dogwood	native	shrub	3	-3
Dryopteris carthusiana	spinulose wood fern	native	fern	7	-3
Dryopteris cristata	crested shield fern	native	fern	7	-5
Epilobium coloratum	cinnamon willow-herb	native	forb	3	-5
Fraxinus pennsylvanica	green ash	native	tree	2	-3
Galeopsis tetrahit	common hemp-nettle	non-native	forb	0	3
Myosoton aquaticum	giant water chickweed	non-native	forb	0	0
Onoclea sensibilis	sensitive fern	native	fern	5	-3
Persicaria punctata	dotted smartweed	native	forb	5	-5
Phalaris arundinacea	reed canary grass	non-native	grass	0	-3
Rhamnus cathartica	common invasive buckthorn	non-native	tree	0	0
Rubus pubescens	dwarf dewberry	native	forb	7	-3
Salix amygdaloides	peach-leaved willow	native	tree	4	-3
Sorbus americana	american mountain-ash	native	tree	7	0
Stachys tenuifolia	narrow-leaved hedge-nettle	native	forb	6	-3
Symphyotrichum puniceum	purple-stem aster	native	forb	5	-5
Urtica dioica	stinging nettle	native	forb	1	0
Verbena hastata	blue vervain	native	forb	3	-3

2014 Species List - Submerged/Floating Aquatic

Scientific Name	Common Name	Native	Physiognomy	Coefficient of Conservatism	Region 3 Wetland Coefficient
Ceratophyllum demersum	coons-tail	native	forb	3	-5
Elodea canadensis	canadian waterweed	native	forb	3	-5
Lemna minor	common duckweed	native	forb	4	-5
Najas flexilis	northern water-nymph	native	forb	6	-5
Nymphaea odorata	american white water-lily	native	forb	6	-5
Potamogeton foliosus	leafy pondweed	native	forb	6	-5
Spirodela polyrrhiza	greater duckweed	native	forb	5	-5

2014 Species List - Cattail Marsh

Scientific Name	Common Name	Native	Physiognomy	Coefficient of Conservatism	Region 3 Wetland Coefficient
Alisma subcordatum	american water-plantain	native	forb	3	-5
Calamagrostis canadensis	blue-joint grass	native	grass	5	-5
Calla palustris	wild calla	native	forb	9	-5
Carex hystericina	porcupine sedge	native	sedge	3	-5
Carex lasiocarpa	woolly-fruit sedge	native	sedge	9	-5
Cicuta bulbifera	bulblet water-hemlock	native	forb	7	-5
Leersia oryzoides	rice cut grass	native	grass	3	-5
Lemna minor	common duckweed	native	forb	4	-5
Lysimachia terrestris	swamp-candles	native	forb	7	-5
Lythrum salicaria	invasive purple loosestrife	non-native	forb	0	-5
Myrica gale	sweet gale	native	shrub	9	-5
Phalaris arundinacea	reed canary grass	non-native	grass	0	-3
Sagittaria latifolia	broad-leaved arrowhead	native	forb	3	-5
Schoenoplectus tabernaemontani	soft-stem bulrush	native	sedge	4	-5
Scirpus cyperinus	wool-grass	native	sedge	4	-5
Sparganium eurycarpum	common bur-reed	native	forb	5	-5
Typha angustifolia	narrow-leaved cat-tail	non-native	forb	0	-5
Typha x glauca	hybrid cat-tail	non-native	forb	0	-5

2014 Species List - Disturbed Shoreline

Scientific Name	Common Name	Native	Physiognomy	Coefficient of Conservatism	Region 3 Wetland Coefficient
Alnus incana	speckled alder	native	tree	4	-3
Anthemis cotula	dog-fennel	non-native	forb	0	3
Artemisia ludoviciana	louisiana sage-wort	native	forb	3	5
Carex lacustris	common lake sedge	native	sedge	6	-5
Hordeum jubatum	foxtail barley	non-native	grass	0	0
Juncus balticus	baltic rush	native	rush	5	-5
Lycopus asper	rough bugleweed	non-native	forb	0	-5
Symphyotrichum ciliatum	alkali rayless aster	non-native	forb	0	0
Tanacetum vulgare	common tansy	non-native	forb	0	3
Typha angustifolia	narrow-leaved cat-tail	non-native	forb	0	-5
Typha x glauca	hybrid cat-tail	non-native	forb	0	-5
Xanthium strumarium	rough cocklebur	native	forb	1	0

2014 Species List - Northern Sedge Meadow

Scientific Name	Common Name	Native	Physiognomy	Coefficient of Conservatism	Region 3 Wetland Coefficient
Acorus americanus	sweet-flag	native	forb	7	-5
Alnus incana	speckled alder	native	tree	4	-3
Anaphalis margaritacea	pearly everlasting	native	forb	3	3
Athyrium angustum	common lady fern	native	fern	5	0
Calamagrostis canadensis	blue-joint grass	native	grass	5	-5
Campanula aparinoides	marsh bellflower	native	forb	7	-5
Carex bebbii	bebbs oval sedge	native	sedge	4	-5
Carex stricta	hummock sedge	native	sedge	7	-5
Cicuta bulbifera	bulblet water-hemlock	native	forb	7	-5
Cirsium arvense	canada thistle	non-native	forb	0	3
Comarum palustre	marsh cinquefoil	native	shrub	8	-5
Cornus alba	red-osier dogwood	native	shrub	3	-3
Doellingeria umbellata	flat-topped white aster	native	forb	6	-3
Dryopteris cristata	crested shield fern	native	fern	7	-5
Equisetum fluviatile	river horsetail	native	forb	7	-5
Eutrochium maculatum	spotted joe-pye-weed	native	forb	4	-5
Frangula alnus	glossy invasive buckthorn	non-native	shrub	0	0
Fraxinus pennsylvanica	green ash	native	tree	2	-3
Hypericum fraseri	frasers marsh st. johns-wort	native	forb	8	-5
Iris versicolor	northern blue flag	native	forb	5	-5
Juncus effusus	soft rush	native	rush	4	-5
Leucanthemella serotina	giant daisy	non-native	forb	0	5
Lysimachia terrestris	swamp-candles	native	forb	7	-5
Lythrum salicaria	invasive purple loosestrife	non-native	forb	0	-5
Mentha arvensis	wild mint	native	forb	3	-3
Onoclea sensibilis	sensitive fern	native	fern	5	-3
Phalaris arundinacea	reed canary grass	non-native	grass	0	-3
Poa palustris	fowl meadow grass	native	grass	5	-3
Populus balsamifera	balsam poplar	native	tree	4	-3
Ribes americanum	american black currant	native	shrub	4	-3
Rubus idaeus var. strigosus	american red raspberry	native	shrub	3	3
Rumex britannica	great water dock	native	forb	8	-5
Salix discolor	pussy willow	native	tree	2	-3
Salix serissima	autumn willow	native	tree	8	-5
Scirpus cyperinus	wool-grass	native	sedge	4	-5
Scrophularia lanceolata	early figwort	native	forb	4	3
Solidago canadensis	canada goldenrod	native	forb	1	3
Sonchus arvensis	field sow-thistle	non-native	forb	0	3
Sparganium eurycarpum	common bur-reed	native	forb	5	-5
Spiraea alba	white meadowsweet	native	shrub	4	-3
Typha x glauca	hybrid cat-tail	non-native	forb	0	-5

2014 Species List - Wet Meadow

Scientific Name	Common Name	Native	Physiognomy	Coefficient of Conservatism	Region 3 Wetland Coefficient
Alisma triviale	northern water-plantain	native	forb	4	-5
Alnus incana	speckled alder	native	tree	4	-3
Anaphalis margaritacea	pearly everlasting	native	forb	3	3
Asclepias syriaca	common milkweed	native	forb	1	5
Calamagrostis canadensis	blue-joint grass	native	grass	5	-5
Calla palustris	wild calla	native	forb	9	-5
Caltha palustris	marsh-marigold	native	forb	6	-5
Carex bebbii	bebbs oval sedge	native	sedge	4	-5
Carex hystericina	porcupine sedge	native	sedge	3	-5
Carex lacustris	common lake sedge	native	sedge	6	-5
Carex lasiocarpa	woolly-fruit sedge	native	sedge	9	-5
Carex stricta	hummock sedge	native	sedge	7	-5
Carex utriculata	common yellow lake sedge	native	sedge	7	-5
Cicuta bulbifera	bulblet water-hemlock	native	forb	7	-5
Cirsium arvense	canada thistle	non-native	forb	0	3
Cornus alba	red-osier dogwood	native	shrub	3	-3
Cynoglossum officinale	common comfrey	non-native	forb	0	5
Equisetum arvense	common horsetail	native	bryophyte	1	0
Euthamia graminifolia	common flat-topped goldenrod	native	forb	4	0
Eutrochium maculatum	spotted joe-pye-weed	native	forb	4	-5
Fragaria virginiana	wild strawberry	native	forb	1	3
Frangula alnus	glossy invasive buckthorn	non-native	shrub	0	0
Fraxinus pennsylvanica	green ash	native	tree	2	-3
Geum laciniatum	rough avens	native	forb	5	-3
Glyceria grandis	american manna grass	native	grass	6	-5
Helianthus maximiliani	maximilians sunflower	non-native	forb	0	5
Impatiens capensis	orange jewelweed	native	forb	2	-3
Iris versicolor	northern blue flag	native	forb	5	-5
Leersia oryzoides	rice cut grass	native	grass	3	-5
Linaria vulgaris	butter-and-eggs	non-native	forb	0	5
Lonicera tatarica	tartarian invasive honeysuckle	non-native	shrub	0	3
Lotus corniculatus	birds-foot trefoil	non-native	forb	0	3
Lycopus asper	rough bugleweed	non-native	forb	0	-5
Lycopus uniflorus	northern bugleweed	native	forb	4	-5
Lysimachia terrestris	swamp-candles	native	forb	7	-5
Lythrum salicaria	invasive purple loosestrife	non-native	forb	0	-5
Mentha arvensis	wild mint	native	forb	3	-3
Muhlenbergia mexicana	leafy satin grass	native	grass	4	-3
Myrica gale	sweet gale	native	shrub	9	-5
Phalaris arundinacea	reed canary grass	non-native	grass	0	-3
Phragmites australis ssp. americanus	american common reed	native	grass	1	-3
Poa palustris	fowl meadow grass	native	grass	5	-3
Populus balsamifera	balsam poplar	native	tree	4	-3
Ribes americanum	american black currant	native	shrub	4	-3
Rubus idaeus var. strigosus	american red raspberry	native	shrub	3	3
Rumex britannica	great water dock	native	forb	8	-5
Rumex crispus	curly dock	non-native	forb	0	0
Sagittaria latifolia	broad-leaved arrowhead	native	forb	3	-5
Salix discolor	pussy willow	native	tree	2	-3
Salix interior	sandbar willow	native	shrub	2	-3
Salix petiolaris	meadow willow	native	shrub	6	-3
Salix x fragilis	crack willow	non-native	tree	0	0
Schoenoplectus tabernaemontani	soft-stem bulrush	native	sedge	4	-5
Scirpus cyperinus	wool-grass	native	sedge	4	-5
Scutellaria galericulata	marsh skullcap	native	forb	5	-5
Sium suave	hemlock water-parsnip	native	forb	5	-5

2014 Species List - Wet Meadow - continued

Scientific Name	Common Name	Native	Physiognomy	Coefficient of Conservatism	Region 3 Wetland Coefficient
Solanum dulcamara	bittersweet nightshade	non-native	vine	0	0
Solidago canadensis	canada goldenrod	native	forb	1	3
Solidago gigantea	giant goldenrod	native	forb	3	-3
Sonchus arvensis	field sow-thistle	non-native	forb	0	3
Sparganium eurycarpum	common bur-reed	native	forb	5	-5
Spiraea alba	white meadowsweet	native	shrub	4	-3
Symphyotrichum lanceolatum	white panicle aster	native	forb	4	-3
Tanacetum vulgare	common tansy	non-native	forb	0	3
Typha angustifolia	narrow-leaved cat-tail	non-native	forb	0	-5
Typha x glauca	hybrid cat-tail	non-native	forb	0	-5
Valeriana officinalis	garden valerian	non-native	forb	0	5
Vicia sativa	common vetch	non-native	forb	0	3

Photo 1. Northern pond, west end of bay north of Erie Pier, view facing south.

Photo 2. Northern pond shoreline, view facing northeast.

Photo 3. Northern pond, view facing west, showing *Phragmites,* pilings in water, Erie Pier and power plant (background).

Photo 4. Alder Thicket community on east shore of northern pond.

Photo 5. St. Louis River shoreline north of USH2 bridge, view northeast.

Photo 6. Northern Sedge Meadow, view facing north showing giant daisy, balsam poplars.

Photo 7. Northern Sedge Meadow community, view facing northwest.

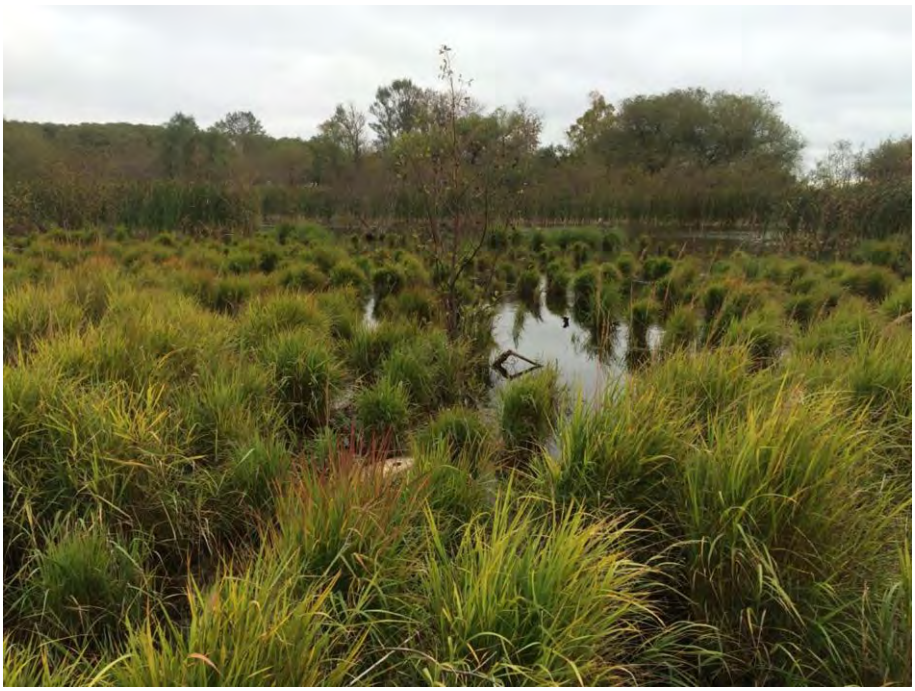

Photo 8. Northern Sedge Meadow, view facing northeast, showing current high water levels.

Photo 9. St. Louis River shoreline, north end of Project Area, view from Erie Pier facing east.

Photo 10. Western pond, view facing south toward USH2 bridge, showing shoreline vegetation including purple loosestrife, sedges and cattail.

Photo 11. West pond, view facing east under USH2 bridge.

Photo 12. Disturbed shoreline (foreground), waterway draining west ponds, cattail marsh and alder thicket along banks (background).

Photo 13. Concrete wall, south shore of bay south of power plant, view facing west. NewPage paper mill in background.

Photo14. Bay south of power plant, view facing northwest, showing islands (left), powerplant (right).